1963–64

VICTORIA

COUNTRY ROADS BOARD

FIFTIETH ANNUAL REPORT

FOR YEAR ENDED 30TH JUNE, 1963

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

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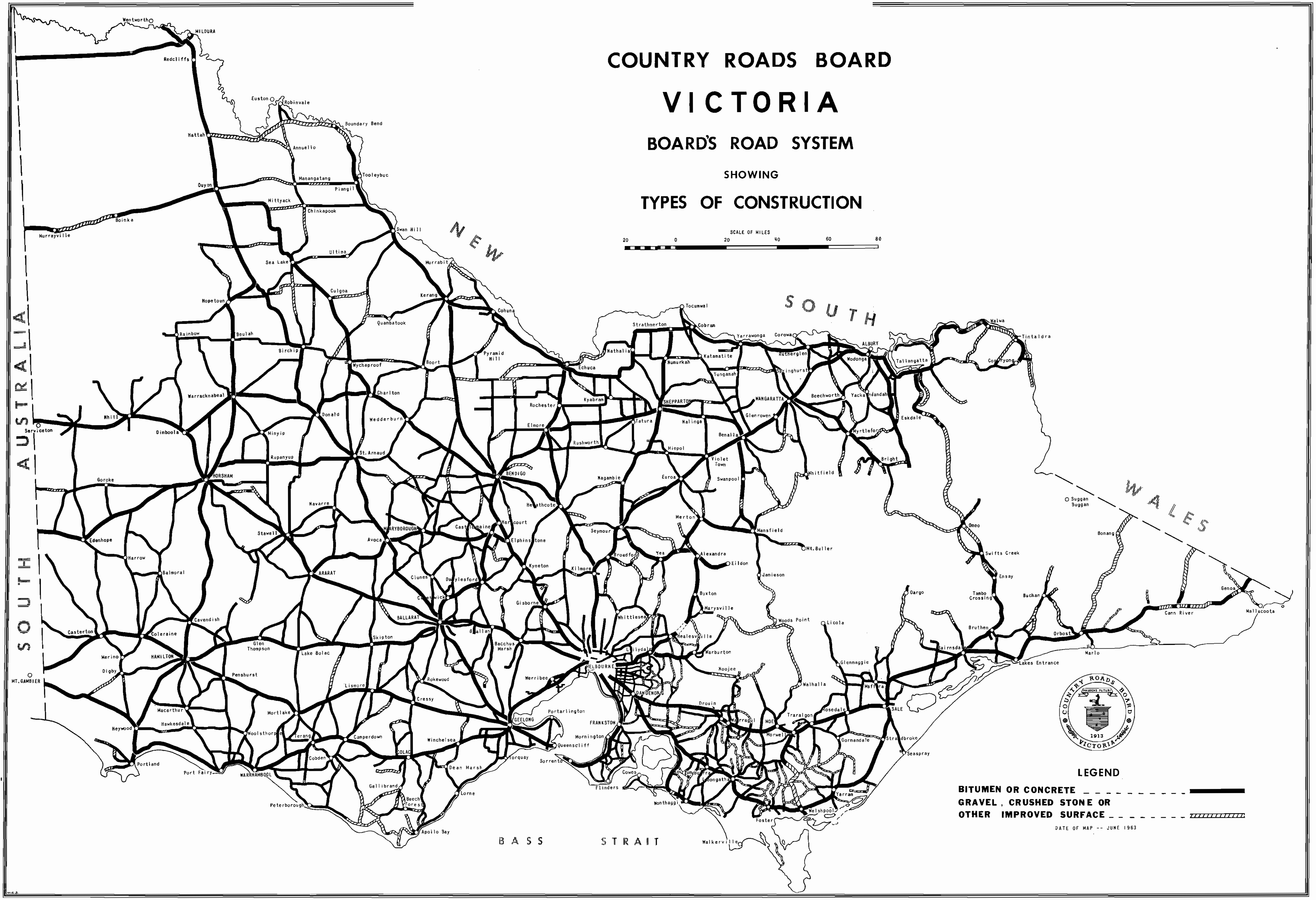
FRONTISPIECE : Duplicated Section of the Nepean Highway at Frankston.

COVER : Healesville—Yarra Glen Road. Healesville Shire. Reflectorised traffic line being applied by Country Roads Board designed line marking machine.


COUNTRY ROADS BOARD
VICTORIA
BOARD'S ROAD SYSTEM
SHOWING
TYPES OF CONSTRUCTION
SCALE OF MILES
20 0 20 40 60 80
NEW SOUTH WALES
SOUTH AUSTRALIA
BASS STRAIT
LEGEND
BITUMEN OR CONCRETE
GRAVEL, CRUSHED STONE OR OTHER IMPROVED SURFACE
DATE OF MAP -- JUNE 1963
COUNTRY ROADS BOARD
VICTORIA
1913
Wentworth
Mildura
Redcliffs
Euston
Robinvale
Boundary Bend
Hattah
Annuello
Manangatang
Tooleybuc
Piangil
Ouyon
Mittyack
Chinkapook
Boinka
Murrayville
Swan Hill
Ultima
Sea Lake
Murrabit
Kerang
Culgoa
Hopetoun
Cohuna
Quambatook
Rainbow
Beulah
Birchip
Wycheproof
Boort
Pyramid Hill
Echuca
Warracknabeal
Charlton
Whitfield
Servicetown
Dimboola
Donald
Wedderburn
Minyip
Rupanyup
St. Arnaud
Bendigo
Horsham
Goroke
Navarre
Heathcote
Edenhope
Stawell
Maryborough
Castlemaine
Harcourt
Avoca
Elphinstone
Harrow
Ararat
Kyneton
Balmoral
Clunes
Daylesford
Creswick
Gisborne
Cavendish
Ballarat
Ballan
Casterton
Coleraine
Glen Thompson
Skipton
Bacchus Marsh
Merino
Hamilton
Lake Bolac
Digby
Penshurst
Rokewood
Werribee
Lismore
Mt. Gambier
Cressy
Macarthur
Mortlake
Geelong
Portarlington
Hawkesdale
Heywood
Woolsthorpe
Terang
Camperdown
Winchelsea
Queenscliff
Portland
Cobden
Colac
Torquay
Sorrento
Port Fairy
Warrnambool
Dean Marsh
Gellibrand
Lorne
Beech Forest
Peterborough
Apollo Bay
Tocumwal
Strathmerton
Cobram
Yarrawonga
Corowa
Nathalia
Katamatite
Rutherglen
Albury
Wodonga
Numurkah
Tungamah
Springhurst
Kyabram
Rochester
Shepparton
Wangaratta
Beechworth
Yackandandah
Tatura
Elmore
Glenrowan
Rushworth
Benalla
Myrtleford
Eskdale
Miepol
Bright
Violet Town
Nagambie
Euroa
Swanpool
Seymour
Merton
Mansfield
Broadford
Yea
Alexandra
Mt. Buller
Kilmore
Eildon
Jamieson
Buxton
Marysville
Whittlesea
Woods Point
Healesville
Lilydale
Warburton
Melbourne
Noojee
Dandenong
Drouin
Frankston
Mornington
Warragul
Moe
Traralgon
Morwell
Rosedale
Sale
Cowes
Flinders
Korumburra
Wonthaggi
Foster
Welshpool
Yarram
Walkerville
Walhalla
Glenmaggie
Maffra
Gormandale
Stradbroke
Seaspray
Licola
Walwa
Tintaldra
Tallangatta
Corryong
Omeo
Swifts Creek
Ensay
Tambo Crossing
Bruthen
Bairnsdale
Lakes Entrance
Buchan
Orbost
Marlo
Cann River
Genoa
Mallacoota
Bonang
Suggan Buggan
Dargo

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	N. G. Roeszler.
Traralgon	A. Jacka.
Warrnambool	J. W. C. Pascoe.

COUNTRY ROADS BOARD

FIFTIETH ANNUAL REPORT, 1962-63

CONTENTS

COUNTRY ROADS BOARD

FIFTIETH ANNUAL REPORT

60 Denmark Street,
Kew, E.4,
2nd December, 1963.

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

SIR,

In accordance with the requirements of Section 128 of the *Country Roads Act* 1958, No. 6229, the Board has the honour to submit to you for presentation to Parliament the report of its proceedings for the year ended 30th June, 1963. The report is of special significance as it is also the Board's Golden Jubilee Annual Report.

1. FIFTY YEARS OF PROGRESS.

Although the Board has already issued a separate 75-page booklet outlining its fifty years of progress it is appropriate in this report to refer briefly to the Board's operations since 1913.

Road Conditions in 1913—

In 1913, roads in Victoria generally were in a deplorable condition. Many of them particularly in hilly country, were little better than primitive tracks and even those which had been well constructed as the principal coach routes before the advent of railways, had been allowed to deteriorate to a very serious extent. Travel by road in 1913 even for comparatively short distances was often difficult, sometimes impossible and generally uncomfortable.

First Statutory Meeting of the Country Roads Board—

The Board's first meeting was held in the office of the Minister of Public Works on 31st March, 1913. The original Board members were Mr. W. Calder, Chairman, who before his appointment to the Board was City Engineer of Prahran City, Mr. W. T. B. McCormack, who had previously been Engineer for Roads and Bridges in the Department of Public Works and Mr. F. W. Fricke who prior to his appointment had been on the staff of the Lands Department.

Main Roads—

The original Country Roads Act provided amongst other things that the Board should carry out all such surveys and investigations as were necessary or expedient to ascertain what roads should be main roads. By 1915, the Board Members had visited most parts of the State and decided upon approximately 3,000 miles of road as suitable for declaration as main roads.

The original Act made available to the Board loan money amounting to £2,000,000 to be expended at the rate of £400,000 per annum on permanent works on main roads. The maintenance of main roads between 1913 and 1924 was shared equally by the Board and the municipalities concerned. In 1924 the statutory contribution from municipalities towards the maintenance of main roads became a maximum of one-third.

Today there are 9,111 miles of main roads upon which approximately £82,786,000 has been expended from the Board's funds to the 30th June, 1963.

Developmental Roads—

With the object of providing the farmer with access to railways and markets, the Government in 1918 passed the Developmental Roads Act. This Act empowered the Board to declare as a developmental road any road which in its opinion would serve to develop any area of land by providing access to a railway station or to a main road leading to a railway station.

Loan money was provided by the Government to finance the construction of developmental roads and the municipalities which benefited were required to pay annually for 20 years an amount of approximately 2 per cent. towards interest on capital expenditure. In 1922, when further funds were provided the period was extended to 31½ years. Repayment of the loan and of portion of the interest was originally from consolidated revenue but the responsibility was transferred to the Country Roads Board in 1930. Maintenance of developmental roads was the responsibility of the relevant municipal council.

By 1937, when the last of the works undertaken under the Developmental Roads Act was completed a total amount of approximately £6½m. had been expended on the construction of developmental roads. Many of these roads have since been declared as main roads.

Isolated Settlers Roads—

In 1925, the Government passed the Roads to Isolated Settlers Appropriation Act. Under this Act £9,000 was provided and provision was made for the expenditure of £2,000 per annum for the construction of short lengths of roads from farm properties to main or developmental roads. During the depression years, funds provided for unemployment relief, together with increased amounts from the Board's revenue, were made available for the construction of isolated settlers roads. Between 1930 and 1943 over £330,000 was expended from the Board's funds on the construction of approximately 5,000 access roads.

State Highways—

As the importance of the motor vehicle increased and the need for long distance and interstate road connexions arose, the Government in 1924 passed the Highways and Vehicles Act which provided for the Board to declare certain roads as State highways.

The full costs of both construction and maintenance works on State highways required for through traffic are charged to the Board's funds. Today there are 4,474 miles of State highways upon which a total of approximately £67,906,000 has been expended from the Board's funds to 30th June, 1963.

Tourists' Roads—

Arising from the attraction of places of tourist interest and the Government's interest in tourism generally, the Tourists' Roads Act was passed in 1936. This Act enabled the Governor in Council, on the recommendation of the Board after consultation with the Commissioner of Crown Lands and Survey, to proclaim roads of sufficient interest to be tourists' roads.

The full cost of all works on proclaimed tourists' roads, required for through traffic, is borne by the Board. At present there are 444 miles of such roads upon which approximately £5,702,000 has been expended from the Board's funds to 30th June, 1963.

Forest Roads—

In 1943 the Government passed the Forest and Stock Routes Act. This Act enabled the Board to recommend to the Governor in Council that certain roads within or adjacent to any State forest or any areas considered by the Board to be timbered, mountainous or under developed, to be proclaimed as forest roads.

The full costs of all works proclaimed on forest roads required for through traffic are borne by the Board. At present there are 461 miles of such roads upon which approximately £2,214,000 has been expended from the Board's funds to 30th June, 1963.

By-pass Roads—

In 1956 an amendment to the Country Roads Act was passed enabling the Board to construct by-pass roads. By-pass roads are becoming popularly known as freeways and possess the distinguishing feature of having no direct access to them from side roads or abutting properties. Any roads which cross them are taken either over or under. Vehicles are permitted to enter by-pass roads only at specially selected points and by means of properly designed interchanges. By-pass roads are being planned in many parts of the State to cope with the increasing demands of traffic. At present there are 29 miles of such roads.

Unclassified Roads—

In addition to expending its funds on declared main roads, State highways, tourists' roads, forest roads and by-pass roads, the Board has since 1926 under the Federal Aid Roads Agreement provided funds to municipal councils for work on unclassified roads. The total amount expended from the Board's funds on the construction and maintenance of unclassified roads to 30th June, 1963 is approximately £42,859,000.

Growth in Five-year Periods—

The following table indicates the growth in five-year periods of the mileages of roads declared under the Country Roads Act, together with motor vehicles registered in Victoria :—

Year Ending 30th June.	Motor Vehicle Registrations.	Miles of Main Roads.	Miles of State Highways.	Miles of Tourists' Roads.	Miles of Forest Roads.	Miles of By-pass Roads.	Mileage of Declared Roads. Total.
1913 ..	..	..	..	..	..	..	..
1918 ..	14,121	2,950	..	..	..	..	2,950
1923 ..	36,673	6,300	..	..	..	..	6,300
1928 ..	126,328	6,300	1,474	..	..	..	7,774
1933 ..	156,163	6,376	2,296	..	..	..	8,672
1938 ..	223,122	6,685	2,308	350	..	..	9,343
1943 ..	216,051	8,490	2,804	392	..	..	11,686
1948 ..	290,153	9,806	3,846	402	241	..	14,295
1953 ..	503,028	9,792	3,849	414	375	..	14,430
1958 ..	720,030	9,754	3,845	415	378	..	14,392
1963 ..	957,494	9,111	4,474	444	461	29	14,519

The following table sets out the Board's expenditure on declared roads and unclassified roads in five-year periods :—

—	Declared Roads.	Unclassified Roads.	Total Road Expenditure from Board's Funds.
	£'000s.	£'000s.	£'000s.
1913–1918	1,750	..	1,750
1919–1923	4,102	542	4,644
1924–1928	7,866	380	8,246
1929–1933	7,024	1,455	8,479
1934–1938	6,752	1,684	8,436
1939–1943	5,509	1,542	7,051
1944–1948	6,149	1,299	7,448
1949–1953	19,477	3,512	22,989
1954–1958	39,737	10,550	50,287
1959–1963	69,232	21,895	91,127

2. MAJOR WORKS IN 1962–63.

Progress was made throughout the year both by the Board and councils in improving the existing road system. In addition considerable attention was given by the Board to the investigation and planning of new routes to meet foreseeable needs in both rural and urban areas.

The continued increase in traffic throughout the State, and more particularly within and adjacent to built-up areas, together with the continuing development taking place along existing routes, makes forward planning of further roads incorporating complete or partial control of access essential in the interests of safe and economical road transportation.

Many of the improvements effected on existing roads must for various reasons be limited in extent in any one financial year. Such works in themselves are not spectacular, but they are an essential part of a plan for raising the standard of roads to a level suitable for the volume of traffic using them.

The following are some of the major works which were in progress in various parts of the State on various classes of roads during the year :—

(*a*) The conversion of the existing 4-lane undivided pavement of the Princes Highway East between Oakleigh and Dandenong to a 6-lane divided facility to cope with an immediate traffic volume of 26,000 vehicles per day. Of the 9 miles involved, construction of approximately 4½ miles in sections between Fern Tree Gully Road and Corrigan's Road was substantially completed during the year (Plate 1) ;

(*b*) reconstruction of a further 1.17 miles of the Maroondah Highway between Springvale Road and Mitcham Road to a 6-lane divided standard to relieve conditions on the existing 3-lane road. This section of the highway carries approximately 17,500 vehicles in both directions in an average 12-hour day, with peak hour volumes of approximately 2,100 vehicles (Plate 2) ;

(*c*) duplication of a further 2 miles of the Hume Highway at Campbellfield including a channelised intersection treatment at Barry's Road ;

(*d*) duplication of a further 1·5 miles of the Nepean Highway from Warrigal Road to White Street in Mordialloc City ;

(*e*) reconstruction of 0·75 mile of the Nepean Highway at Frankston to provide a dual highway. The work involved construction of 1,700 feet of sea wall to reclaim sufficient land from the sea to accommodate duplication and to replace existing parking facilities (Plate 3) ;

(*f*) reconstruction of the Murray Valley Highway between Piambie and Lake Powell to place the roadway above flood level. A section of 2½ miles was completed during the year (Plate 4) and proposals are in hand to complete the reconstruction and sealing of the remaining 23 miles to Lake Powell by December, 1965 ;

(*g*) extension of the Frankston By-pass Road by 1·2 miles from the Frankston–Dandenong Road to Beach Street. These works include a grade separation at Beach Street and an at-grade channelized intersection at the Frankston–Dandenong Road pending grade separation at this point ;

(*h*) construction of the road over rail overpasses and approaches on the Western Highway at Albion and at Brooklyn on the Princes Highway West (Plate 5) ;

(*i*) reconstruction of the Tallangatta-Corryong Main Road in Towong Shire to provide for the increase in traffic generated by the Snowy Mountains project (Plate 6). During the year 4 miles between Derbyshire and Koetong were constructed on a new and much improved alignment, thereby eliminating 3 level crossings and one sub-standard road over rail structure ;

MAJOR WORKS.

Plate 1.—Princes Highway East Section 1.—36 ft. wide hot mix seal being laid east of Springvale Road. City of Springvale.

Plate 2.—Maroondah Highway—Duplication at Springvale Road intersection. City of Nunawading.

Plate 3.—Nepean Highway. Duplication approaching Olivers Hill. Shire of Frankston.

MAJOR WORKS.

Plate 4.—Murray Valley Highway Section 4.—Reconstructed and sealed section at approximately 44 miles. Shire of Swan Hill.

Plate 5.—Princes Highway West Section 1.—Construction of railway overpass at Brooklyn. City of Sunshine.

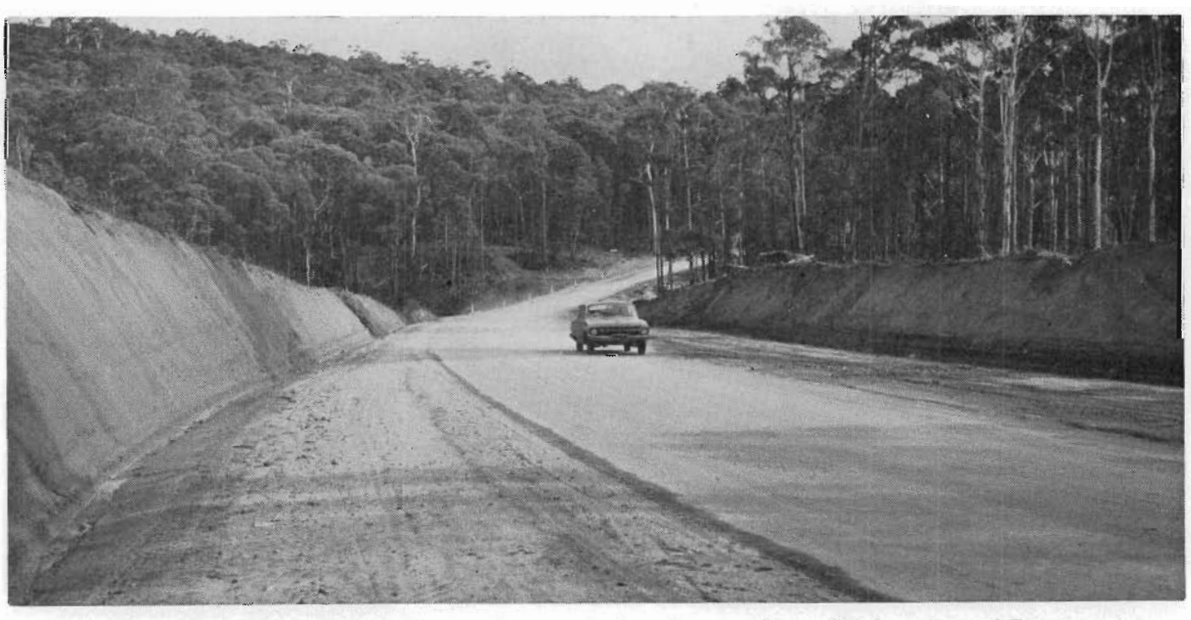


Plate 6.—Tallangatta—Corryong Road. Reconstructed section near Boggy Creek. Shire of Towong.

(*j*) construction of a new reinforced concrete and steel bridge over the Barwon River to replace Princes Bridge—a narrow timber bridge with poor approach alignment—constructed about 80 years ago. The new structure will be 480 feet long and 28 feet between kerbs and is on a much improved alignment. The substructure was completed and a contract let for the fabrication and erection of the steel girders;

(*k*) construction of a steel truss bridge over the Glenelg River at Nelson. The new bridge was completed during the year and is 454 feet long with a reinforced concrete deck. The bridge replaces an old timber structure constructed in 1892.

3. RECEIPTS AND PAYMENTS.

The total funds received by the Board during the year amounted to £25,084,718. These, together with the balance carried forward from 1961–62 of £4,922, provided total funds available for expenditure of £25,089,640, as compared with £24,045,769 during the 1961–62 financial year, an increase of £1,043,871.

Actual expenditure from these funds totalled £23,689,118 of which £15,039,139 was incurred by the Board and £8,649,979 by the municipalities.

Country Roads Board Fund.

The Board received £11,564,838 from motor registration fees and fines, half the drivers' licence fees, drivers' testing fees, and municipality repayments, an increase of £920,786 over the amount of £10,644,052 received from these sources during 1961–62.

Proceeds of charges under the Commercial Goods Vehicles Act amounted to £2,459,557, an increase of £197,140 over the amount of £2,262,417 received during the preceding year.

The amount standing to the credit of the Country Roads Board Fund at 30th June, 1963 was £1,400,522.

Commonwealth Aid Roads Fund.

The sum of £10,876,992 was available to the State of Victoria under the provisions of the *Commonwealth Aid Roads Act* 1959. Of this amount the Board received £10,675,566 and the balance of £201,426 was made available to the Public Works Department for works connected with transport by road or water. The whole of the money received by the Board was expended.

Loan Funds.

Loan moneys made available to the Board during 1962–63 totalled £301,000 which 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 and its expenditure for the year.

Full details of the Board's receipts and payments for the year ended 30th June, 1962, are shown in the statement certified by the Auditor-General on page 68 of this report.

4. COMMONWEALTH AID ROADS ACT.

Road needs are still far greater than funds available. Road traffic is estimated to double at the end of ten years and many costly construction and reconstruction works will be required to meet the growing needs.

The *Commonwealth Aid Roads Act* 1959 provided for a distribution among all the States of £54 million in 1962–63. Victoria received £10,876,991 which represents approxmately 20 per cent. of the total distributed by the Commonwealth. There is still a very large difference between the percentage distribution to Victoria and the contribution by Victorian vehicle owners of over 30 per cent. of the total fuel tax collected by the Commonwealth. The stipulation that 40 per cent. of the money provided under this Act is to be expended on rural roads other than State highways and main roads is regarded as an intrusion

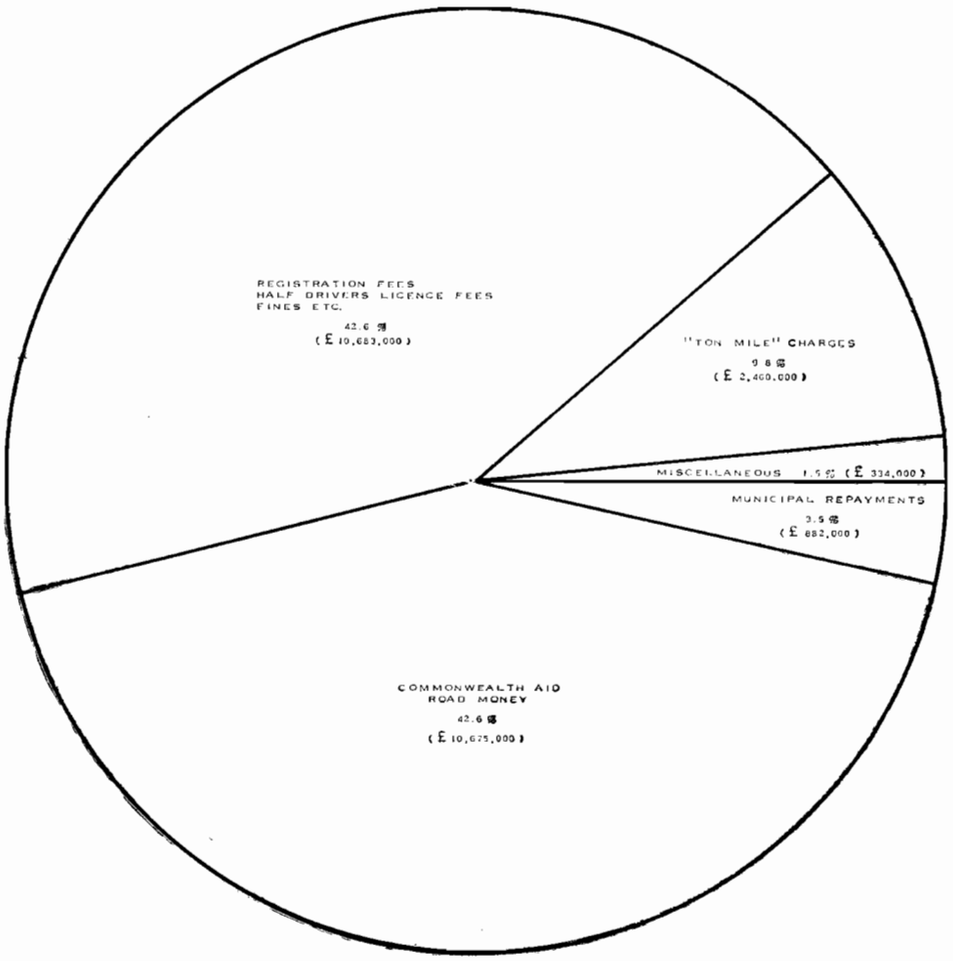


Figure 1.—RECEIPTS 1962-63.

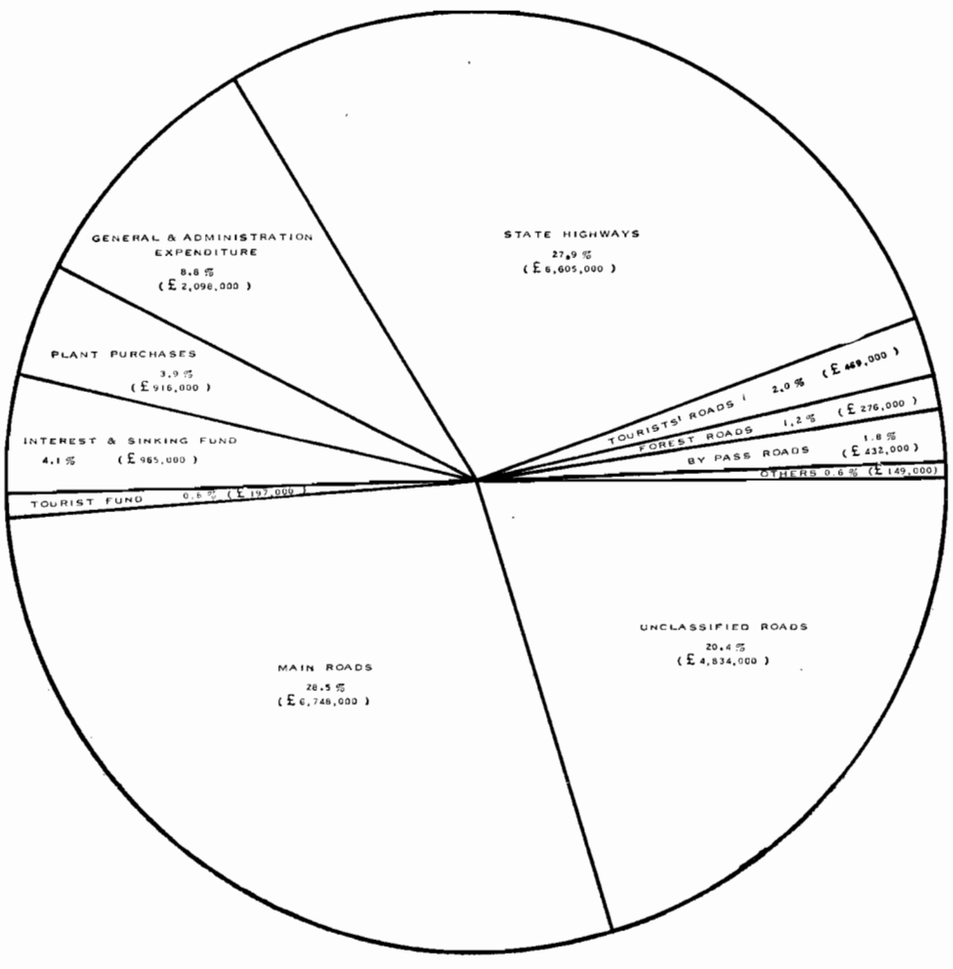


Figure 2.—EXPENDITURE 1962-63.

on the discretion the State should be free to exercise. There are very sound reasons for action to revise the Act to eliminate the exclusion of State highways, trunk roads and main roads in rural areas from participation in the expenditure on rural roads so that a balanced system based on needs can be developed in rural areas and so that consideration can be given to the declaration of more main roads, proposals for which are constantly being submitted by municipalities.

The present Commonwealth legislation extends until 30th June, 1964. To ensure that the facts regarding road needs are available, the Board has participated in an Australia-wide survey of road needs covering the decade 1964 to 1974. This survey was organised by the National Association of Australian State Road Authorities and it is hoped that the results will be available for publication late in 1963.

5. ALLOCATIONS FOR ROAD AND BRIDGE WORKS.

Before making its annual allocation for funds for fresh works, the Board must first provide funds to meet outstanding commitments at the end of the preceding financial year. Such commitments include works which have not actually commenced but for which plans and specifications have been approved, and also works which were uncompleted in the preceding financial year.

In July, 1962, the Board considered the applications for funds submitted by municipal councils and the Board's own engineers. Once again the applications for funds greatly exceeded the amounts which the Board was able to allocate. This is indicated by the following table :—

	1961–62.		1962–63.	
	Applications.	Allocations.	Applications.	Allocations.
	£'000s.	£'000s.	£'000s.	£'000s.
State Highways	12,280	7,461	10,773	7,843
Main Roads	14,531	9,723	12,906	9,633
Tourists' Roads	856	701	773	621
Forest Roads	448	379	460	366
By-pass Roads	958	803	748	632
Unclassified Roads—				
Construction	14,765	6,231	13,718	5,765
Maintenance	1,562	697	2,077	916
TOTAL	45,400	25,995	41,455	25,776

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

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

With the assistance of the Board's Divisional Engineers, many municipal councils are planning the development of what may be called a tertiary system of unclassified roads. Such plans ensure that the Board's funds are being expended on the more heavily trafficked and potentially important unclassified roads.

6. SHARING THE COST OF ROAD WORKS.

The Board, as required by the Country Roads Act, 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.

The Country Roads Act provides in effect that not more than one-third of the amount expended from the Country Roads Board Fund on main roads during the preceding financial year may be apportioned to municipalities. Where the expenditure incurred is considered to be excessive and where such cost is due to motor traffic not of local origin or to other factors, the Board may reduce a Council's contribution below one-third.

Details of expenditure incurred on main roads in 1961–62 and apportioned to municipalities in 1962–63 are as follows :—

Expenditure from Country Roads Board Fund	£4,891,198
Expenditure from Commonwealth Aid Road moneys	£1,491,973
Expenditure from proceeds of ton-mile tax under the Commercial Goods Vehicles Act	£766,665
	£7,149,836

Amount apportioned to Councils (based on expenditure from Country Roads Board Fund only)	£846,115
Percentage of amount apportioned to the total expenditure from the Country Roads Board Fund	17·3%
Percentage of apportionment to total expenditure (including Commonwealth Aid Roads and ton-mile tax grants)	11·83%

Had the whole of the expenditure on main roads been financed from the Country Roads Board Fund and the apportionment to councils not been reduced by the Board below one-third, municipal councils would have been required to contribute one-third of £7,149,836, i.e., £2,383,278. As shown above, the actual amount apportioned to councils was only £846,115.

The percentage of contributions by councils to the total expenditure on main roads for 1961–62 was 11·83 per cent. compared with 12·82 per cent. for 1960–61. These figures indicate that relief to councils is very considerable.

Loan moneys expended on main roads were expended on permanent works in urban areas. As is normally the case, expenditure is being shared equally by the Board and councils with repayments extending over a period of 35 years.

On unclassified roads the Board continued to require councils to contribute towards expenditure charged to the Board's allocations. In determining the contributions to be made by each council, the Board takes into account the nature, extent and location of the work, together with the council's financial position. On construction works the total council contribution was less than one-fifth.

The Board also made allocations subject to a council contribution for the purpose of assisting councils with the maintenance of unclassified roads. Such allocations were generally on a £1 for £1 basis in urban areas and £2 Board to £1 council in rural areas.

7. CONTRACTS UNDER BOARD'S DIRECT SUPERVISION.

During the financial year 1962–63 the Board gave further emphasis to its policy of doing work by contract whenever practicable. This is reflected in the considerable increase in the number of contracts entered into, the total of 495 being the greatest number let in any financial year throughout the Board's history. The following table shows the categories and their respective values :—

Type of Contract.	Number of Contracts.	Value.
		£
Road construction and supply of road-making materials	253	2,390,800
Bituminous surfacing materials	88	1,191,200
Bridge construction	34	282,300
Manufacture of bridge components and supply of fabricated steel	22	196,000
Supply of reinforced concrete pipes and box culverts	19	248,100
Supply of roadmaking equipment	63	720,200
Depot facilities and workshop equipment	3	7,400
Miscellaneous services and materials	13	226,700
TOTALS	495	5,262,700

The greatest increase in both numbers and cost was in those contracts for road construction and supply of road-making materials where in comparison with the previous financial year the number increased by 100 per cent. and the value by approximately 150 per cent.

Many competent contractors who had been engaged on other works over the period of the financial credit restrictions commenced tendering for the Board's contracts again.

An amendment to the Country Roads Act has enabled progress payments to contractors to be made at the discretion of the Board. Prior to the amendment progress payments were restricted to not more than 90 per cent. of the value of work done. Since the amendment the figure of 90 per cent. has been increased to 95 per cent. In respect of supply and delivery contracts, the Board makes progress payments on the basis of 100 per cent. of the value of material supplied.

Contracts under Council's Supervision.

In the past year the Board approved of the acceptance by municipalities of 808 tenders for a total liability of £2,988,000 for road and bridge works for which the Board has provided funds. Approval was also given to the utilization of 124 municipal period contracts for supply of materials and services incorporated in direct labour works financed from funds allocated by the Board.

8. STATE HIGHWAYS.

The total length of declared State highways at the end of the financial year was 4,473·5 miles. Divisional Engineers submitted applications for funds amounting to £10,773,100 to maintain and improve the highway system. Allocations totalling £7,843,800 were made, including £1,587,700 (20·2 per cent.) for maintenance and £6,256,100 (79·8 per cent.) for construction and reconstruction.

Because of the large amount of funds expended on maintenance each year, considerable attention is given to maintenance procedures. To increase the economy of maintenance operations and to enable the increasing demands on maintenance gangs to be met, the Board, during the past year, continued to provide additional plant and mechanical aids.

Maintenance bituminous reseals were carried out on 304 miles of State highways during the year while increasing use was made of premixed bituminous materials for surface correction and improvement of the riding quality of sound bituminous surfaces which had developed roughness through continued use.

Apart from hotmix surfacing carried out by contract in the metropolitan and Geelong areas, a mobile plant owned by the Board has been used to carry out hotmixed bituminous surfacing on 24 miles of highway in the vicinity of some of the larger provincial cities where surface correction of pavements was required. Such work is normally restricted to sections carrying traffic in excess of 1,500 vehicles per day.

Where maintenance was no longer economical and highways were inadequate for the volume of traffic using them, or where improvements were warranted to increase the safety of the section, construction and reconstruction was carried out to the extent of available funds.

On the more heavily trafficked sections of State highways and main roads in urban areas, the provision of 4 and 6-lane divided carriageways has been extended where sufficient right of way has been available and appropriate intersection treatments have been constructed to provide improved safety and capacity.

Several channelized intersection treatments have also been constructed on high-speed, high-volume rural highways to provide greater safety.

The length of sealed highways was extended by 29·6 miles on the Maroondah, Midland, Murray Valley, North Western, Omeo and Ouyen Highways. A further 7 miles of the Princes Highway East has been prepared for sealing but weather conditions prevented the work being sealed in the 1962–63 season.

The following works are typical of the improvements to State highways effected during the year :—

Princes Highway West—

Duplication and provision of six lanes between Arunga Avenue and Separation Street, North Geelong, a distance of approximately 1·0 mile (Plate 7).

Reconstruction and sealing of several sections comprising a total length of 4·27 miles between Mount Moriac and Winchelsea.

Reconstruction of 1 mile at Camerons Hill immediately east of Colac.

Reconstruction and realignment of 0·64 mile at Pirron Yallock involving box cutting through rock.

Channelized intersection treatment at the western approach to Terang.

Reconstruction of two sections of 1·10 miles and 4·15 miles at Heathmere and Rennick respectively (Plate 8).

Princes Highway East—

Reconstruction of the outward carriageway in Dandenong from Clow Street to Foster Street, a distance of 0·37 mile.

Regrading and reconstruction of 2·46 miles for a 24-ft. sealed pavement near Darnum (Plate 9).

Regrading and reconstruction of 1·32 miles between Trafalgar and Moe for a 24-ft. sealed pavement.

Reconstruction of 2·10 miles for a 24-ft. sealed pavement east of Trafalgar.

Reconstruction of 2,300 lineal feet through the City of Sale, including the provision of a central median strip.

Construction of bridges over the Thomson River and an " all weather road " section near Sale at Warruk. The completed work was officially opened by the Minister of Public Works on 6th December, 1962.

Reconstruction of two 1 mile sections of sub-standard highway between Stratford and Bairnsdale.

Reconstruction of 2·80 miles immediately east of Cann River eliminating a " loop " in the highway.

Western Highway—

Resurfacing from Duke Street to Anderson Street, in the City of Sunshine, a distance of approximately 1 mile.

Construction on an improved alignment of a new culvert and approaches at Myrniong.

Reshaping and resealing with bituminous concrete of 3·5 miles between Bungaree and Ballarat.

Reconstruction of 0·8 mile east of Ballarat. Duplication of 2 miles was also commenced (Plate 10).

Widening and resheeting of 4·9 miles west of Ballarat. Reconstruction of 1·7 miles was commenced.

Construction of a new reinforced concrete bridge 120 feet long and 28 feet between kerbs over Fiery Creek, west of Beaufort.

Sealing with hot bituminous asphalt of two sections comprising 1·44 miles in Horsham.

Sealing with hot bituminous asphalt of 1 mile in Nhill.

Reconstruction of 1·8 miles at Merwyn Swamp between Nhill and Kaniva, to provide a 22-ft. sealed width.

Calder Highway—

Widening to 24 feet between Arundel Road, Keilor and Holden Road, a distance of approximately 5·8 miles.

Plate 7.—Princes Highway West Section 1.—Divided Highway at Separation Street North Geelong looking north.

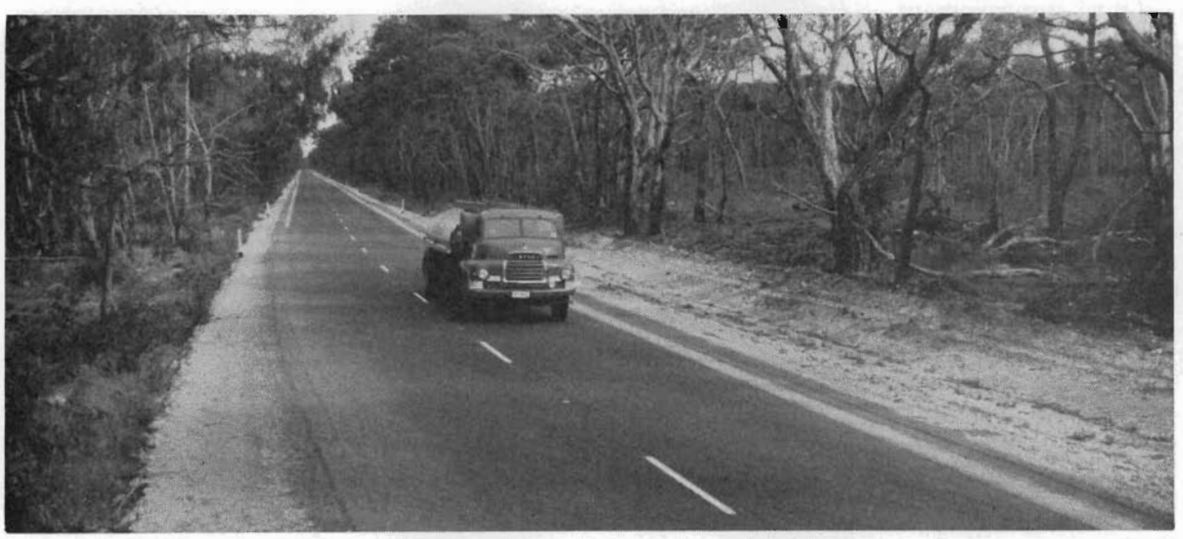


Plate 8.—Princes Highway West Section 5. Reconstructed and sealed section at 273 miles near Rennick. Portland Shire.

Plate 9.—Princes Highway East Section 2. Widened and reconstructed section near Darnum. Warragul Shire

Reconstruction of 2·2 miles between Holden Road and Diggers Rest.

Regrading and widening over Gap Hill for a distance of 1 mile.

Removal of logs from the old corduroy section in the Black Forest for a distance of 1·25 miles. This corduroy was placed during the gold mining era in the last century (Plate 11).

Widening between Woodend and Carlsruhe for a distance of 2·50 miles.

Reconstruction of 1 mile, including the widening of a culvert, at Boggy Creek.

Widening of two sections of 12-ft. sealed pavements to 20-ft. sealed pavements between Nandaly and Nunga, together with light resheeting to strengthen short failed sections.

Reconstruction and sealing under the supervision of the Mildura Shire Council of the old 22-ft. pavement north of Red Cliffs to a width of 24 feet.

Hume Highway—

Resheeting of 2·60 miles through Kal Kallo with fine crushed rock to strengthen the pavement and improve the riding qualities. Visibility at several points was improved by filling over the existing pavement to a maximum depth of 2 ft. 6 in.

Reconstruction of 1·94 miles in hilly country north of Winton to provide a 24-ft. seal, including major realignment and regrading (Plate 12).

Northern Highway—

Widening of the seal to 22 feet between Tooborac and Heathcote including curve and visibility improvement.

Reconstruction of the approach to the River Murray Bridge at Echuca to channelize traffic and provide a Fruit Fly Inspection Point.

Omeo Highway—

Reconstruction and widening between Glen Wills and Lightning Creek and the widening of curves between Omeo and Glen Wills.

Murray Valley Highway—

Light resheeting and initial treatment priming and sealing of 6·40 miles towards Burrowye.

Reconstruction of 1·30 miles at Mount Alfred Gap (Plate 13).

Reconstruction to complete 2·1 miles at Ebden commenced in 1961–62 (Plate 14).

Widening and strengthening 4·35 miles of failed 16-ft. sealed pavement east of Cohuna to provide a 22-ft. seal. A composite type of pavement has been used comprising a regulating course of sandy loam, and a 4-in. consolidated intermediate course of granitic sand into which has been scarified a 1½-in. loose layer of fine crushed rock as an armour coat.

South Gippsland Highway—

Of technical interest was the repair of two circular brick culverts, each approximately 80 feet long, one being 4 feet in diameter and the other 5 feet in diameter, in the old railway embankment, immediately east of Korumburra, by inserting Armco pipes of smaller diameter and filling the annular space with cement grout injected under pressure. This is understood to be the first use of this technique in Australia. (Plate 15).

Realignment and reconstruction of 0·65 mile for a 22-ft. sealed pavement west of Meeniyan.

Realignment and reconstruction of 1·85 miles for a 20-ft. sealed pavement east of Stony Creek.

Reconstruction of 1·5 miles for a 22-ft. sealed pavement at Welshpool.

Reconstruction of 4 miles for a 22-ft. sealed pavement near Hedley.

HIGHWAYS.

Plate 10.—Western Highway. Section being duplicated at Woodmans Hill. East of Ballarat.

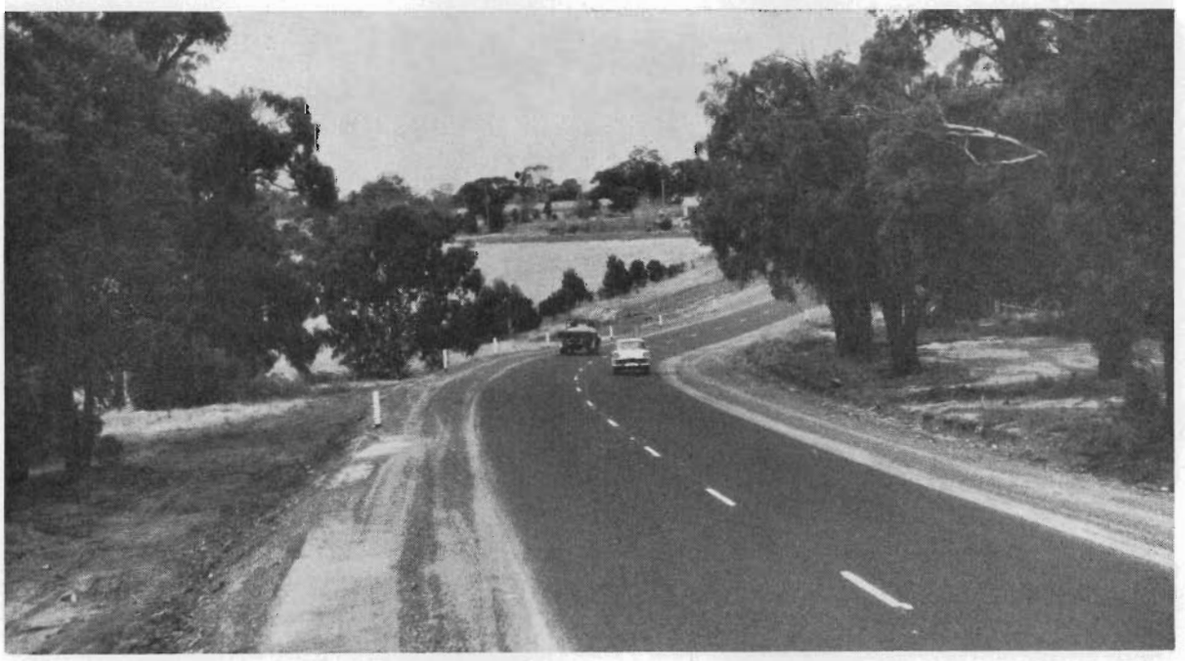


Plate 11.—Calder Highway—Reconstructed former corduroy section through the Black Forest, between Macedon and Woodend.

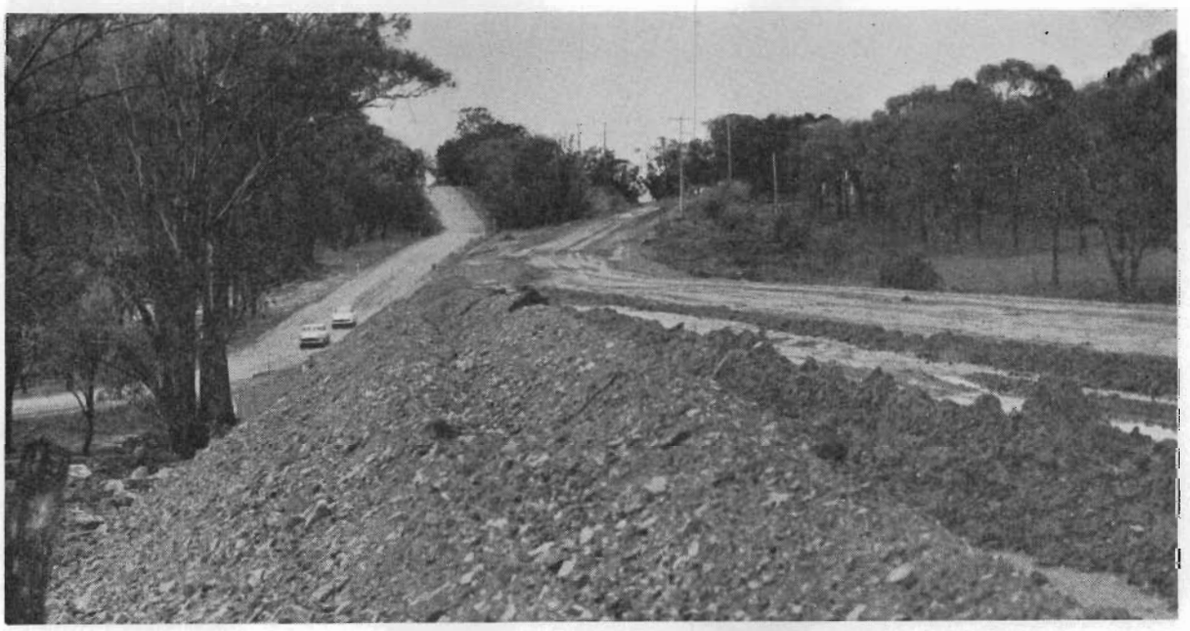


Plate 12.—Hume Highway Section 3. Reconstruction in progress north of Winton. Shire of Benalla.

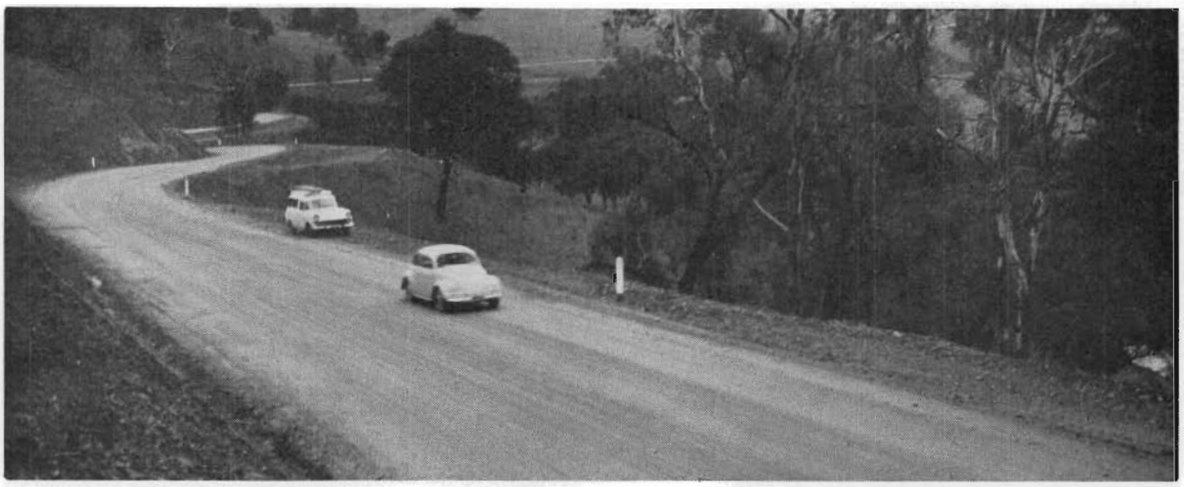


Plate 13.—Murray Valley Highway Section 1. Reconstruction and widening at Mt. Alfred Gap. Towong Shire.

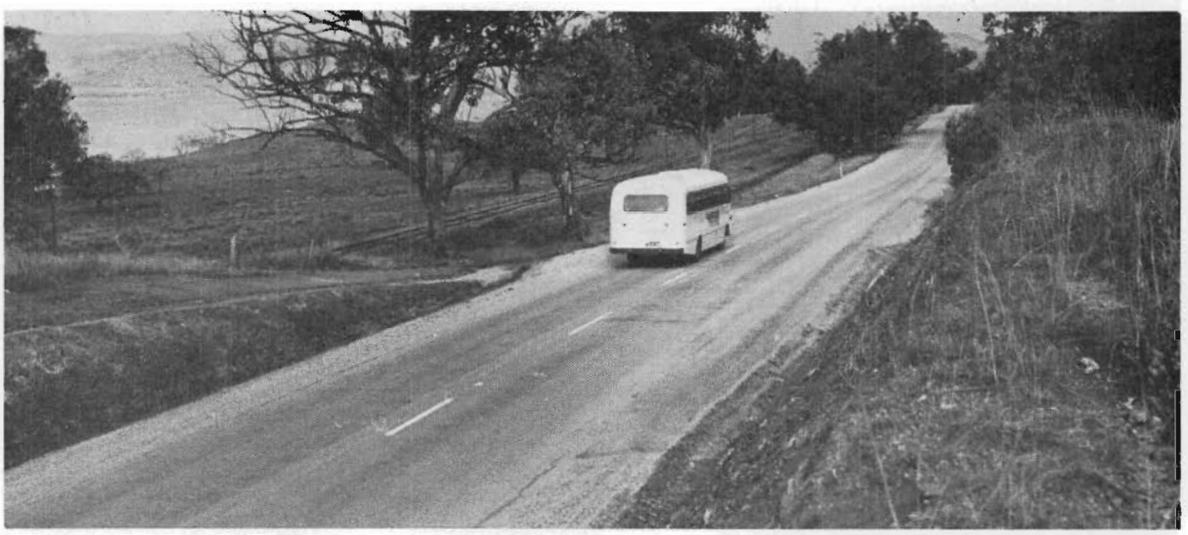


Plate 14.—Murray Valley Highway Section 1. Reconstructed and sealed section near Ebden. Wodonga Shire.

Plate 15.—South Gippsland Highway. Installing armco pipe in old railway embankment immediately east of Korumburra.

Midland Highway—

Widening to four lanes of a section in Ballarat, including the permanent channelization at the intersection with Arthur Street (Plate 16).

Widening and regrading of 1 mile at Eganstown, near Daylesford.

Reconstruction of two curves at Meredith.

Widening to 22 feet and strengthening of 1·79 miles of failed 20-ft. seal west of Tatura, including the construction, in conjunction with the State Rivers and Water Supply Commission, of a new 3-span prestressed, slab floodway structure over Mosquito Depression, to replace the old open floodway. The new structure will ultimately be used by the State Rivers and Water Supply Commission in a future drainage scheme in this area.

Reconstruction through Mooroopna, including the provision of a duplicated carriageway which will improve conditions for heavy traffic and relieve congestion.

Reconstruction and initial treatment priming and sealing between Barjarg and Nillahcootie, a distance of 2·40 miles.

Realignment and reconstruction of 2·2 miles near Granite Bar.

Bonang Highway—

Letting of a contract for the supply and delivery of 15,000 cubic yards of crushed river gravel to resheet the highway between mileages 33 and 45 near Goongarrah.

Cann Valley Highway—

Reconstruction of 1·60 miles near Noorinbee and 2 miles near the N.S.W. border.

Pyrenees Highway—

Construction of a new concrete bridge 90 feet long and 28 feet between kerbs at Amphitheatre Creek, Amphitheatre.

Henty Highway—

Sealing with bituminous asphalt of 2·74 miles in Horsham and north of Horsham.

Resheeting and widening to 20 feet of 4·0 miles of the sealed pavement northerly from the junction with the Wimmera Highway (Plate 17).

Widening of 4·4 miles of the 16-ft. sealed pavement to 20-ft. north of Beulah.

Widening of 7·53 miles at Myamyn.

Construction of a new 4-span 80 feet long, 28 feet between kerbs reinforced concrete bridge south of Cavendish, together with approaches.

Loddon Valley Highway—

Widening to 22 feet of the existing sealed pavement between Eaglehawk and Campbell's Forest, including curve improvement.

Goulburn Valley Highway—

Reconstruction of 3·42 miles northerly from the junction with the Hume Highway at Mangalore West (Plate 18).

Ouyen Highway—

Realignment and regrading of 3.20 miles between Linga and Boinka and the realignment of the approaches to a railway level crossing at Boinka.

A total length of 22·60 miles of the highway remains unsealed and completion of the sealing of this length is expected during 1965–66.

Nepean Highway—

Extension of duplication of the carriageway from Warrigal Road, Mentone to White Street, Mordialloc, a distance of approximately 1·5 miles.

Duplication between Davey Street and Rocky Cliff, Frankston, a distance of approximately 0·75 miles.

Widening of approximately 0·5 mile to provide a 24-ft. pavement near Hughes Road, Sorrento.

Plate 16.—Midland Highway. Channelization at junction of Midland Highway and Arthur Street, Ballarat

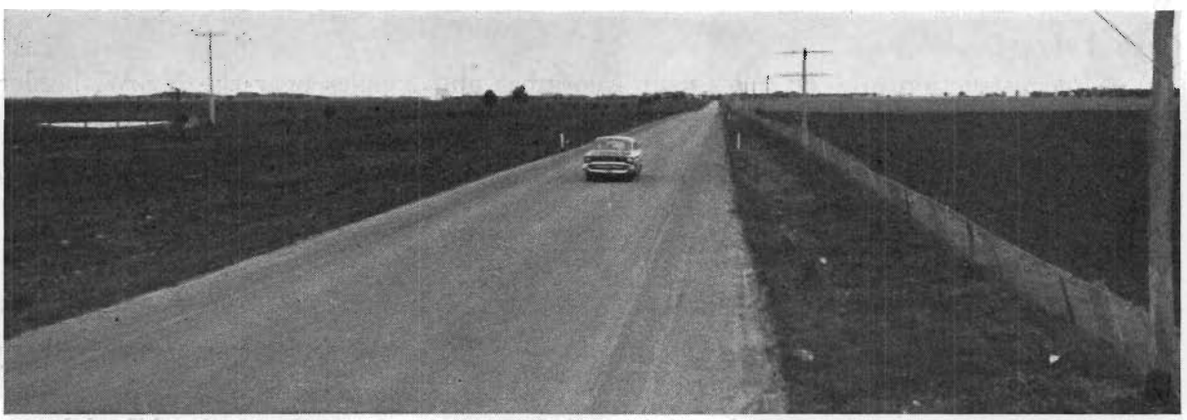


Plate 17.—Henty Highway Section 3. Reconstructed and sealed section north of junction with Wimmera Highway, near Horsham.

Plate 18.—Goulburn Valley Highway. Widened and reconstructed section at Mangalore West.

Plate 19.—Borung Highway. Reconstructed and sealed section at Ailsa.

Plate 20.—North Western Highway—Widened section south of Kinnabulla.

Plate 21.—Maroondah Highway. Channelization at intersection of Maroondah Highway and Warburton Highway, near Lilydale.

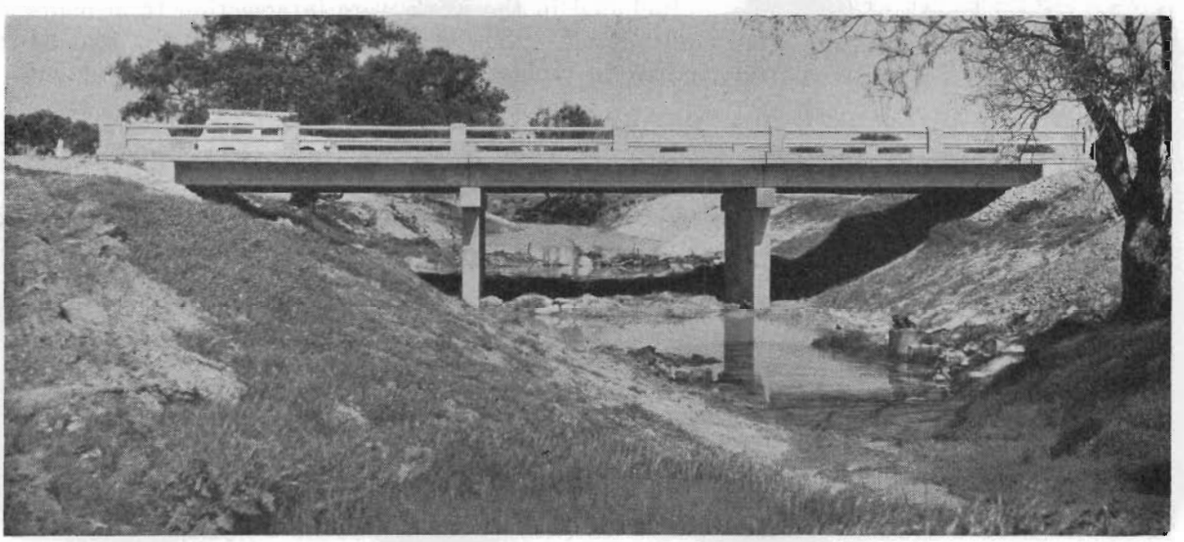


Plate 22.—Wimmera Highway Section 2. New bridge over Wallaloo Creek.

Glenelg Highway—

Realignment and regrading of 2 miles west of Linton, including the steep, poorly aligned section over Flagstaff Hill. Provision was made for climbing lanes for slow moving traffic.

Widening and resheeting a further 2 miles east of Skipton.

Reconstruction of 0·83 mile in Coleraine.

Ovens Highway—

Reconstruction of 2·1 miles between Everton and Brookfield.

Borung Highway—

Resealing of several sections totalling 11·60 miles between Litchfield and Homecroft.

Reconstruction and widening of 2 miles to 20-ft. sealed pavement at Ailsa, west of Warracknabeal (Plate 19).

North Western Highway—

Widening and reconstruction of 3·0 miles of old narrow pavement through Learmonth township.

Elimination of O'Shannessy's Floodway at Swanwater by the construction of a bridge 80 feet long and 28 feet between kerbs, using prestressed, precast slabs.

Reconstruction and realignment at the Lake Buloke railway level crossing with provision of flashing warning lights.

Widening and sealing to 20 feet of 4·5 miles south of Kinnabulla (Plate 20).

Resealing of several sections totalling 12·20 miles near Watchupga.

Construction, regrading and sealing to 20 feet of 3·3 miles between Woomelang and Lascelles. This work completed the sealing of the full length of this highway.

Maroondah Highway—

Duplication of the carriageway from Box Hill Town Hall to Middleborough Road, a distance of approximately 0·6 mile.

Widening and reconstruction of 1·95 miles between Taggerty and Acheron.

Reconstruction and channelization of the intersection of the Maroondah and Warburton Highways in the Shire of Lillydale (Plate 21).

Reconstruction of 3·68 miles between Maindample and Mansfield.

Bellarine Highway—

Improvement of the junction with the Wallington–Ocean Grove Road, including the widening of a narrow bridge.

Burwood Highway—

Duplication from 800 feet west of Fern Tree Gully Road to 600 feet east of Dorset Road—a total length of 0·68 mile. Included in the work were intersection treatments at both Dorset Road and Fern Tree Gully Road. The duplication provides for two 34-ft. carriageways with a 32-ft. central median to replace the former 20-ft. sealed pavement.

Hamilton Highway—

Reconstruction of 1 mile near Stonehaven School.

Construction of a new reinforced concrete bridge 114 feet long over Native Hut Creek.

Reconstruction and widening between the Woady Yallock Creek Bridge and the junction with the Ballarat–Colac Road.

Realignment, reconstruction and regrading of 1·08 miles at Mundy Gully.

Construction of a three-span reinforced concrete bridge 91 feet long and 28 feet between kerbs east of Lismore, together with approaches.

Reconstruction and realignment of 1·67 miles at Haunted Gully.

Wimmera Highway—

Construction of a new 3-span prestressed concrete structure 90 feet long and 28 feet between kerbs to replace the old narrow timber structure known as Boundary Bridge.

Replacement of the old narrow timber bridge over the Wallaloo Creek with a reinforced concrete structure 90 feet long and 28 feet between kerbs (Plate 22).

Elimination of a floodway at Blind Creek with a prestressed precast slab bridge 60 feet long and 28 feet between kerbs.

Reconstruction and regrading to give a 20-ft. sealed width of 3·85 miles west of St. Arnaud.

9. FREEWAYS (BY-PASS ROADS).

In recent years the Board has become increasingly involved in the planning of freeways under the by-pass roads provisions of Part VII. of the Country Roads Act.

A freeway is a divided highway of four or more lanes for motorized traffic. All crossings of the through carriageways are grade separated and access is fully controlled. Entry to the freeway, only at designated points, is effected by a gradual merging manoeuvre, and vehicles leave the freeway by means of a gradual diverging manoeuvre.

Freeways, by virtue of their limited access and high geometric standards, require large amounts of land and are expensive to build. On the other hand, where traffic volumes are high, they provide the necessary road capacity at a cheaper rate per vehicle than any other form of highway. Statistics indicate that they have an accident rate approximately one-third that of conventional roads and indeed the building of freeways has been demonstrated to be the most effective of all attempts to reduce the number of road accidents. The free movement of industrial traffic on these roads provides one of the major justifications for their construction.

It is in urban areas that the greatest savings are achieved by early freeway route location. If the land for a freeway can be located before the area develops, the cost per mile of land acquisition ranges from £15,000 to £60,000. When the land required is sub-divided, the cost can be as high as £240,000 per mile and, when built on, over £800,000 per mile.

The advantages of early determination are obvious, however a great deal of investigation is necessary before any route can be adopted. The service to traffic must be weighed against the problems of property affection and over-all cost for many trial locations, and this is a time consuming task. Until such time as a final appropriate location has been determined, it is not reasonable to hold up development for all alternatives over the whole length of the route.

It is therefore unavoidable that, in some instances, when a route location first becomes public some recent development is affected, however regrettable this may be.

The Board proposes to plan and reserve new freeway routes as the need is established, plans are finalized and funds to meet acquisition commitments are available. In addition, plans are being developed for the conversion or replacement of highways to the main provincial centres by routes of a freeway nature.

BY-PASS ROADS.

At the end of the financial year 1962–63 the length of proclaimed by-pass roads was 29 miles.

As stated elsewhere a further length of 1·2 miles of the Frankston By-pass Road was constructed during the year. Apart from this, no major construction work was carried out on by-pass roads, but considerable expenditure was incurred on land purchase, and right of way clearance on approved routes.

Healesville Freeway By-pass Road—

Recent traffic studies have indicated that major east-west routes to the east of Melbourne will reach saturation around 1970 even if the present street system is developed to maximum capacity.

The Board therefore undertook investigation of a suitable by-pass route from the end of M.M.B.W. Route 31 near Middleborough Road, through to Healesville and, in consultation with the Melbourne and Metropolitan Board of Works and the Councils concerned, approved the general location of the new route as far as Croydon. Detailed plans and survey of the route have still to be carried out before the precise location is finalized.

Princes By-pass Road—

Plans have been prepared for construction of a further 3·8 miles of by-pass road between Moe and Hernes Oak to connect with the existing Princes By-pass Road linking Hernes Oak and Morwell. Construction of this section is programmed for 1963–64.

Plans have been completed to permit the declaration of a further section of the Princes By-pass Road between Kororoit Creek at Brooklyn and the Maltby By-pass Road. Declaration of this section will increase the length of access controlled roadway between Melbourne and Geelong from 6·2 miles to 14·1 miles.

Tullamarine Freeway—

Development by the Commonwealth Government of a new jet airport at Tullamarine has made it necessary to deviate the existing Lancefield Main Road. To provide for expected traffic, the Board, in consultation with the Melbourne and Metropolitan Board of Works, Councils and the Department of Civil Aviation, has designed a deviation to by-pass road standard capable of ultimate development to six lanes. From the present Essendon airport to the new jetport terminal interchange, the deviation will be constructed to 4-lane standard initially and beyond this point the deviation will be built to 2-lane standard.

Construction work is programmed to commence in 1963–64 to ensure that the work is completed by 1966–67 in time for the opening of the new jetport.

10. MAIN ROADS.

Applications received from municipal councils and from the Board's Engineers for works under the direct supervision of the Board amounted to a total of £12,906,000 and a total of £9,633,000 was allocated. The following table shows the figures for this year compared with those of last year, together with the relevant percentages indicative of the " carry-over " inherent in planning and executing works :—

	—	1961–1962.	1962–1963.
		£'000s	£'000s
A	Applications	14,531	12,906
B	Allocations	9,723	9,633
C	Expenditure	7,427	6,748
		%	%
B	as percentage of A	66·9	74·5
C	as percentage of B	76·4	70·0

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

Bairnsdale Division—

Avon Shire.—Bengworden Road—Reconstruction and sealing of 2·5 miles and major repairs to the timber truss bridge over the Avon River (Chinn's Bridge) at Clydebank.

Bairnsdale Shire.—Bengworden Road—Reconstruction and sealing of 1·8 miles.

Omeo Shire.—Ramrod Flat Road—Reconstruction of a further half mile.

Tambo Shire.—Gelantipy Road—Reconstruction of a further 2 miles north of Buchan.

Ballarat Division—

Ararat Shire.—Ararat-Hall's Gap Road—Reconstruction and sealing of 0·5 mile through Carrol's Cutting.

Maroona–Glenthompson Road—Reconstruction and realignment of two sections totalling 2·90 miles.

Rossbridge–Streatham Road—Reconstruction and sealing of two sections totalling 2·31 miles.

Avoca Shire.—Maryborough–Natte Yallock Road—Reconstruction of a 3-span concrete bridge approximately 116 feet long over the Avoca River in Natte Yallock township.

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

Creswick Shire.—Daylesford–Ballarat Road—Reconstruction and realignment of two sections totalling 0·97 mile.

Ripon Shire.—Eurambeen–Streatham Road—Reconstruction and sealing of a further 4 miles.

Benalla Division—

Cobram Shire.—Cobram–Yarrawonga Road—Construction of a 6-span rolled steel joist and concrete bridge 201 feet long and 24 feet between kerbs, together with approaches (Plate 23).

Oxley Shire.—Bright Road (Henley's Gap)—Reconstruction of 1·97 miles, together with the construction of a multi-cell reinforced concrete culvert.

Towong Shire.—Tallangatta–Corryong Road—Construction of 4 miles between Darbyshire and Koetong on a new alignment.

Upper Murray Shire.—Tallangatta–Corryong Road—Reconstruction of a total length of 3·17 miles.

Corryong Road (Hansen Street, Corryong)—Reconstruction through Corryong township to provide a divided carriageway with a central median strip. This work is part of the strengthening work required to carry Snowy Mountains Hydro Electric Authority traffic.

Yackandandah Shire.—Gundowring Road—Reconstruction and realignment of 3·0 miles.

Bendigo Division—

Bet Bet Shire.—Avoca–Bealiba Road—Replacement of a narrow timber bridge over Sandy Creek with a 4-span reinforced structure 22 feet between kerbs, and the reconstruction and sealing of a previously gravelled 3·0 miles section. This road is now sealed over its full length.

Deakin Shire.—Echuca–Kyabram Road—Reconstruction and sealing of 4·5 miles.

Gordon Shire.—Boort–Kerang Road—Reconstruction and sealing of a further 2·4 miles.

Boort–Wycheproof Road—Reconstruction initial treatment priming and sealing of 4 miles.

Huntly Shire.—Bendigo–Tennyson Road—Replacement of two old narrow bridges over the Bendigo and Back creeks with new reinforced concrete structures 22 feet between kerbs.

Kerang Shire.—Donald–Swan Hill Road—Reconstruction and sealing of 4 miles near Lalbert, including the realignment of the approaches to an open crossing over the Ultima–Robinvale railway line, 3 miles north of Lalbert. The work completed the sealing on the road from its junction with the Murray Valley Highway at Swan Hill to Lalbert, a distance of 24 miles.

Boort–Kerang Road—Reconstruction and sealing of a further 3 miles.

Maldon Shire.—Baringhup Road—Construction of a new 5-span 200 ft. long 24-ft. wide reinforced concrete bridge over the Loddon River at Baringhup.

Maldon–Lockwood Road—Reconstruction and sealing of 3·37 miles.

Marong Shire.—Bendigo–Eddington Road—Continuation of the replacement of a number of old narrow timber bridges by the construction of a further two reinforced concrete structures 24 feet wide at Stone's Bridge over Murphy Creek and Wright's Bridge over Spring Creek.

McIvor Shire.—Heathcote–Nagambie Road—Reconstruction and sealing of 5½ miles east of Costerfield to complete the sealing of the road in the Shire. The work included the minor regrading of crests for improved visibility.

Strathfieldsaye Shire.—Strathfieldsaye Road—Construction of a deviation to replace the poor alignment at Butcher's Corner, including the replacement of two narrow timber bridges with multi-cell culverts.

Swan Hill Shire.—Ouyen–Piangil Road—Reconstruction and sealing of 6 miles east of Manangatang.

Sea Lake–Robinvale Road—Continuation of reconstruction and sealing. A total length of 22 miles has now been sealed within Swan Hill Shire. Two years ago only 3 miles of this road within the Shire were sealed (Plate 24).

Wycheproof Shire.—Sea Lake–Woomelang Road—Reconstruction and sealing the remaining unsealed length of 6·75 miles, including a minor deviation to improve the alignment.

Dandenong Division—

Bass Shire.—Wonthaggi–Loch Road—Realignment and reconstruction of a further 1·90 miles.

Berwick Shire.—Hallam–Emerald Road—Reconstruction of 1·0 mile northerly from Heatherton Road.

Cranbourne Shire.—Koo-Wee-Rup–Longwarry Road—Reconstruction of 1·33 miles south westerly from the end of the existing seal.

Fern Tree Gully Shire.—Belgrave–Hallam Road—Realignment and reconstruction of 1·25 miles northerly from Wellington Road.

Dorset Road—Reconstruction and widening of 0·26 mile from Boronia Road to Williams Street, Boronia.

Healesville Shire.—Yarra Glen–Yea Road—completion of construction and sealing of 2·12 miles to 32 feet formation and 20-ft. pavement. This work replaced the poorly aligned section at School Hill.

Geelong Division—

Bellarine Shire.—Geelong–Portarlington Road—Reconstruction and sealing of 1·8 miles to cater for the additional traffic to Alcoa.

Barrabool Shire.—Anglesea Road—Completion of the bridge and approaches to Bell Brae (Plates 25 and 26).

Bulla Shire.—Gap Road—Widening and sealing of 1½ miles.

Colac Shire.—Colac–Forest Road—Reconstruction and sealing of the remaining unsealed section of 0·8 mile.

Corangamite Lake Road—Widening of 2·4 miles and realignment, reconstruction and sealing of 2·7 miles.

Corio Shire.—Geelong–Bacchus Marsh Road—Reconstruction and sealing of 3·2 miles.

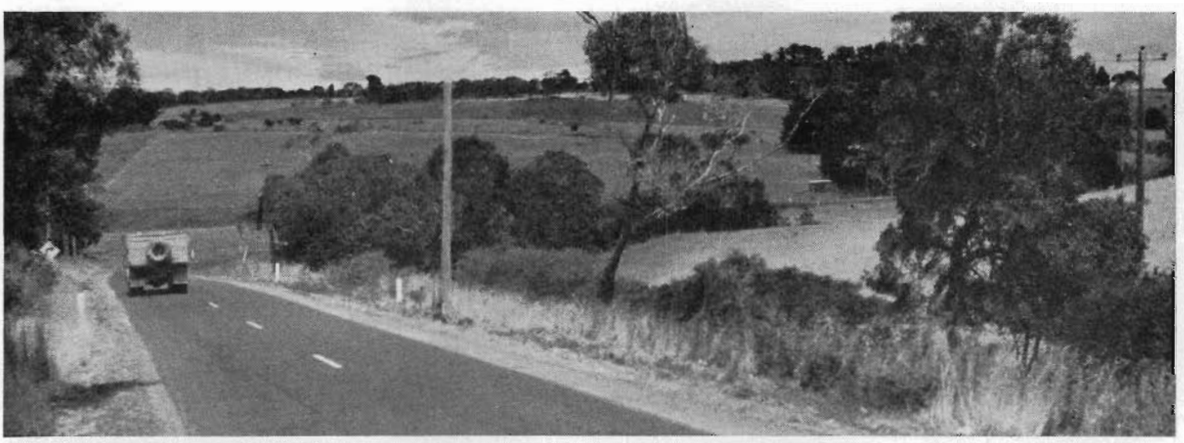
Geelong–Ballan Road—Realignment of 0·4 mile.

Gisborne Shire.—Gisborne–Melton Road—Extension of seal by 1·5 miles.

MAIN ROADS.

Plate 23.—Cobram Shire. Cobram—Yarrawonga Main Road. New six-span bridge over Murray River Flats at Cobram.

Plate 24.—Swan Hill Shire. Sea Lake—Robinvale Main Road Reconstructed and sealed section 5 miles north of Chinkapook.



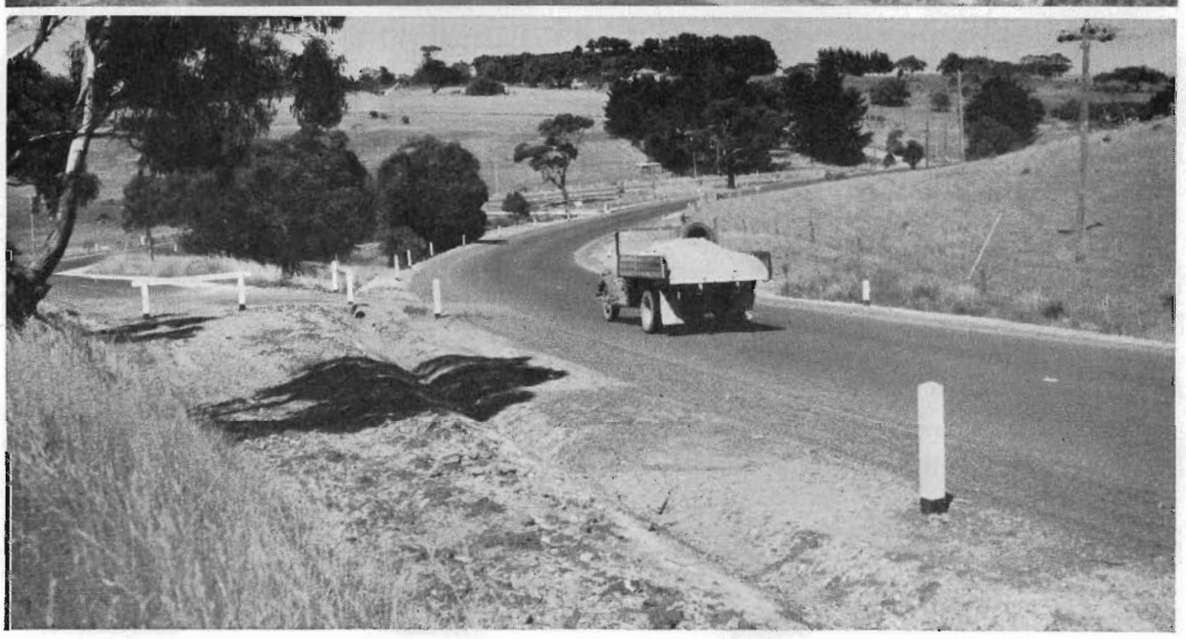


Plate 25 and 26.—Barrabool Shire. Anglesea Main Road. Realignment at Bellbrae. Above—before. Below—after.

Leigh Shire.—Shelford–Bannockburn Road—Widening of narrow bridge over Stony Creek.

Melton Shire.—Coimadai–Diggers Rest Road—Construction of a new bridge and approaches at Toolern Vale.

Gisborne–Melton Road—Reconstruction and sealing of 2·4 miles near Toolern Vale.

Otway Shire.—Charley's Creek Road—Reconstruction and sealing of 1·3 miles. This road is being strengthened to cater for additional traffic caused by the closing of the railway line to Beech Forest. Skenes Creek Road—Continuation of reconstruction and sealing towards Apollo Bay over a distance of 1 mile.

South Barwon Shire.—Barrabool Road—Construction of a new culvert at Kardinia Creek and the improvement of the intersection with Mount Pleasant Road.

Torquay Road—Regrading at Mount Duneed to improve visibility and the reconstruction and sealing of 0·5 mile near Belmont.

Winchelsea Shire.—Birregurra–Forrest Road—Construction of a new reinforced concrete bridge and approaches at Mathews Creek and the construction of a new concrete bridge and large pipe culvert at the Barwon River crossing at Barwon Downs, including improvement to the approaches.

Horsham Division—

Birchip Shire.—Berriwillock–Birchip Road—Sealing of 6·5 miles to provide an 18-ft. seal (Plate 27).

Birchip–Sea Lake Road—Construction of 6·00 miles with an 18-ft. seal.

Dimboola Shire.—Rainbow Road—Widening of 9·25 miles from 12 feet to 18 feet.

Nhill–Jeparit Road—Widening of 5·10 miles to 18 feet and resealing of 6·70 miles.

Horsham City.—Horsham-Lubeck Road—Widening of an existing 2-span reinforced concrete beam and slab bridge 35 feet long and 20 feet between kerbs at Burnt Creek to 26 feet between kerbs with 35 feet span prestressed slabs.

Kara Kara Shire.—Bendigo–St. Arnaud Road—Construction of the Logan Bridge over the Avoca River to replace an old timber structure 16 feet between kerbs and 150 feet long. The new bridge is a 5-span prestressed concrete bridge 201 feet long and 24 feet between kerbs.

Karkarooc Shire.—Hopetoun–Patchewollock Road—Reconstruction of 5·5 miles to provide for an 18-ft. sealed pavement.

Hopetoun–Rainbow Road—Construction of 4·79 miles to an 18-ft. sealed width. This work completed the seal between Hopetoun and Rainbow.

Kowree Shire.—Kaniva–Edenhope Road—Construction and sealing of 3·20 miles. The road between Kaniva and Edenhope is now sealed throughout.

Stawell Shire.—Marnoo Road—Construction of a 5-span rail and concrete bridge 116 feet long and 24 feet between kerbs.

Glenorchy–Horsham Road—Construction and sealing of 4·1 miles.

Wimmera Shire.—Horsham–Noradjuha Road—Construction of a new bridge over the Wimmera River. The new bridge is a 7-span steel and concrete structure 316 feet long and 24 feet between kerbs, and replaces an old timber structure.

Metropolitan Division—

Brighton City.—South Road—Construction of northern carriageway, Cummins Road to Nepean Highway.

Brunswick City.—Brunswick Road—Reconstruction between Truscott Street and Nicholson Street

MAIN ROADS.

Plate 27. Birchip Shire. Berriwillock-Birchip Main Road. Reconstructed and sealed section.

Plate 28.—Wannon Shire. Natimuk—Hamilton Main road—New bridge over Mathers Creek.

UNCLASSIFIED ROAD.

Plate 29.—Coburg City. Murray Road—Widened bridge over Merri Creek.

Moorabbin City.—North Road—Reconstruction from East Boundary Road to Poath Road.

Northcote City (Joint Fitzroy City).—St. George's Road—Reconstruction of the bridge and approaches over Merri Creek.

Oakleigh City.—Fern Tree Gully Road—Duplication of the carriageway from Princes Highway East to Huntingdale Road.

North Road—Construction of new northern carriageway from Lerina Street to Princes Highway East.

Preston City.—Epping Road—Reconstruction at Reservoir Railway Crossing, including channelization.

Fairfield–Reservoir Road—Reconstruction as divided carriageway from Dundas Street to Bell Street.

Sandringham City.—South Road—Construction of southern carriageway from Hampton Street to Bluff Road.

South Melbourne City.—Beach Road—Reconstruction of southern carriageway from Armstrong Street to Kerferd Street.

Traralgon Division—

Alberton Shire.—Balloong Road—Realignment and reconstruction of 2·3 miles east of Old Sale Road.

Narracan Shire.—Realignment of approaches to the Latrobe River Bridge on the Willow Grove Road.

South Gippsland Shire.—Fish–Creek Foster Road—Realignment and sealing of 1·8 miles between Fish Creek and Hoddle.

Woorayl Shire.—Farmers Road—Reconstruction of 1 mile near Dumbalk. Inverloch–Lower Tarwin Road—Realignment and reconstruction of 1·4 miles near Pound Creek.

Warrnambool Division—

Heytesbury Shire.—Cobden–Scotts Creek Road—Reconstruction and realignment of 1·3 miles.

Timboon–Nullawarre Road—Reconstruction and realignment of 1 mile.

Portland Shire.—Portland–Casterton Road—Construction of a 3-span prestressed beam bridge 120 feet long, 24 feet between kerbs, over the Crawford River at Hotspur.

Wannon Shire.—Natimuk–Hamilton Road—Construction of a 5-span rolled steel joist and concrete bridge 202 feet long, 24 feet between kerbs, over Mathers Creek (Plate 28).

11. UNCLASSIFIED ROADS.

During the past 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.

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.—

—	1961–1962.	1962–1963.
	£'000s	£'000s
Construction—		
Applications (totals)	14,765	13,718
Allocations (Country Roads Board portion)	6,231	5,765
Expenditure (Country Roads Board portion)	4,520	3,959
Maintenance—		
Applications (totals)	1,562	2,077
Allocations (Country Roads Board portion)	697	916
Expenditure (Country Roads Board portion)	673	875

The particulars of some of the major works follow :—

Bairnsdale Division—

Avon Shire.—Mawley Road—Reconstruction and sealing 1·5 miles.

Bairnsdale Shire.—Woodglen Road—Reconstruction and sealing of 1 mile.

Romawi Road—Reconstruction and sealing of 1 mile.

Omeo Shire.—Omeo Valley Road—Reconstruction and sealing of 1·2 miles.

Mount Leinster Road—Sealing of 1·8 miles near the Benambra Road.

Orbost Shire.—Bonang–Gelantipy Road—Further extensive work on the replacement of old timber culverts.

Tambo Shire.—Suggan Buggan and Snowy River Road—Extensive widening and reconstruction on this new connexion to New South Wales.

Buchan–Ensay Road—Commencement of reconstruction of 3·75 miles to cater for heavy timber traffic.

Ballarat Division—

Ararat Shire.—Tatyoon Road—Reconstruction and sealing of a further 2·38 miles.

Moyston–Willaura Road—Construction and sealing of a further 3·79 miles.

Buangor–Tatyoon Road—Completion of the construction of two concrete bridges together with 2·0 miles of roadworks.

Ripon Shire.—Beaufort–Carranballac Road—Construction and sealing of a further 2 miles.

Tullaroop Shire.—Maryborough–Baringhup West Road—Construction of a new concrete bridge 120 feet long and 16 feet between kerbs, over Deep Creek.

Benalla Division—

Towong Shire.—Lockharts Gap Road—Construction of a 2-span reinforced concrete bridge 81 feet long, 24 feet between kerbs, over the Mitta Mitta floodway, together with the raising of the floodway to 1934 flood level.

Wangaratta Shire (*Joint Oxley Shire*).—River Road (Tarrawingee)—Construction of a 9-span concrete rolled steel joist and timber bridge 363 feet long, 20 feet between kerbs, over the Ovens River.

Bendigo Division—

Cohuna Shire.—Mansfield's Road—Construction of a new reinforced concrete and rolled steel joist bridge, 160 feet long, 20 feet between kerbs, over Box Creek at the Cohuna–Gordon Shires' boundary. The new bridge replaced an old timber structure which was limited to a 2-ton load.

East Loddon Shire.—Echuca–Serpentine Road—Reconstruction and sealing of a 4·5 miles section south east from Serpentine.

Maldon Shire.—Fogarty's Gap Road—Reconstruction and sealing of 3·5 miles.

McIvor Shire.—Heathcote–Spring Plains Road—Construction of a reinforced concrete bridge 90 feet long by 20 feet between kerbs.

Tooleen–Axedale Road—Reconstruction and sealing of 3·6 miles which completed the sealing of the full length of the road in the shire.

Rochester Shire.—Lockington West Road—Construction and sealing of 2 miles.

Walpeup Shire.—Continuation of construction to provide a more direct route for traffic from Patchewollock to Ouyen and Walpeup through virgin mallee country.

Wycheproof Shire.—Berriwillock–Springfield Road—Construction and sealing of 4 miles north of Berriwillock.

UNCLASSIFIED ROADS.

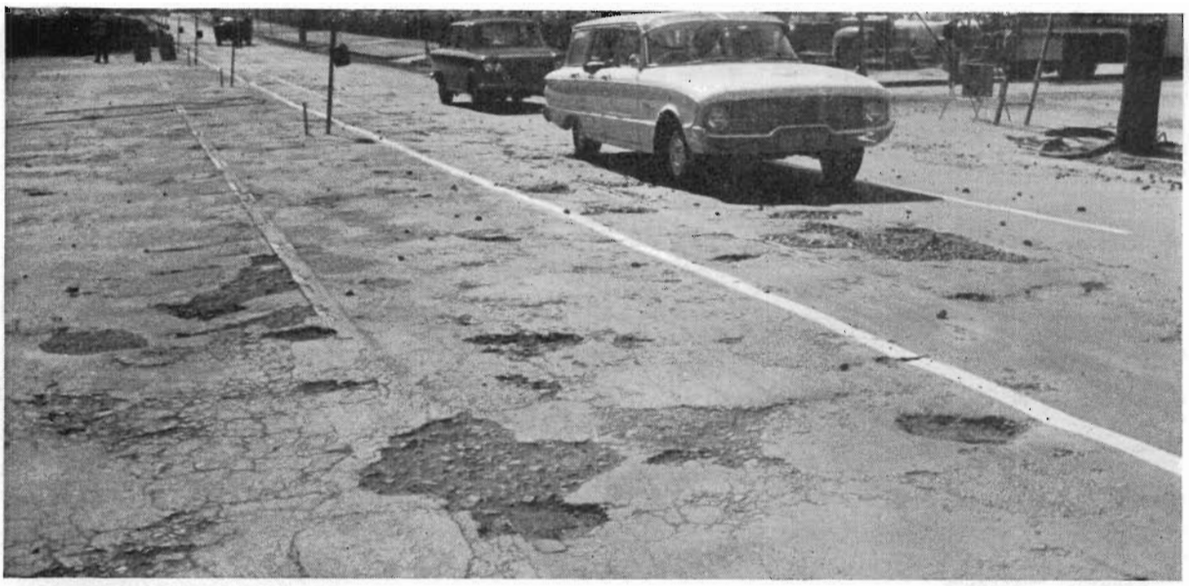


Plate 30 and 31.—Fitzroy City. Victoria Parade—Brunswick Street to Smith Street—before and after reconstruction.

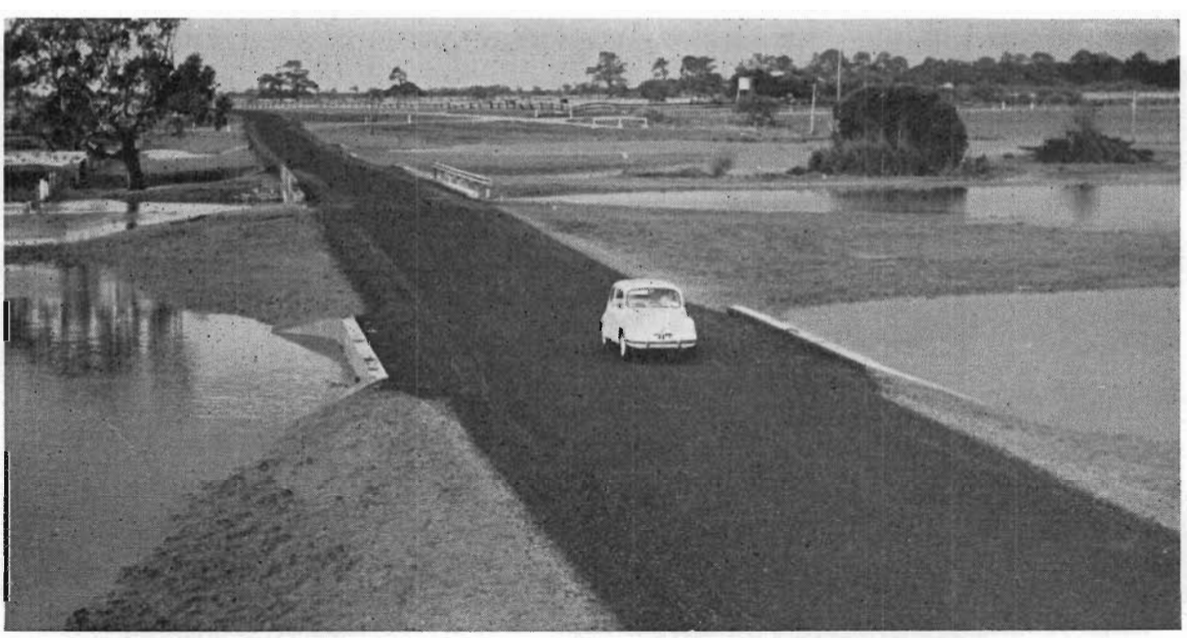


Plate 32.—Alberton Shire. Pound Road East—New culverts and bridge on new alignment over Tarra River, east of Yarram.

Dandenong Division—

Alexandra Shire.—Eildon–Jamieson Road—Construction and sealing of a further 1·3 miles easterly from the end of the existing road near Eildon.

French Island.—Construction, under the Board's supervision, of 6·04 miles of unsealed road for the Department of Lands and Survey. The new road was constructed to open up Crown land for settlement and will also form a link with a vehicle ferry service operating from Tooradin to a point on the north coast of the island.

Geelong Division—

Bacchus Marsh Shire.—Glenmore Road—Commencement of reconstruction of 5 miles to improve the access road to Brick Industries Ltd.'s clay deposits at Glenmore.

Barrabool Shire.—Reservoir Road—Construction and preparation for sealing of 1 mile leading to the proposed new cement works at Waurn Ponds.

Bellarine Shire.—Point Henry Road—Extensive reconstruction to improve access to Alcoa.

Colac Shire.—Larpent Road—Construction and sealing of 1·5 miles.

Stones Road—Construction of a new bridge over Macks Creek.

Geelong West City.—Gordon Avenue—The first stage of construction of this road which connects Latrobe Terrace and Pakington Street is now complete. The Council proclaimed 8 acres in this area which is to be developed as an industrial zone.

Gisborne Shire.—Construction and sealing of several streets at Macedon.

Kyneton Shire.—Kyneton–Metcalfe Road—Reconstruction and sealing of a 2 mile section.

Newham and Woodend Shire.—Campaspe Road—Realignment and reconstruction of this road, together with the construction of a new culvert, was completed.

Otway Shire.—Carlisle–Colac Road—Extension of the sealed pavement by 1·3 miles north from Carlisle.

Romsey Shire.—Woodend–Wallan Road—Reconstruction and sealing of 1 mile.

South Barwon Shire.—Breamlea Road—Extension of the seal by 2 miles to give access to Bancoora Beach at Breamlea.

Werribee Shire.—Ballan Road—Initial construction of 2 miles.

Winchelsea Shire.—Cape Otway Road—Extension of the seal by 2 miles.

Horsham Division—

Arapiles Shire.—Brimpaen–Lah Arum Road—Construction of a 3-span rail and concrete bridge over McKenzie Creek.

Donald Shire.—Laen Bridge Road—Replacement of an old timber bridge with 3 ft. 6 in. reinforced concrete pipes with mass concrete endwalls and wingwalls to provide 32 feet between kerbs.

Dunmunkle Shire.—Murtoa South Road—Construction and sealing of 1 mile which completed the sealed pavement between Murtoa and Lubeck.

Kaniva Shire.—Serviceton North Road—Construction and sealing of 1·6 miles.

Murrawong Road—Construction and sealing of 1·5 miles.

These roads provide access to the Australian Mutual Provident Society's land settlement scheme in the Big Desert area.

Cove Estate Road—Construction and sealing of a further 2 miles.

Kara Kara Shire.—Carapooee Road—Construction of a 4-span reinforced concrete bridge 91 feet long, 20 feet between kerbs.

Stawell Shire.—Joel South Road—Construction of a 3-span continuous rail and concrete bridge 90 feet long and 20 feet between kerbs over the Six Mile Creek.

Warracknabeal Shire.—Warracknabeal–Jeparit Road—Construction and sealing of 2·7 miles which completed the seal between Warracknabeal and Jeparit.

Wimmera Shire.—Wonwondah–Toolondo Road—Construction and sealing of 1·3 miles. With the construction and sealing of 2·0 miles of the road in Kowree Shire, the seal between Wonwondah and Toolondo was completed.

Metropolitan Division—

Camberwell City.—Belmore Road—Reconstruction and pavement widening from Burke Road to Buchanan Avenue.

Coburg City.—Gaffney Street—Reconstruction between Sussex Street and Sydney Road, work in progress.

Murray Road—Widening of the old masonry bridge over Merri Creek, and approaches (Plate 29).

Collingwood City.—Gold Street—Reconstruction between Alexandra Parade and Queens Parade, work in progress.

Fitzroy City.—Victoria Parade—Reconstruction of northern carriageway from Brunswick Street to Smith Street (Plates 30 and 31).

Footscray City.—Nicholson Street—Reconstruction from Irving Street to Donald Street.

Keilor City.—Milleara Road—Reconstruction and widening south of the Calder Highway.

Northcote City.—Westgarth Street—Reconstruction between Holmes Street and Panther Place.

Preston City.—Angliss Street—(undeclared section of Fairfield–Reservoir Road)—Widening of duplicate pavements from Tyler Street to Summerhill Road.

Richmond City.—Highett Street—Widening and surfacing from Burnley Street to Church Street.

Williamstown City.—Mason Street—Reconstruction as divided roadway between Walker Street and Challis Street.

Traralgon Division—

Alberton Shire.—Pound Road East—Construction of a 3-span reinforced concrete bridge 60 feet long, 22 feet between kerbs, over the Tarra River, together with 0·50 mile of approaches (Plate 32).

Maffra Shire.—Heyfield–Upper Maffra Road—Construction of an 11-span reinforced concrete bridge 440 feet long, 20 feet between kerbs, over the Macalister River at Hagens and 0·70 mile of approaches.

Morwell Shire.—Mountain Hut Road—Realignment and reconstruction of 3 miles.

Rosedale Shire.—Rice's Road—Construction of a 4-span composite bridge 180 feet long, 12 feet between kerbs, over the Rainbow Creek.

South Gippsland Shire.—Lower Toora Road—Construction of a 2-span reinforced concrete bridge 120 feet long, 22 feet between kerbs, over the Franklin River.

Promontory Road—Realignment of 3·2 miles for an 18-ft. sealed pavement through the sand hills south of Yanakie (Plates 33, 34, and 35).

Warrnambool Division—

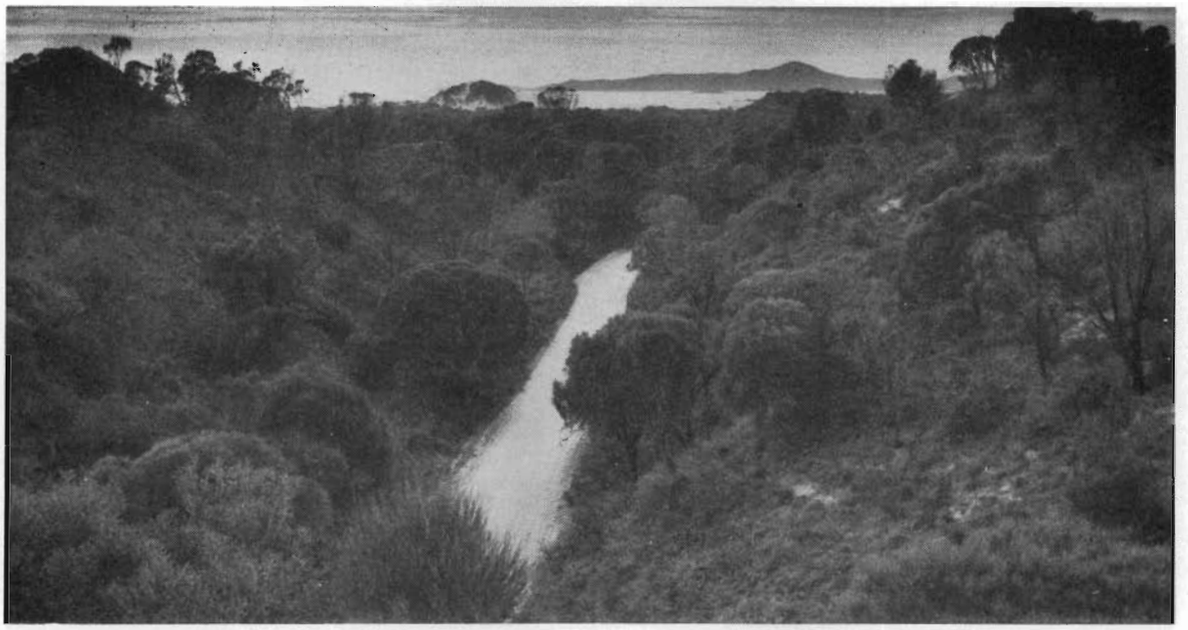
Mortlake Shire.—Hexham–Woolsthorpe Road—Construction of a 3-span prestressed beam bridge 132 feet long, 20 feet between kerbs, over Muston's Creek.

Portland Shire.—Condah–Coleraine Road—Reconstruction and sealing of 3 miles.

Drik Drik–Nelson Road—Reconstruction of 2·5 miles (Plate 36).

Portland–Nelson Road—Construction of a steel truss and concrete pier and deck bridge, 454 feet long and 22 feet between kerbs, together with approaches, at Nelson.

RECONSTRUCTION THROUGH SAND HILLS.



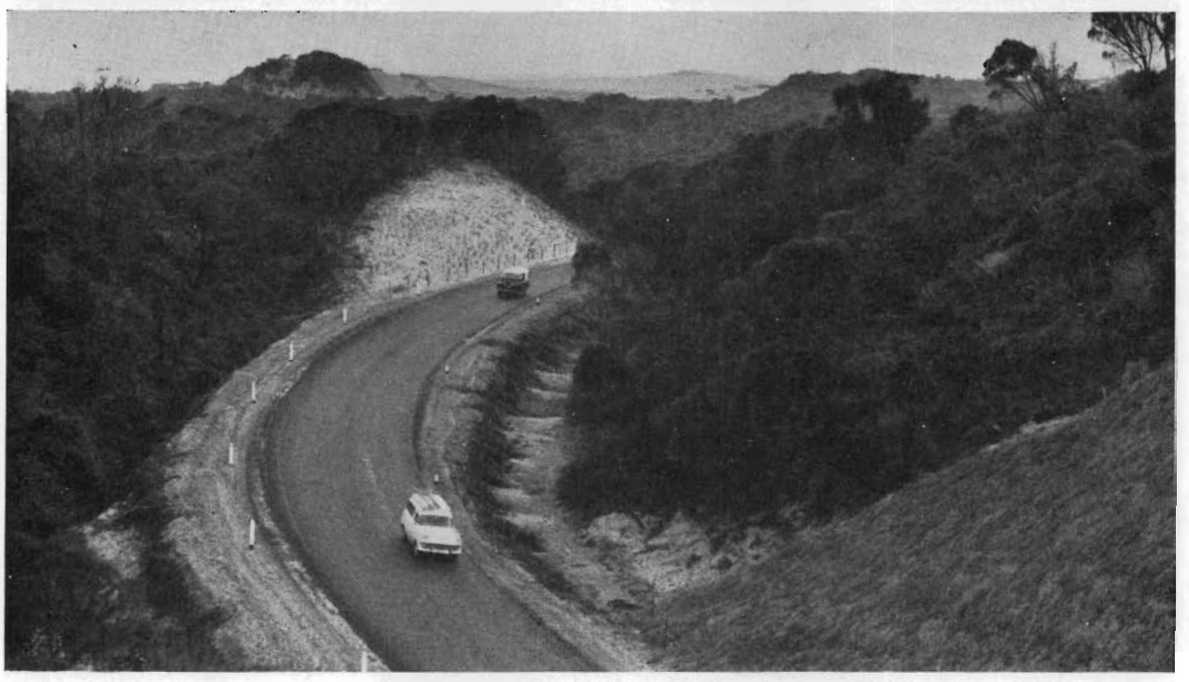


Plate 33 and 34.—South Gippsland Shire. Promontory Road—Section through the sand hills at "The Canyon" before and after reconstruction.

Plate 35.—South Gippsland Shire. Promontory Road—section through the sand hills under construction.

UNCLASSIFIED ROAD.

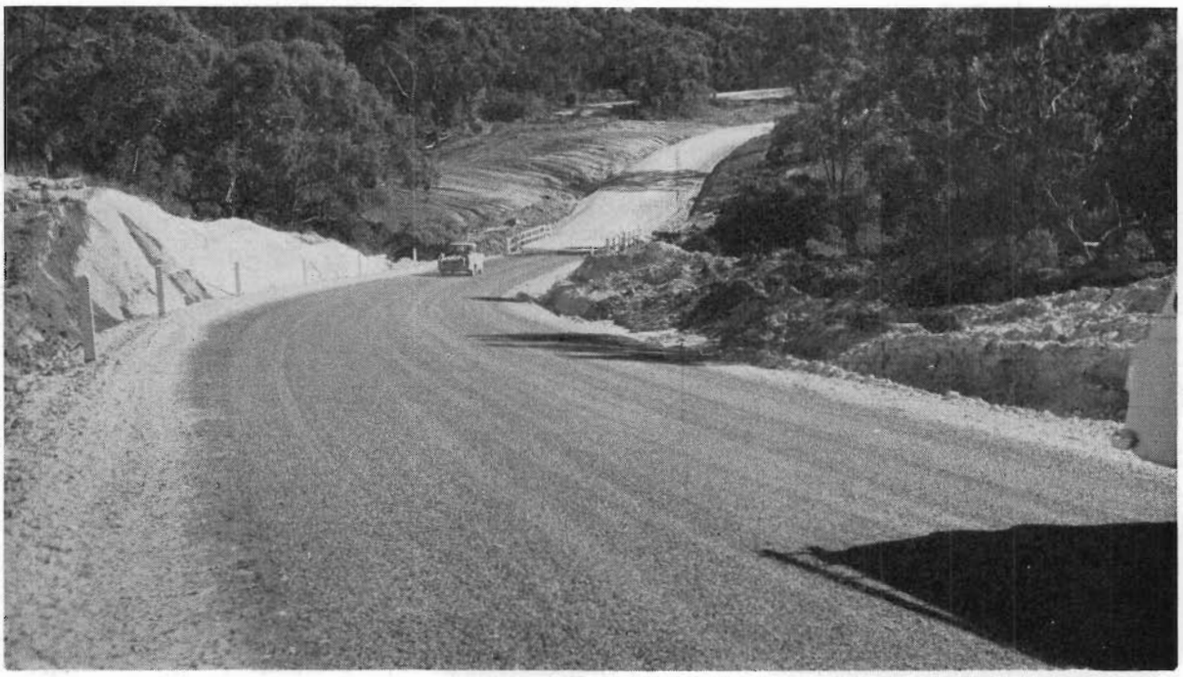


Plate 36.—Portland Shire. Drik Drik—Nelson Road. Reconstructed and sealed section south of Drik Drik.

TOURISTS' ROADS.

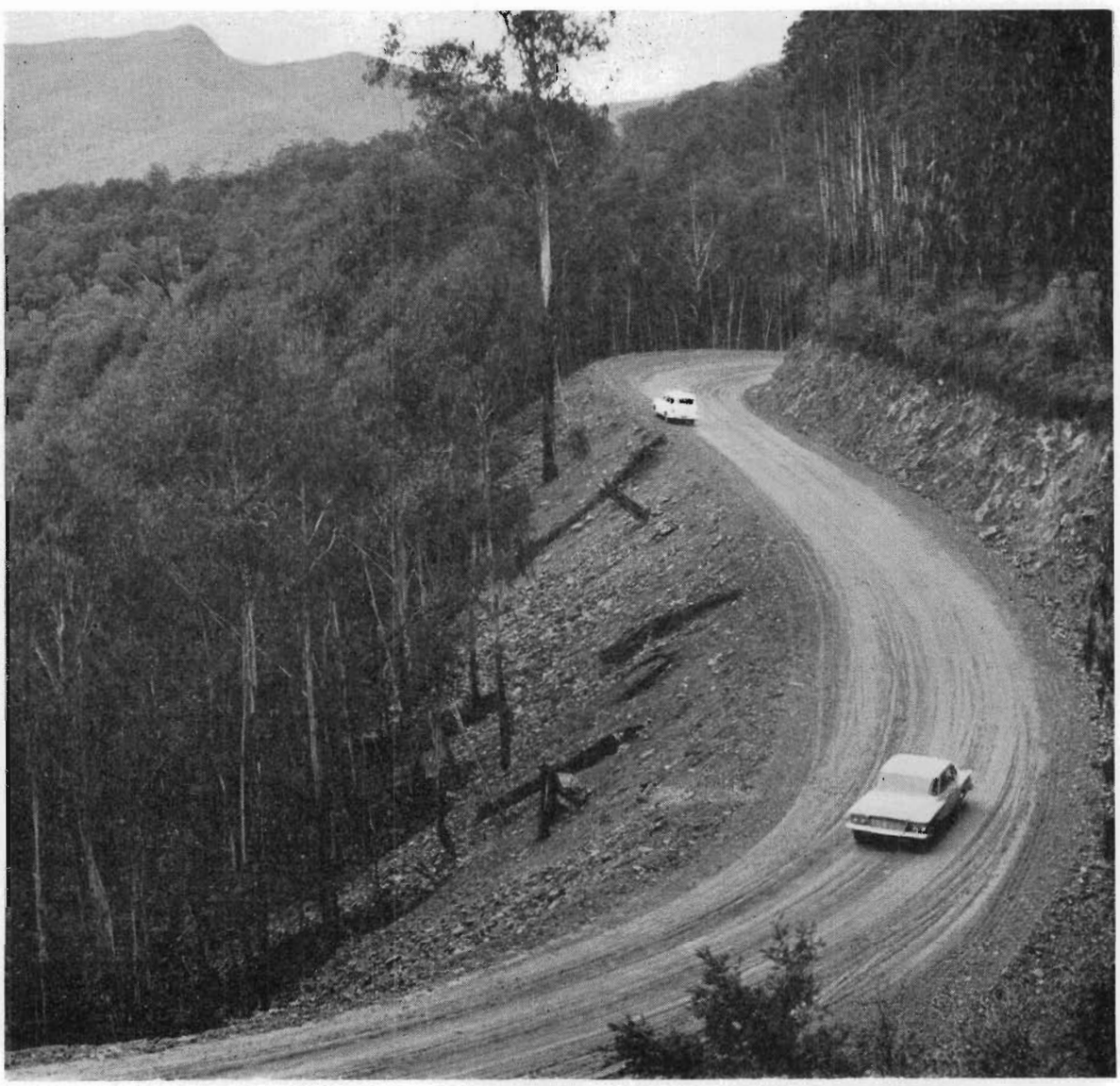


Plate 37.—Bright Shire, Alpine Road. A section reconstructed with fine crushed rock.

12. TOURISTS' ROADS.

Applications for funds for tourists' roads by Divisional Engineers totalled £773,360 and an amount of £621,050 was allotted for work on these roads.

The length of tourists' roads declared under the provisions of the Country Roads Act was increased from 426 to 444 miles by the declaration of a further 18 miles of the Wilsons Promontory Road between Yanakie and Tidal River. This section which passes generally through Crown lands and the Wilsons Promontory National Park carries very heavy tourist traffic, especially during holiday seasons, to the many attractions offering within the National Park.

Most of the Board's declared tourists' roads are located in the more mountainous areas of the State and the provision of reasonable width for the comparatively high volumes of traffic, including passenger buses, experienced on such roads, usually for only a few months of the year, is comparatively costly. Considerable progress has been made in recent years, however, in widening many of these roads or in improving sight distances around substandard curves thereon to provide reasonably safe driving conditions for tourist traffic.

Typical of these improvements during the past year is the widening of the Arthurs Seat tourists' road, which gives tourist traffic on the Mornington Peninsula access to a magnificent panorama of Port Phillip Bay and its surroundings. This work was carried out on the Board's behalf by the Shire of Flinders with funds provided by the Board.

The more important works carried out elsewhere on tourists' roads during the year are as follows :—

Alpine Road.—Construction of a further 3 miles of road near Dinner Plain. The Board's primary and secondary crushing units were used to good advantage in the production of the fine crushed rock required for strengthing the pavement on the section above the snow line. (Plate 37).

Mallacoota Road.—Reconstruction and sealing of 1 mile and sealing of a further 1·5 miles.

Dargo High Plains Road.—Widening of various sections over the first 10 miles.

Ocean Road.—Reconstruction of 1 mile between Airey's Inlet and Moggs Creek; widening of the narrow timber bridge over Grassy Creek, widening of the section between the Cumberland and the Pacific Hotel in Lorne and improvement to the approach roads to the pier (Plate 38); construction of a new bridge 65 feet long and 24 feet wide over Sugarloaf Creek and approaches (Plate 39); widening of 2 miles of sealed pavement from 12 feet to 18 feet between Browns Creek and Skenes Creek.

Grampians Road.—Reconstruction and regrading of 3·7 miles between Stockyard Creek and Jimmy's Creek; construction of a 4-cell 72 inch diameter reinforced concrete pipe culvert 28 feet long to replace a timber bridge at Jimmy's Creek; reconstruction and regrading of 3·7 miles between Jimmy's Creek and the Wannon River.

13. FOREST ROADS.

Total applications for works on forest roads amounted to £460,000 and a total of £366,000 was allocated. Expenditure amounted to £276,261.

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

Benalla Shire.—Tatong–Tolmie Road—Construction of a 3-span rolled steel joist and concrete bridge 110 feet long, 24 feet between kerbs, over Hollands Creek.

Glenlyon Shire.—Drummond–Vaughan Road—Construction of a single span concrete bridge 16 feet long, 26 feet between kerbs, over Back Creek.

Heytesbury Shire.—Cobden–Lavers Hill Road—Resheeting and resealing of 1·0 mile.

Kyneton Shire.—Greendale–Trentham Road—Reconstruction in preparation for sealing 1·5 miles.

OCEAN ROAD.

Plate 38.—Winchelsea Shire. Ocean Road—sealing in progress on widened section at Lorne.

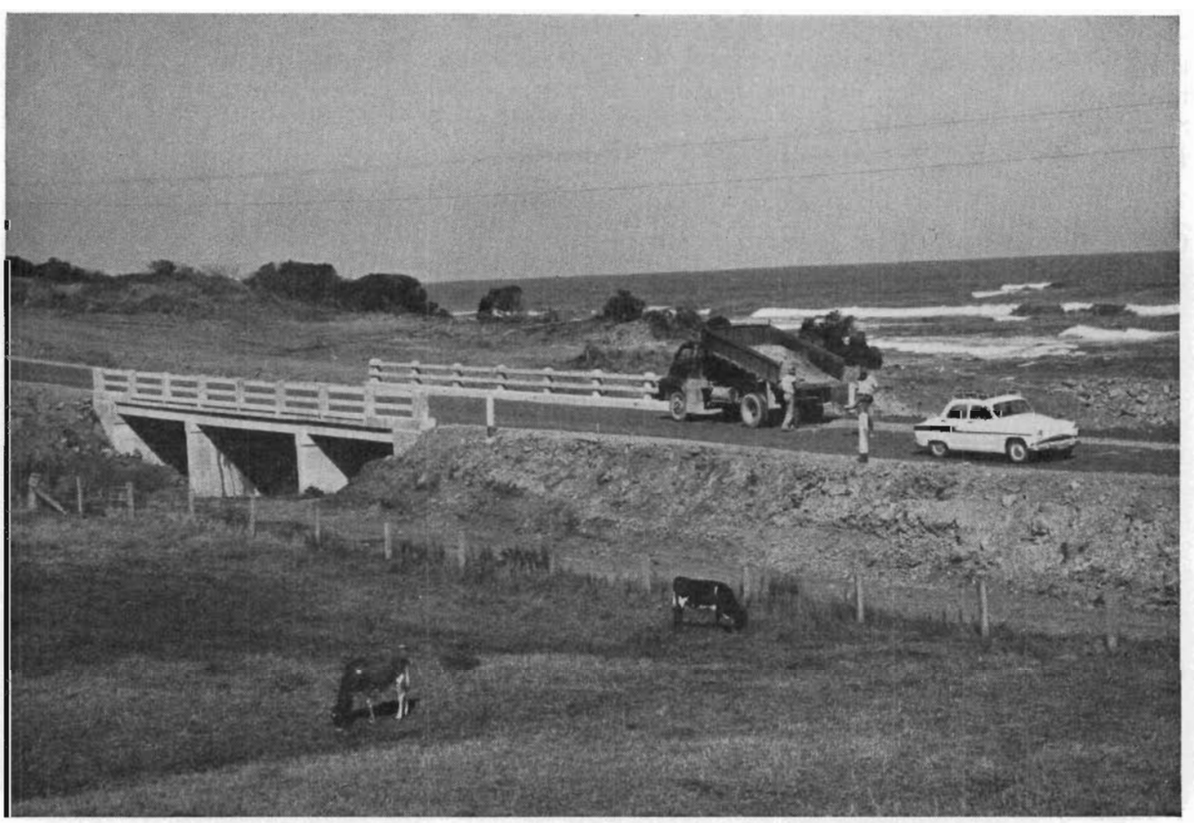


Plate 39.—Otway Shire. Ocean Road—new bridge over Sugarloaf Creek.

THE SALE CAUSEWAY.

Plate 40.—Princes Highway East—Aerial view showing heavy flooding near Sale. Before construction of the Sale causeway.

Plate 41.—Sale Causeway. Hon. H. R. and Mrs. Petty performing the opening ceremony. Plate 42.—New bridge over Thomson River.

Mansfield Shire.—Warburton–Woods Point Road—Resheeting of a further 2 mile section. Completion of widening to 20 feet of a 2·53 miles section between Matlock and Woods Point.

Otway Shire.—Forrest–Apollo Bay Road—Sealing of 1·5 miles and reconstruction in preparation for sealing of 1·5 miles near Barramunga.

14. BRIDGES.

During the financial year, 197 new bridges were commenced at an estimated cost of £2,126,000. Last financial year 199 new bridges were commenced at an estimated cost of £2,119,000. Of the new bridges commenced in 1962–63, 128 were under municipal supervision and 69 under the Board's supervision. The estimated cost of the new bridges commenced under the Board's supervision is £1,293,000.

Some of the larger bridges completed throughout Victoria during 1962–63 under the Board's supervision, included :—

(*a*) a steel girder and reinforced concrete bridge 282 feet long by 28 feet between kerbs over the Thompson River on the Princes Highway East near Sale (Plates 40 and 42). Construction of this bridge completed the new Sale Causeway, which was officially opened for traffic by the Honorable H. R. Petty, M.L.A., Minister of Public Works, on 15th December, 1962 (Plate 41) ;

(*b*) a steel truss bridge with reinforced concrete deck, 450 feet long by 22 feet between kerbs, plus a 4-ft. footway over the Glenelg River at Nelson. This bridge provides a major crossing of the Glenelg River at Nelson between Mt. Gambier and Portland, and was officially opened by the Honorable H. R. Petty, M.L.A., Minister of Public Works, on the 14th March, 1963 ;

(*c*) three prestressed concrete slab bridges 210 feet, 210 feet and 240 feet long respectively by 28 feet between kerbs on the new high level causeway over the Yarra Flats on the Maroondah Highway near Healesville (Plates 43 and 44) ;

(*d*) a reinforced concrete and prestressed concrete beam bridge 142 feet long by 28 feet between kerbs plus a 6-ft. footway over Cardinia Creek on the Princes Highway East at Beaconsfield ;

(*e*) a prestressed concrete beam and reinforced concrete bridge, 181 feet long by 28 feet between kerbs, over the Franklin River on the South Gippsland Highway near Toora.

The reinforced concrete sub-structure was completed for Princes Bridge over the Barwon River at Geelong. The bridge will be 481 feet long by 28 feet between kerbs plus a 6-ft. footway. A contract has now been let for the supply of the 225 tons of welded steel plate girders required for the bridge.

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

(*a*) Hagen's Bridge, a reinforced concrete and prestressed concrete beam bridge 440 feet long by 20 feet between kerbs, over the Macalister River on the Heyfield–Upper Maffra Road in the Shire of Maffra (Plate 45) ;

(*b*) Tarrawingee Bridge, a reinforced concrete and rolled steel girder bridge 363 feet long by 20 feet between kerbs over the Ovens River on the River Road in the Shires of Wangaratta and Oxley (Plate 46) ;

(*c*) replacement of Faux's Bridge, with a reinforced concrete and prestressed concrete beam bridge 201 feet long by 22 feet between kerbs, over the Wimmera River on the Riverside Road near Horsham in Wimmera Shire (Plate 47) ;

(*d*) Logan's Bridge, a reinforced and prestressed concrete beam bridge 212 feet long by 24 feet between kerbs over the Avoca River on the Bendigo–St. Arnaud Road in the Kara Kara Shire (Plate 48) ;

(*e*) a rolled steel girder and reinforced concrete bridge 101 feet long by 24 feet between kerbs, plus a 6-ft. footway over the Creswick Creek on the Glengower Road in the Borough of Clunes.

(*f*) a reinforced concrete and prestressed concrete beam bridge 200 feet long by 24 feet between kerbs over the Loddon River on the Baringhup Road in Maldon Shire.

Metropolitan Bridges and Overpasses.

In addition to constructing bridges in country areas, the Board continued with the design and construction of many bridges in the metropolitan area. Some of the bridges on which work was started or completed during the year included :

(*a*) the southern lane main structure of the Albion Overpass 261 feet long by 28 feet between kerbs in rolled steel girder and reinforced concrete construction. The construction of this bridge together with ancillary structures completed the road over rail overpass on the Western Highway at Albion ;

(*b*) the parallel twin overpass structures, each 136 feet by 40 feet between kerbs, in reinforced concrete and prestressed concrete-slab construction, for the road over rail overpass on the Princes Highway West at Brooklyn ;

(*c*) a prestressed concrete beam and slab bridge 107 feet by 28 feet between kerbs, plus a 6-ft. footway, over the Moonee Ponds Creek in Reynard Street, Coburg ;

(*d*) the widening of the 70-ft. span, stone arch bridge over the Merri Creek in Murray Road, Coburg. This bridge was widened from 25 feet to 50 feet between kerbs plus two 6-ft. footways. The arch barrel was widened in reinforced concrete and the outer bluestone spandrel wall replaced, retaining the historic character of the bridge.

Bridge and Culvert Materials.

Contracts were let during the year for the supply of 6,720 tons of prestressed concrete bridge components valued at £142,000 and reinforced concrete pipes and box culverts to a value of £273,000. The use of reinforced concrete pipes increased by approximately 40 per cent. over the previous year, approximately one-half of the concrete pipe requirements and two-thirds of the box culvert requirements being supplied by country contractors.

A major part of the prestressed concrete units was obtained from metropolitan factories, although some units for use in the Western District are now being obtained from a factory at Mt. Gambier.

A further notable feature has been the first use by the Board of a 78-in. diameter by 8-ft. long precast reinforced concrete pipes. During the year the Board purchased 296 lineal feet of the standard pipe while a further 640 lineal feet of the pipe with increased cover of the reinforcement was purchased for the use in a culvert subject to tidal action.

Corrugated steel pipe and guardrail purchases during the year totalled £29,200, Approximately 7,400 tons of cement were used directly on the Board's projects during the year. A feature in the use of cement has been its increased use in soil stabilization and premixed cement stabilized crushed rock.

Ample supplies of rolled steel girders and reinforcing rounds were available. Approximately 500 tons of rolled steel girders and 1,800 tons of reinforcing rounds were used on the Board's projects during the year.

Bridge Foundation Testing.

The Board's bridge boring team carried out 128 test bores sunk at 31 bridge sites in various parts of Victoria, for a total of 4,760 lineal feet of bore.

BRIDGES.

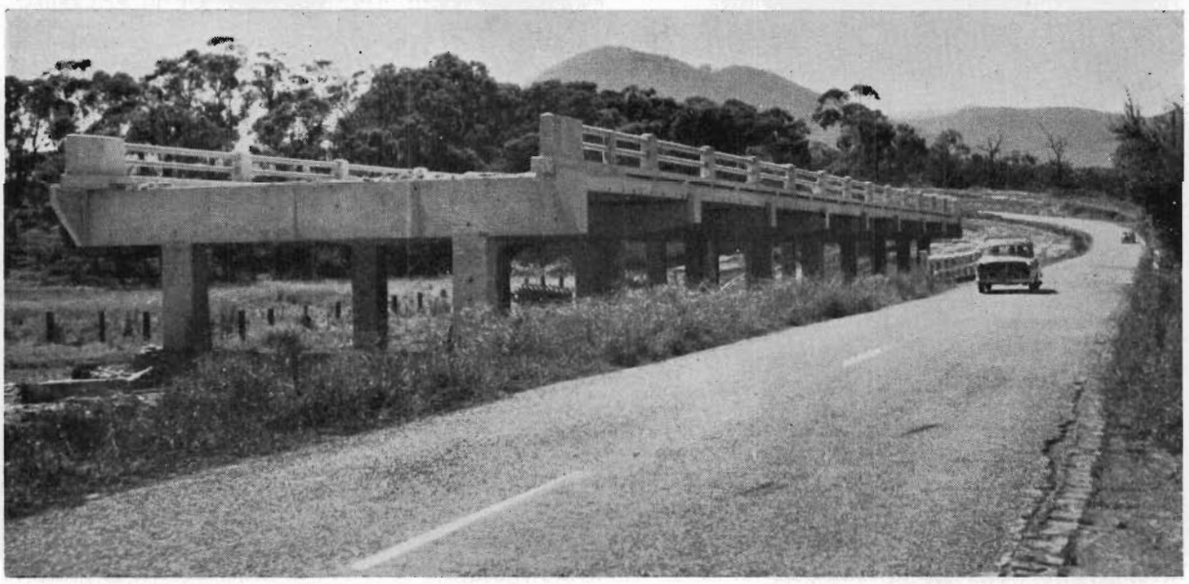


Plate 43 and 44.—Maroondah Highway. Two of the series of bridges over Yarra Flats, near Healesville, to raise pavement above flood level.

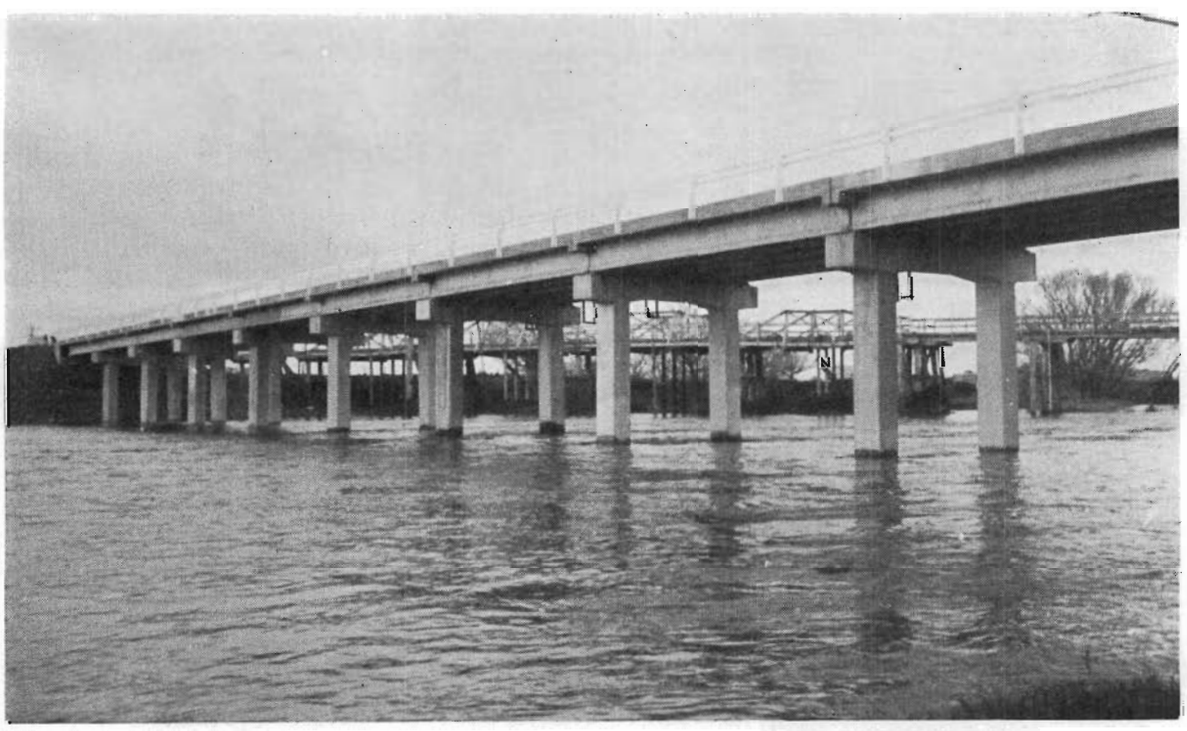


Plate 45.—Maffra Shire. Heyfield—Upper Maffra Road—Hagan's bridge over Macalister River.

BRIDGES.

Plate 46.—Wangaratta and Oxley Shires. Tarrawingee—Milawa Road—new nine-span bridge over the Ovens River.

Plate 47.—Wimmera Shire. Riverside Road bridge over Wimmera River.

Plate 48.—Kara Kara Shire. Bendigo—St. Arnaud Road—Logan's bridge over Avoca River.

15. BITUMINOUS SURFACING.

Extent of Work.

The bituminous surfacing completed in 1962–63 added another 1,074 miles of sealed road to the State's road system. The additional sealing carried out comprised 30 miles of State highways, 35 miles of tourists' and forest roads, 363 miles of main roads, and 646 miles of unclassified roads.

The length of sealed pavement on the Board's declared road network of State highways, by-pass roads, tourists' roads, forest roads, and main roads, now amounts to 11,817 miles or 81·4 per cent. of the total mileage of declared roads.

The total length of all bituminous work carried out amounted to 2,744 miles, which is 73 miles or 2·6 per cent. less than the length treated in 1961–62. The work included 252 miles of widening of the existing sealed pavement, 6 miles of duplication of existing carriageways, 353 miles of restoration of the seal coat on reconstructed sections, and 961 miles of maintenance retreatment.

As in the past it was again possible to assist State and Commonwealth Authorities, and municipalities in cases where no grants had been provided by the Board, by carrying out 98 miles of sealing work on their behalf.

A length of 98 miles was surfaced with 125,155 tons of bituminous asphalt, of which 15,302 tons were laid on the more heavily trafficked roads in the vicinity of the provincial cities of Warrnambool (Plate 49), Horsham, Nhill, Wangaratta and Benalla.

Bituminous Plant and Personnel.

Twenty-three of the mobile spraying units and approximately 600 men were kept fully employed for about seven to eight months of the year on spraying bituminous surfacing work. Suitably equipped municipalities and contractors assisted materially in the programme of work, particularly in the priming of prepared roads ahead of the Board's sealing unit.

Approximately 88 per cent. of the bituminous asphalt surfacing on roads nearer the metropolitan area, Dandenong, Geelong, and Ballarat was undertaken by contractors. The Board's new mobile asphalt plant, to which reference was made in the 49th Annual Report, was employed to do the work in the provincial areas outside the economical range of contractors' fixed plants.

Supply of Material.

Bitumen was again drawn, predominantly in bulk, from the two Victorian refineries, supplied by three marketing companies and distributed by these companies, assisted by the Board's own transporting fleet. A bulk depot was set up by one marketer at Wodonga which was of value for work near that area. The total quantity of bitumen purchased directly by the Board amounted to 27,137 tons, 66 per cent. being distributed by rail and the balance by road vehicles. In addition to this approximately 6,000 tons of bitumen were supplied and used by contractors in the bituminous asphalt work. Approximately 9,000 tons of other bituminous materials such as priming tars and cutback bitumen were used.

In sprayed bituminous surfacing work a quantity of 271,031 cubic yards of covering aggregate was used, while an estimated quantity of 104,000 cubic yards of crushed stone and sand was used by contractors for bituminous asphalt. The total programme for the year therefore required the use of approximately 375,000 cubic yards of mineral aggregates.

In Retrospect.

In the fiftieth year of the Board's activities it is of interest to recall that the first self-propelled bitumen sprayer was purchased in 1916, and that the Board's 10th Annual Report in 1924 records that a length of 61 miles of "main roads radiating from the metropolis" was treated with tar or bitumen with the Board's mechanical sprayers.

From that time on, the annual mileage of sealing work carried out by the Board increased steadily and by the end of the first 25 years of the Board's activities mobile facilities for undertaking this type of work had been built up to provide twelve carefully

designed self-propelled sprayers and other special plant. In the year 1937–38 a length of 837 miles of bituminous sealing work was done by these mobile units, bringing the length of sealed roads on the declared State highway and main road systems to a total of approximately 5,000 miles. Almost 7,000 miles of sealed roads have been added to the declared road system since 1937–38.

Because of gradual improvements in overall efficiency brought about by developments in techniques and plant, and the advent of bulk handling of bituminous materials, about three times the amount of work done in the 1937–38 year was carried out during the present year with only twice the number of mobile units in use 25 years ago.

16. RURAL FINANCE AND SETTLEMENT COMMISSION ESTATE ROADS.

The Board continued to assist in the construction of roads in Rural Finance and Settlement Commission Estate areas.

In the Heytesbury Settlement area, the programme included the formation of approximately 9 miles and the paving of 24 miles of road in addition to the construction of two timber bridges over Bryants Creek. As much use as possible was made of materials available locally, approximately 48,000 cubic yards of pavement material being supplied by contract. Private plant was hired to assist on formation work.

Work also proceeded on the East Goulburn irrigation settlement area in the Shire of Tungamah.

During the year the total expenditure on road and bridge works to serve Rural Finance and Settlement Commission Estates was £127,990. Such expenditure is shared by the Commission ($\frac{1}{2}$) the Board ($\frac{3}{8}$ths) and the Council ($\frac{1}{8}$th).

Since the inception of the scheme in 1947, the total expenditure on all road and bridge works is £2,343,578 of which the Commission has contributed £1,302,854, the Board £756,460 and the respective councils £284,264.

Plate 49.—Warrnambool City. Princes Highway West. Laying bituminous asphalt surface.

WORK FOR OTHER AUTHORITIES.

Plate 50.—State Rivers and Water Supply—Kimbolton Forest Road—Widened and sealed section on new alignment necessitated by construction of the Eppalock Weir.

Plate 51.—Department of Public Works. Northern Highway—Realignment at fruit fly inspection point near Murray River Bridge—Echuca.

Plate 52.—Special Project—City of Melbourne—New Footscray Road—Coal Canal bridge during construction.

17. WORKS FOR OTHER AUTHORITIES.

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

WORKS EXECUTED ON BEHALF OF COMMONWEALTH AND STATE GOVERNMENT AUTHORITIES FOR YEAR ENDED 30TH JUNE, 1963.

Departments.	Description of Works.	Expenditure.					
Victorian Departments.							
State Rivers and Water Supply Commission	Construction of various bridges over Commission channels in connection with Eppalock Weir and Lake Bellfield deviation (includes finalization of Board's contribution to Hume Weir) (Plate 50)	1,563	19	10 *Cr.*			
Rural Finance and Settlement Commission	Roadworks—Commission estates throughout the State	63,092	15	11			
State Electricity Commission	Roadworks—Morwell Shire—Hernes Oak Deviation	95	4	2			
Housing Commission	Roadworks—Morwell Housing Estate	9,149	2	9			
Department of Lands and Survey	Roadworks in Kaniva, other Shires and French Island	47,434	4	11			
Department of Public Works	Roadworks—Albert Park Lake Reserve roads. Construction of various fruit fly inspection points (Plate 51)	1,662	17	2			
Melbourne and Metropolitan Board of Works	Roadworks—Healesville Shire	387	6	1			
Latrobe Valley Water and Sewerage Board	Roadworks—Gould deviation on Walhalla Road—Shire of Narracan	6,280	18	7			
Latrobe Valley Developmental Advisory Council	Cost of land acquisition and removal of buildings, Morwell-Maryvale Road, Morwell Shire	4,725	0	0			
Forests Commission	Road and bridgeworks in Shire of Maffra	116	12	6			
Victorian Railways	Construction of Madden Road Level Crossing for boom barrier	1,734	6	9			
Premier's Department	Contribution towards cost of roadworks on access road to Frazer National Park	6,000	0	0			
					139,114	9	0
Commonwealth Departments.							
Department of Works	Roadworks—various access roads to Commonwealth establishments	60,788	1	4			
					60,788	1	4
Special Projects.							
Kings Bridge	Rentals received, and proceeds to date of disposal, property acquired in connection with the construction of Kings Bridge, less sundry expenditures	10,384	5	2 *Cr.*			
Coal Canal Bridge	Construction of temporary and permanent bridge over the Railway Coal Canal at West Melbourne—City of Melbourne (Plate 52)	57,648	3	7			
Railway Level Crossings	Elimination of various railway level crossings	33,218	17	7			
Municipalities Forest Roads Improvements	Improvement of various roads adjacent to State forests to facilitate the extraction of forest produce	23,500	10	1			
Lower Yarra Crossing	General and preliminary foundation investigations	14,849	3	8			
					118,832	9	9
					318,735	0	1

18. ELIMINATION OF LEVEL CROSSINGS.

Expenditure on projects for the elimination or improvement of level crossings totalled £668,820.

This expenditure was shared as follows :—

	£
Country Roads Board	263,316
Victorian Railways	145,425
Level Crossings Fund	260,079
Total	£668,820

No new works were commenced during the year, the above expenditure all being incurred on continuing and, in some cases, completing work in hand. Such works were at Newport; Pascoe Vale Road, Strathmore; Hampshire Road, Sunshine; Albion and Brooklyn. In addition, some expenditure was incurred on land acquisition for a grade separation proposal at Warrigal Road, Oakleigh, and smaller sums were spent in finalizing works on land acquisition at Craigieburn, Tallarook, Euroa, Seymour, Glenrowan and Wangaratta.

Investigations were continued into the needs and priorities for grade separation works at other localities, and subject to funds being made available at the current rate, the programme for 1963–64 will include provision for beginning two new major schemes in the metropolitan area and two or three in the country. Preliminary investigations were begun into the need for grade separation at Canterbury Road, Canterbury.

19. FLOOD AND BUSHFIRE DAMAGE.

In the Board's 49th Annual Report reference was made to the dryness of the countryside providing the worst bushfire conditions since 1939. In contrast to the extensive bushfires in the Healesville, Eltham, Warrandyte and Mount Dandenong districts in January, 1962, the year 1962–63 witnessed no damage of any consequence to bridges from bushfires.

No major flood damage to roads or bridges occurred during the year although there were isolated instances of minor damage to road pavements following heavy rain storms. The damage incurred was rectified and expenditure incurred charged to road funds. No special Government provision was required for the purpose.

20. ROAD MAKING MATERIALS AND RESEARCH.

The Materials Research Division has again been able to assist several municipalities in locating supplies of gravel and stone and has used both seismic and resistivity methods for this purpose. In one case seismic surveys of a basalt deposit enabled the number of test holes drilled to be reduced to a minimum and at the same time gave more complete information regarding the extent of the deposit than could have been obtained by drilling. Seismic methods, combined with boring and probing, have been used at the site of a proposed bridge at San Remo as well as at numerous other bridge sites.

The routes of proposed freeways and by-pass roads have been examined to determine depths to hard rock and other foundation conditions which might affect the design and location of these facilities.

It has been known for some time that in certain parts of the United States of America and in South Africa, basaltic rocks may have been altered by natural weathering to such an extent that they will break down to clay if used in a pavement. This condition is not always apparent at the quarry or in the crushed material and often is only revealed by examination with a petrological microscope. There have been some indications of similar behaviour in this State, and equipment has been obtained which enables the Board's geologists to prepare specimens and examine them for the minerals which are liable to further decomposition.

More use is being made of the Benkelman beam apparatus for measuring the deflection which occurs when a loaded truck travels over a pavement. This is found to be a very useful indication of the strength of the pavement and often reduces the need for more detailed and expensive testing.

The importance of properly controlling the compaction of road materials has led to the development of instruments using radioactive sources for this purpose and one of these instruments has been purchased and experience is being obtained in its use.

For many years a continuous quality control check on supplies of bitumen from local refineries has been maintained and control is now also exercised over hot mixed asphalt supplied in and near the metropolitan area. The number of plants producing the latter material is increasing and considerable demands are made on the staff engaged in this work.

21. CONTROL OF HEAVY TRAFFIC.

The number of offences reported during 1962–63 was 8,129, an increase of 931 or 13 per cent. compared with the previous year. Successful prosecutions numbered 7,036 or 86·6 per cent. of the total offences reported and resulted in fines and costs amounting to £123,181, an increase of £15,910 16s. above that of last year.

The number of summonses not served was 113 compared with 241 last financial year. This satisfactory result was due in part to the improved staff position at Head Office.

Refusals to weigh were the same as last year and the number of motor vehicles impounded increased by 6 to 28.

During the year the 5 ton gross axle limitation was removed from the Bonang Highway, the Ouyen–Piangil main road and the Grampians tourists' road, the mileages affected amounting to 154. No additional limitations were imposed during the year and the total mileages of such restrictions at present in force are :—

	Miles.
Main Roads	25
Tourists' and Forest Roads	112
Total	137

The steady increase in the number of permits issued for excess weight and for over-dimensional loads over the last few years has continued. The number of permits issued was 15,785, representing an increase of 20 per cent. over financial year 1961–62. Of this number single trip permits issued from Head Office were 9,737, fourteen-day permits, 1,052 and annual permits 2,283. The remaining 2,713 permits were single-trip permits issued by Divisional Offices.

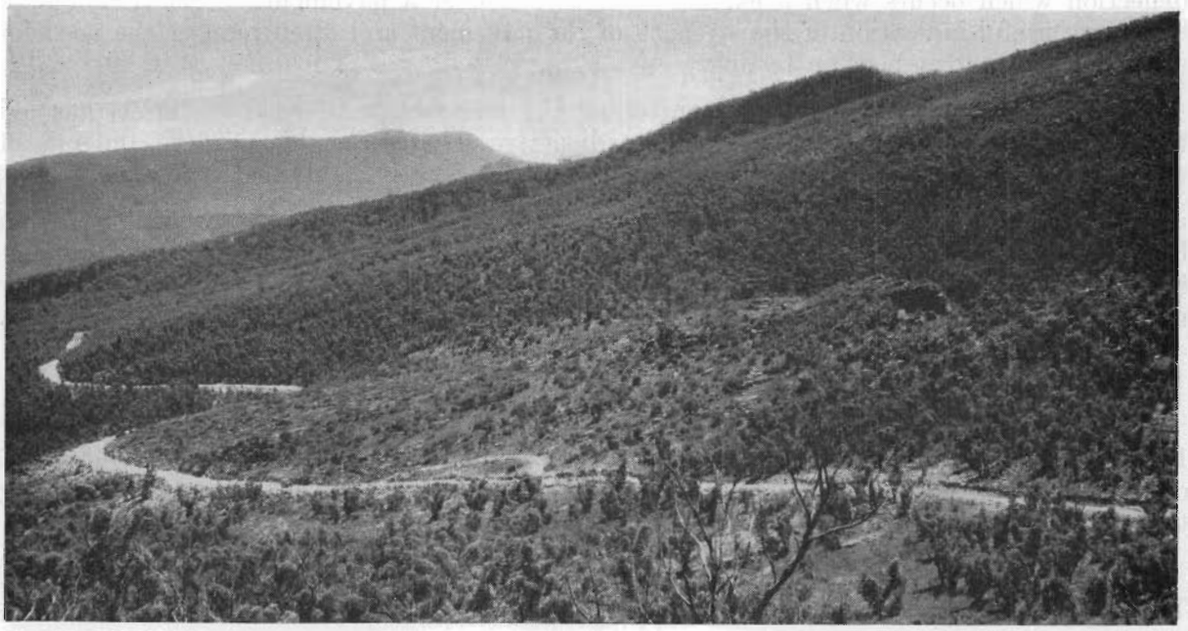
Of the permits issued, 133 were for loads in excess of 70 tons. This figure represents an increase of 47 per cent. compared with last year. Accurate and detailed investigations and planning are required before such permits are issued. The increase in this type of permit is an indication of the development which is taking place in the State. It is interesting to note that of 33 loads which exceeded 80 tons gross, nineteen constituted items manufactured in Victoria.

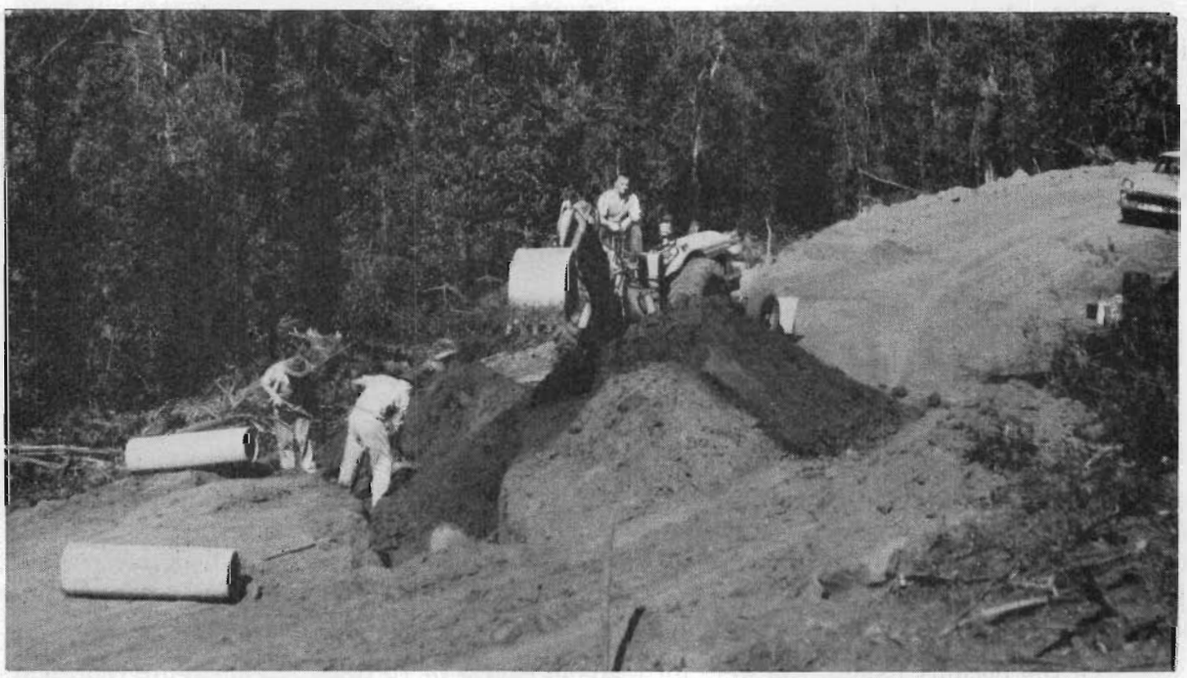
The heaviest single lifts were two transformers carried on behalf of the Snowy Mountains Hydro-Electric Authority from Cudgewa to Bringenbrong. Each of these with the vehicle and prime mover, weighed 169 tons gross. There were five other loads which exceeded 100 tons gross, three of which were articles manufactured within the State.

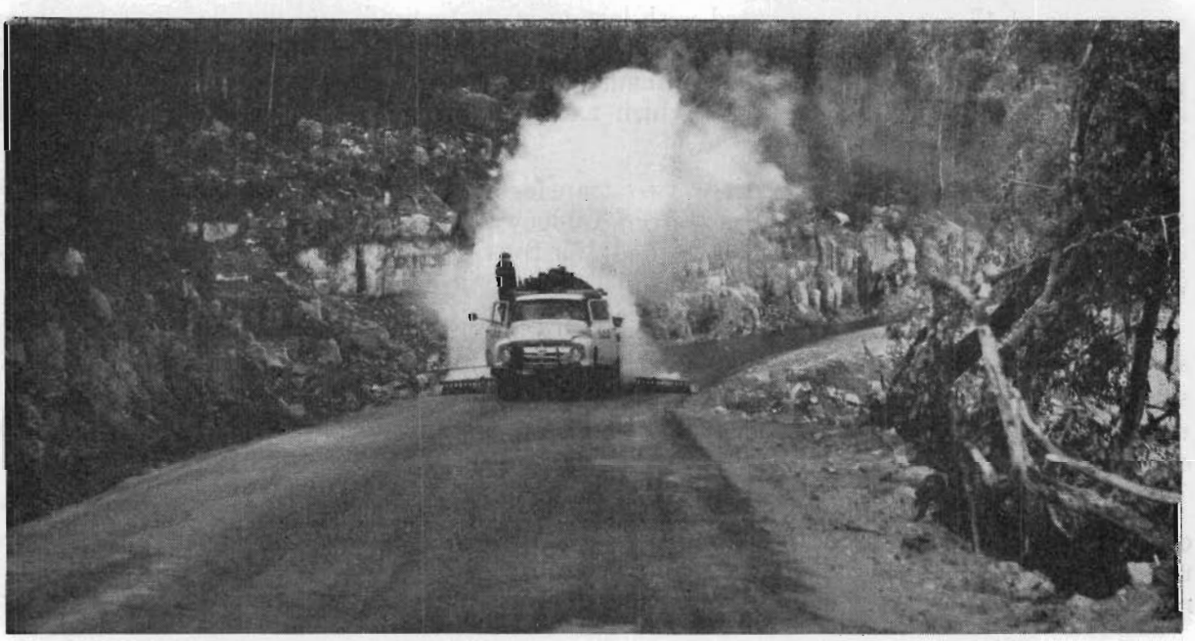
During the year the Board installed two-way car-to-car radio in six of the Traffic Section's cars and the results obtained over the six months of use have been extremely satisfactory. The use of radio has increased the efficiency of the detection operations by rapid communication between patrol cars and a reduction in the mileage travelled by Board's officers.

Despite the fine work of two police officers attached to the Board for the purpose of collecting unpaid fines, a total of £73,596 of all fines imposed since 1947 still remains unpaid. Additional clerical assistance has been provided to assist these two officers to give more time to the work of actually collecting the fines.

NEW GRAMPIANS ROAD TO MT. WILLIAM.







Plates 53, 54, 55.—Construction of the road to the top of Mt. William in the Grampians.

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

22. TOURIST DEVELOPMENT.

As in financial years 1960–61 and 1961–62, the Government provided £100,000 for expenditure on roads of tourist interest apart from the Board's declared tourists' roads.

An amount of £300,000 has therefore been allocated for works selected jointly by the Tourist Development Authority and the Board.

The practice of requiring a contribution from councils whose ratepayers benefited by the works was continued.

The sum of £100,000 provided in 1962–63 was utilized in providing access to various waterfalls, pinic places, seaside resorts and other places of scenic attraction including Jerusalem Creek at Eildon, the Dargo High Plains, Lake Mountain, the access to Mount Baw Baw, Laancoorie Weir, Cape Conran and Kinglake National Park. Another major project was the construction of a road to the top of Mount William in the Grampians for the Commonwealth to which a contribution was made in view of the tourist potential created (Plates 53, 54, and 55).

In addition to participating in the allocation of funds for specified road works of tourist interest, the Board is required under the terms of the *Tourist Act* 1958, to pay into the Tourist Fund each year 2 per cent. of the amount credited to the Country Roads Board Fund from motor registration fees, fines and drivers' licence fees. In 1962–63 the Board paid into the Tourist Fund an amount of £197,328.

23. MUNICIPALITIES FOREST ROADS IMPROVEMENT FUND.

Since the establishment in 1955 by the Government of a fund called the Municipalities Forests Roads Improvement Fund with an initial contribution of £50,000, additional contributions of £15,000 and £50,000 have been made.

The fund is used for the improvement of roads adjacent to State forest areas in order to facilitate the extraction of forest produce.

At the commencement of the financial year £90,000 of the total provision of £115,000 had been allocated. The balance of £25,000 was allocated early in the financial year after consultation and with the concurrence of the Forests Commission. Expenditure reimbursed to councils to 30th June, 1963 in respect of allocations made was £100,595. A contribution was payable in each instance by the Councils benefiting from the allocations made.

24. PHOTOGRAPHY.

During the year the Board's film unit produced a documentary film covering the 50 years of activity of the Board. The film was entitled " The Golden Jubilee of the Country Roads Board " and was exhibited at the conference of Municipal Engineers and was telecast by the national stations in Victoria.

Other films of a technical nature, produced by the Board in previous years, have been utilized in Queensland in educational and public information sessions.

The Board's mobile projection unit screened films hired from commercial distributors and films produced by the Board at 30 camps in locations remote from townships. A total of 120 screenings was given to audiences totalling 2,510 people. Films were loaned on 22 occasions and reports indicate the viewing audiences totalled 2,000 persons.

Throughout the year many still photographs were taken of councils' and Board's road and bridge works, both from ground and from the air.

The services of the Board's photographers were made available to the State Film Centre to assist in obtaining a pictorial record of the tour of Her Majesty Queen Elizabeth II. in February, 1963.

25. DISPLAYS AND EXHIBITIONS.

A special display stand complete with a working model of road construction activities was prepared for exhibition at the Annual Show of the Royal Agricultural Society of Victoria. The display also included enlargements of photographs taken by the Board's photographer and illuminated coloured transparencies.

A leaflet describing the Board's activities was distributed to interested inquirers.

This display was also exhibited at the Motor Show in the Exhibition Buildings.

26. NATIONAL ASSOCIATION OF AUSTRALIAN STATE ROAD AUTHORITIES.

The twenty-fifth meeting of the National Association of Australian State Road Authorities was held at the offices of the Highways and Local Government Department, Adelaide, South Australia, from 29th October, 1962 to 2nd November, 1962.

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 finance, road and vehicle standards and allied subjects and matters relating to the Permanent International Association of Road Congresses were under discussion.

The Chairman and Deputy Chairman of the Board attended the meeting.

There were 63 items on the agenda, including the use of electronic computers, a programme for co-ordinated research by N.A.A.S.R.A. in the field of traffic engineering, principles and practice of bituminous surfacing, and bridge construction practice.

Arrangements were made for various committees to meet during the year, i.e. Principal Technical Committee, Bridge Design Committee, Bituminous Pavements Committee, Plant and Equipment Committee, Materials Research Committee and the Advance Planning Committee. It was also decided to hold the next meeting of the Association in Melbourne from 11th to 15th November, 1963.

27. AUSTRALIAN ROAD RESEARCH BOARD.

A notable event during the year was the First Conference of the Australian Road Research Board. The Conference was held from the 10th September, 1962, to the 14th September, 1962, at the Academy of Science Building, Canberra, A.C.T.

The Conference was attended by 360 delegates, and included Dr. C. G. Charlesworth, Head of the Traffic Section, Road Research Laboratory, U.K. representing Sir William Glanville, Director of the Laboratory, who was prevented by illness from being present; Dr. P. J. Rigden, Director of the National Institute for Road Research, South Africa, and Mr. J. M. Macky, Director of Roading, National Roads Board, New Zealand.

The Conference was opened by the Hon. Hubert F. Opperman, O.B.E., M.P., Minister of Shipping and Transport deputizing for the Prime Minister. Following the official opening an address prepared by Sir W. Glanville was delivered by Dr. C. G. Charlesworth.

Sixteen technical sessions were held at which 76 papers were presented. The sessions were arranged to provide effective discussion on each of the topics.

A record of the proceedings of the First Conference will be available for distribution in July, 1963.

The Second Conference will be held in Melbourne in September, 1964.

During the year three meetings of the Board were held. Mr. F. D. Jackman, Commissioner of Highways, South Australia, was elected Chairman in May, 1963 in succession to Mr. C. N. Barton, Commissioner of Main Roads, Queensland. Mr. C. G. Roberts, Chairman, Country Roads Board, Victoria was re-elected Deputy Chairman until his retirement on the 30th June, 1963.

In February, 1963, the Director of the Board, Mr. D. F. Glynn, left on an overseas visit. He visited England and the U.S.A. where he gained first-hand knowledge of the research being undertaken at the major research establishments in these countries. The visit was also particularly useful in establishing liaison between the Board and its overseas counterparts. Mr. Glynn also attended the United Nations Conference on the Application of Science and Technology for the Benefit of Less Developed Areas Conference in Geneva at which he was a member of the official Australian delegations headed by Lord Casey.

The earlier detailed planning for the Board's research programme was evidenced in the projects continued or commenced during the year. The co-operative studies in conjunction with the Universities throughout Australia, initiated during 1961, were further extended. The Board now has research topics being studied at the Melbourne, Sydney, New South Wales, Queensland, Adelaide and Western Australia Universities. In all States the road authority is co-operating fully with the Board.

In addition, the road authorities co-operated with the Board in a number of applied research projects.

A number of projects under the immediate surveillance of the Human Factors Specialist Committee are in progress. At the Adelaide University, a team is investigating on-the-spot accidents. The problem of driver-road-vehicle interaction is being studied at the Melbourne University. Further studies in the field of human factors have been approved by the Board and will be commenced shortly.

The Board has agreed to support a number of projects recommended to it by the Traffic Flow and Operations Specialist Committee.

At its meeting in May, 1963, the Board approved the establishment of a Road Transport Economics Specialist Committee. The Committee will hold a preliminary meeting early in July, 1963.

Investigations are also proceeding into the desirability of establishing a Specialist Committee on Pavement Design.

These specialist committees, together with the Advisory Council which advises the Board on where and how research can best be carried out continue to contribute materially to the Board's activities. As well as acting in their advisory capacities these bodies provide supervision of projects.

The Board's journal " Australian Road Research " continues to provide a medium for the dissemination of information concerning road research throughout Australia and overseas.

Expenditure during the financial year to 30th June, 1963 was in the vicinity of £100,000.

28. MUNICIPAL ASSOCIATION CONFERENCES.

Each year a representative of the Board attends Municipal Association Conferences throughout the State. This year, conferences were held as follows :—

1. Municipal Association of Victoria ..	At Melbourne on 10th and 11th October, 1962. Attended by the Chairman and Members.
2. Gippsland Municipalities Association ..	At Korumburra on 29th March, 1963. Attended by the Chairman, Mr. C. G. Roberts
3. Northern District Municipal Association	At Kerang on 23rd April, 1963. Attended by the Chairman, Mr. C. G. Roberts.
4. North-Eastern and Goulburn Valley Councils Developmental Association	At Myrtleford on 9th May, 1963. Attended by Mr. I. J. O'Donnell, Deputy Chairman.
5. North-Western Municipalities Association	At Rupanyup on 31st May, 1963. Attended by Mr. R. E. V. Donaldson, Member of the Board.
6. Western District Municipalities Association	At Warrnambool on 16th May, 1963. Attended by Mr. J. W. C. Pascoe, Divisional Engineer, Warrnambool

These conferences strengthen the close co-operation which already exists between the Board and local government. The Board appreciates the opportunity to attend them.

29. COMMISSION OF INQUIRY INTO LOCAL GOVERNMENT IN VICTORIA.

Towards the end of 1962, the report of the Commission of Inquiry into Local Government in Victoria was issued. Mr. D. V. Darwin, when Chairman of the Board, gave evidence to the Commission in answer to certain specific questions and also generally on the nature and scope of the Board's activities, and on road finance.

The Commission in its report referred to the need for increased finance for road construction and maintenance and supported the suggestion for an increase in petrol tax, the proceeds of which should be returned to each State as raised.

The Commission also considered that expenditure in the Melbourne metropolitan area should not be on the basis of a fixed percentage. Rather, the Commission report stated " main thoroughfares should be constructed and maintained or subsidized from road-user funds according to traffic needs, and that this should apply also in provincial cities, towns and boroughs ".

The Commission also suggested that the Country Roads Board be renamed the Victorian Roads Board.

30. CONFERENCE OF MUNICIPAL ENGINEERS.

The 1963 (Nineteenth) Conference of Municipal Engineers was convened by the Board in April instead of May to form part of the Board's Jubilee celebrations. The conference was held at the Board's Head Office, Kew, from 3rd-5th April, 1963. Approximately 250 persons attended, including engineers from most of the 208 municipalities throughout the State, senior engineers from the Country Roads Board, and representatives of the various Commonwealth and State Government Departments interested in various items on the agenda.

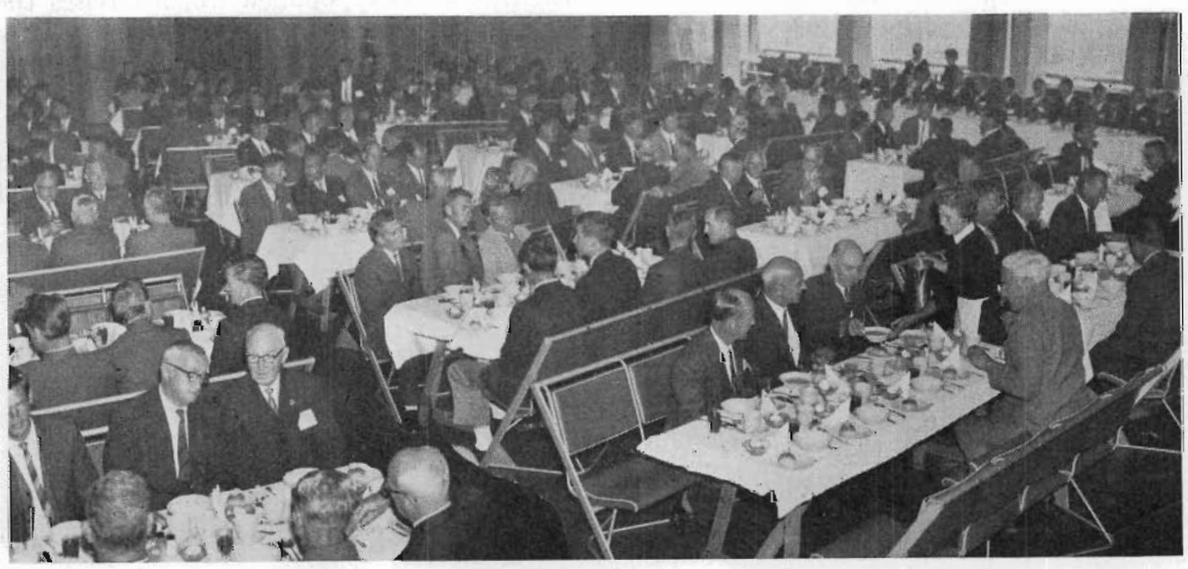


Plate 56.—Luncheon party at Kew City Hall Municipal Engineers Conference 1963.

Before introducing the Hon. H. R. Petty, M.L.A. Minister of Public Works, Mr. C. G. Roberts referred with regret to the passing since the last conference of Mr. F. M. Corrigan and Mr. W. H. Neville, former Deputy Chairman and Member of the Board respectively, Mr. F. H. Osborne (Traralgon Shire), Mr. F. R. Lucas (Ringwood City), Mr. I. D. McDonald (Geelong City) and Messrs. F. J. Walters and D'Arcy Gray (former municipal engineers).

The Honorable H. R. Petty, M.L.A. welcomed the delegates and officially opened the conference. He mentioned that the first conference of municipal engineers was convened in 1939, and referred to the fact that the conference gives to both Board's engineers and municipal engineers the chance to discuss their problems and to exchange information about the development of new methods and techniques.

Items on the agenda included the widening of pavements, multi-cell culvert construction, winning, breaking down and preparation for seal of soft sandstone, use of rubber in bituminous surface treatment, neoprene bearing pads in bridge construction, two-way radio communication in municipal operations and tree planting on rural roads and town streets. In addition, Mr. C. C. Perrin, the Board's Asphalt Engineer, addressed the conference on his recent mission abroad.

During the conference, Mr. E. M. Harvey (Oxley Shire) and Mr. L. G. Bower (Heidelberg City), on behalf of the municipal engineers of Victoria, presented Mr. C. G. Roberts with a Voigtlander 35 m.m. camera in appreciation of the long and valuable service to the Board and municipal government on the eve of his retirement as Chairman of the Board.

31. BOARD'S INSPECTIONS.

It has been the practice of the Board since its inception to make detailed inspections of municipalities in conjunction with local Councillors and officers to :

(*a*) refresh and increase its knowledge of roads and conditions in municipalities inspected ;

(*b*) examine the potential development and future road requirements of the municipalities ;

(*c*) exchange information with councils and discuss problems of mutal interest.

Municipalities visited during the year were the Shires of Whittlesea, Fern Tree Gully, Warrnambool, Towong, Wycheproof, Huntly, Kaniva, Lowan, Wangaratta, Flinders, Broadford, Belfast, Bacchus Marsh, Arapiles, Woorayl, Yackandandah, Oxley, Romsey, Tullaroop, Avoca, Bulla and Wimmera ; the Boroughs of Port Fairy and Wonthaggi and the Cities of Warrnambool, Brighton, Wangaratta, Keilor, Maryborough and Horsham.

The Board extends its thanks to these councils for the co-operation in making detailed arrangements for these inspections, and for the hospitality extended by them.

32. SERVICE ROADS WITHIN STATE HIGHWAY RESERVES.

During the year the Board decided to make contributions towards the construction of service roads within State highway reserves. The Board advised municipal councils that where service roads are made necessary by the duplication of State highways or other improvements to the pavement for through traffic, the Board would be prepared to consider making a contribution of one-half of the cost of construction of the formation and pavements of service roads provided that the service road is required to serve substantial existing development. The Board's contribution will include one-half of the cost of moving existing services where necessary and the full cost of any retaining walls or other work necessary to provide for differences in level between the service road and the edge of the formation provided for through traffic.

Councils will still be required to pay the full cost of footpaths, kerbs, channels and drainage of the service road except that the Board will pay one-half of the cost of any kerbing and channelling on that side of the service road remote from the building line. Subsequent maintenance will continue to be the responsibility of the council.

The Board also advised councils that contributions towards the cost of service roads will be part of the normal allocation of funds made to councils for construction works on unclassified roads.

33. LEGISLATION AFFECTING THE BOARD.

The following legislation affecting the Board was enacted during the year :—

Country Roads (*Amendment*) *Act* 1962, (No. 6943).

This Act made provision for the following :—

(*a*) Authority to make progress payments to contractors, based on the value of work done, at the discretion of the Board. Prior to this admendment, progress payments could be made to contractors, but not more than 90 per cent. of the contract price of any work done could be paid before the full completion of the work. The Board has since increased the figure of 90 per cent. to 95 per cent.

(*b*) Payments for promotion of research into transportation up to a maximum of £5,000 per annum.

(*c*) Increased authority to make payments in respect of traffic control lights on any road. The total amount of £50,000 previously authorized was increased to £100,000. In addition the Board was granted authority to make contributions up to £10,000 per annum towards the cost of installation of traffic lights on State highways.

(*d*) Authority for the Board to make its activities known to the public.

Public Works Loan Application Act 1962, (No. 6931).

This Act makes provision for the application from the Loan Fund of various amounts for the purposes set out in the schedule of the Act and the following concern the Board :—

(*a*) Payments required to be made by the Treasurer under the provisions of the *Coal Canal Bridge Act* 1960 (No. 6613)—£153,000.

(*b*) Payments required to be made by the Treasurer under the provisions of the *Napier Street Bridge Act* 1954 (No. 5822)—£2,464.

(*c*) Test boring and preliminary investigations in connexion with the proposed Lower Yarra Crossing—£50,000.

Sale of Lands Act 1962, (No. 6975).

Amongst other things this Act amends the provisions of the Local Government Act relating to subdivisions of land. Plans of subdivisions for any land abutting on a State highway, main road, tourists' road, forest road or by-pass road, or main road in an approved planning scheme, are required to be referred to the Board. Forest roads and by-pass roads were not previously included. In addition, it is prescribed that unless the Board reports to a Council on a plan of subdivision within 60 days, it will be presumed to have raised no objection or to have consented. There was previously no time limit.

34. WORKS STUDY.

The Methods Section continued to undertake projects of work simplification throughout the Board's organization.

Some of the major tasks performed by the Section during the year included :—

(*a*) a review of the various factors to be considered in preconstruction planning ;

(*b*) investigations in conjunction with the Accountant into the development of a system of budgetary control ;

(*c*) further investigations into the possibilities of using a data processing installation in the Board's organization together with practical experience in the use of punched paper tape produced as a by-product of the accounting machine at the Geelong Divisional Office ;

(*d*) investigations into land acquisition procedures ;

(*e*) forms design.

Where the Section's investigations led to the introduction of new procedures, officers of the Section assisted in their installation to enable a smooth changeover.

35. PUBLIC RELATIONS.

In November, 1961, Australian Public Relations Services Pty. Ltd. was engaged to advise and assist the Board to keep the public more adequately informed of the scope and extent of the Board's activities.

It was a natural development for the Board to appoint a member of its own staff to co-ordinate the various public relations activities undertaken by different members of the staff.

In May, 1963, the Board appointed Mr. J. H. G. Williams, B.A., already a member of the Board's staff, as Public Information Officer.

36. MISSIONS ABROAD.

The Board's Asphalt Engineer, Mr. C. C. Perrin, attended the International Conference on the Structural Design of Asphalt Pavements which was held during August, 1962, at the University of Michigan. A paper on practices in asphalt pavement construction, prepared jointly by Mr. Perrin and Mr. A. H. Gawith, the Board's Materials Research Engineer, was presented to the Conference at the invitation of the University in co-operation with the American Asphalt Institute.

Mr. Perrin's itinerary included visits to a number of highway authorities in North America, the United Kingdom and Europe and he also attended the Fourth World Meeting of the International Road Federation which was held in Madrid during October.

In January, 1963, Mr. I. J. O'Donnell, then Deputy Chairman of the Board, and Mr. K. N. Opie, Senior Design Engineer, visited the United Kingdom, Holland, Belgium, France and the United States of America, to study the construction and operation of tunnels under and bridges over waterways. In 1959 the Government authorized the Board to carry out investigations to establish engineering and economic data on which the provision of a toll crossing of the Lower Yarra River could be based, and Mr. O'Donnell's and Mr. Opie's visit abroad was for the same purpose. The report of their investigations has been submitted to the Government.

37. RETIREMENT OF MR. C. G. ROBERTS, MR. W. H. NEVILLE AND MR. J. MATHIESON.

Mr. C. G. Roberts retired on 30th June, 1963, after 38 years' service with the Board. He joined the Board's staff in 1925 as Assistant Highways Engineer, subsequently becoming Highway's Engineer in 1928, and Chief Engineer in 1939.

During the war Mr. Roberts served with Military Intelligence. He was appointed Director of Military Intelligence, Army Headquarters in 1942 and Controller, Allied Intelligence Bureau, Headquarters, South-West Pacific Area.

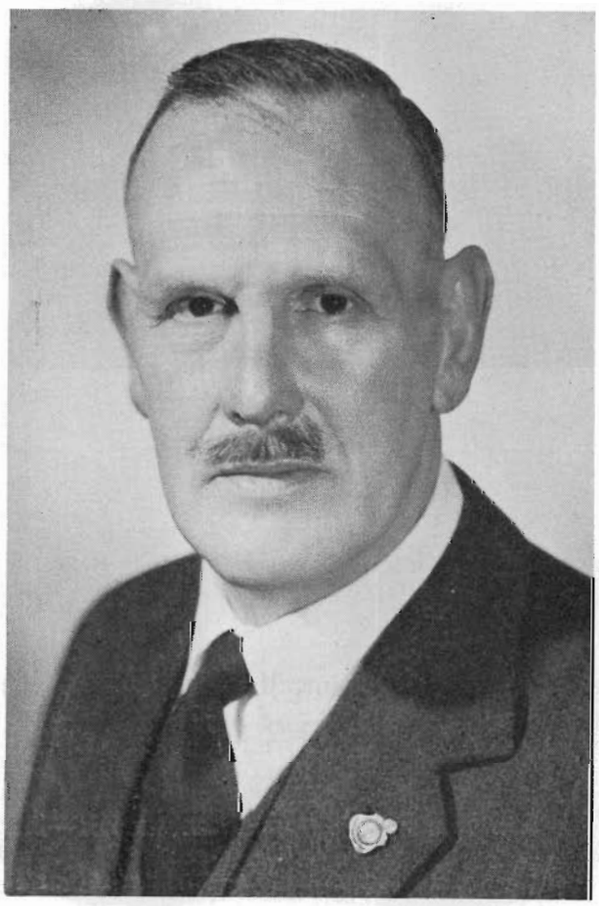


Plate 57.—C. G. Roberts.

Mr. Roberts was appointed to the Board in 1956 and became Chairman on the retirement of Mr. Darwin in 1962.

During his period of office as Chief Engineer, Mr. Roberts visited America and the United Kingdom in 1947 and upon his return recommended the establishment of a permanent research agency, under the aegis of the then Conference of State Road Authorities to extend and co-ordinate road research throughout Australia. This recommendation led to the constitution of the Australian Road Research Board in 1959. In July, 1962, Mr. Roberts became Deputy Chairman of the Australian Road Research Board.

Mr. W. H. Neville retired on the 9th August, 1962, after a life-time's service with the Board. Mr. Neville joined the staff as a junior clerk in January, 1914, the year after the Board was first established, and apart from service with the armed forces during the First World War spent the whole of his working life in the Board's service.

Plate 58.—The late W. H. Neville.

Mr. Neville was appointed Assistant Secretary in 1930, Secretary in 1949, and a Board Member in 1956.

For some years prior to his retirement, Mr. Neville suffered from a heart condition and the Board and staff learned with deep regret of his death in December, 1962.

Mr. Mathieson joined the Board's staff in 1921 and subsequently held the appointments of Assistant Bridge Engineer, Metropolitan Engineer and Highways Engineer before becoming Deputy Chief Engineer in 1945, and Chief Engineer in 1956. For a short period in 1957 he was an acting Board Member.

Plate 59.—J. Mathieson.

During his service with the Board, Mr. Mathieson made several visits overseas to study developments in road engineering. He also represented the Board with distinction on a number of important committees.

38. PASSING OF FORMER BOARD MEMBERS.

As mentioned previously in this report it was with deep regret that the Board learned of the passing of Mr. W. H. Neville, Board Member, 1956–1962.

The Board and staff also express their regret at the passing during the year of two other former Board Members, Mr. A. D. McKenzie, who was a member from 1938 to 1940, and Mr. F. M. Corrigan who was a Member from 1940 to 1950, and Deputy Chairman from 1950 to 1956.

39. PERSONNEL.

Personnel Employed.

The following personnel were employed by the Board at 30th June, 1962, and 30th June, 1963 :—

	30*th June*, 1962	30*th June*, 1963
Salaried Staff	915	918
General Staff	691	750
Award Employees	2,343	2,255
Total	3,949	3,923

Towards the end of the financial year arrangements were in hand to obtain the services of additional staff for road design, title survey and land acquisition activities to cope with the Board's increased programme of work.

Recruitment.

While for the first time since the war the supply of young qualified engineers last financial year was adequate to meet the demand, the availability this financial year exceeded the demand.

In order to fill a number of vacancies amongst the Divisional Accountants and other positions at Head Office which required qualified accountants, the Board recruited a further five qualified accountants during the year.

During the past few years there have been numerous requests from technical schools, secondary schools and other organizations for senior members of the Board's staff to provide information at career nights about the types of careers provided by the Board's activities. To assist in this matter a special stand has been prepared with selected photographs highlighting the various aspects of the Board's work.

No recruitment problems in employee classifications were encountered during the year.

Staff Associations.

One of the most notable features of staff relations during 1962–63 was the formation of Sub-branches of the Municipal Officers' Association and the Association of Architects, Surveyors, Engineers and Draftsmen.

The C.R.B. group of the Association of Professional Engineers has existed for some years and following a log of claims submitted by the Association, the Board was directed by the Commonwealth Arbitration Commission to apply the Professional Engineers Award No. 2 to its qualified engineering staff. After a considerable amount of negotiation an Agreement on salaries was reached with the Association and certified by the Arbitration Commission in June, 1963. The Board is now for the first time, legally bound to pay fixed salaries assessed on the basis of work value to its qualified engineers.

Staff Retirements.

The following officers with substantial service retired during 1962–63 :—

Mr. F. W. Hine, Paying Officer, on 22nd August, 1962, after 42 years' service with the Board.

Miss F. E. Poole, Clerk, on 30th September, 1962, after 33 years' service with the Board.

Mr. J. Mathieson, Chief Engineer, on 27th December, 1962, after 41 years' service with the Board.

Mr. W. Langford, Clerk, on 31st December, 1962, after 17 years' service with the Board.

Mr. A. G. Martin, Assistant Accountant, on 1st January, 1963, after 27 years' service with the Board.

Mr. E. Denny, Clerk, on 2nd March, 1963, after 30 years' service with the Board.

Mr. R. O. Boucher, Divisional Engineer's Clerk, on 29th March, 1963, after 28 years' service with the Board.

Mr. J. R. Alford, Assistant Experimental Officer, on 2nd April, 1963, after 31 years' service with the Board.

Mr. J. Bowman, Divisional Engineers' Clerk, on 15th April, 1963, after 31 years' service with the Board.

The following officers died during the year :—

Mr. J. N. Crebbin ; Mr. S. A. Lovegrove ; Mr. H. E. Batty ; Mr. R. E. Carbines ; Mr. R. W. Williams.

Industrial Activity.

The financial year 1962–63 saw a considerable amount of activity in the Industrial Courts which affected the Board. In April, 1963, the Full Bench of the Commonwealth Arbitration and Conciliation Commission awarded 10 per cent. marginal increases and an additional week's leave to members of the Metal Trades Unions. This award and its subsequent effect on other awards and determinations to which the Board is bound, is estimated to cost the Board an additional £65,000 per annum.

The major activity in which the Board's industrial advocates were engaged was the Building Trades case before the Arbitration Commission. During the hearing inspections were made by Commissioner Webb, accompanied by employer and employee representatives, of several Board camps in which bridge construction employees were housed. One of the features of the final award made by the Commission was the considerable increase in the distant job allowance from £3 5s. to £12 12s. where accommondation was not provided.

With the support of the unions concerned arrangements were made during the year for medical examination and X-rays of employees engaged in the preparation and serving of food in Board's camps and cafeterias.

In November, 1962 with the support of the Trades Hall Council the Board introduced a retiring gratuity scheme for its award employees and general staff, i.e., permanent depot and supervisory personnel. This scheme provides for the payment of £22 10s. per annum for each completed year of service with a minimum period of ten years' service. Retirement at the age of 65 years has become compulsory. Supervisory personnel have the option of participating in the State superannuation scheme instead of receiving a retiring gratuity. Many of the young supervisory staff have elected to contribute towards superannuation benefits.

40. TRAINING.

Development of Courses.

The systematic development of training was sustained during the financial year. In keeping with the Board's policy of directing training towards meeting defined needs, the Training Steering Committee examined and assessed training needs for the guidance of the Training Officer.

The following training courses were conducted through the year :—

A course of one week was held for two groups of Supervising Engineers on Construction, Planning and Control, and Use of Plant.

A general course of four days for Traffic Officers.

A follow-up course of two days for Traffic Officers on specific aspects of Acts and Regulations.

A transition course of five days for Cadets graduating in 1962.

An induction course of three days for Cadets newly appointed in 1963.

Special attention was devoted during the year to detailed planning for the future. Among plans formulated were those relating to the introduction of a comprehensive scheme of induction for staff and employees, the holding of a course for Senior Administrative Section Leaders and a programme of training for Overseers.

An important innovation which should have a substantial influence on developments in the future was the nomination of a Training Liaison Officer amongst existing personnel in each regional division.

Noteworthy among the uses made of external institutions for training purposes were the attendances of Mr. W. S. Brake, Assistant Divisional Engineer, Dandenong at the Traffic Planning and Control Course, University of N.S.W. and of Mr. S. H. Hodgson, Assistant Programme Engineer at the Intermediate Course, Australian Administrative Staff College, Mount Eliza.

Provision was again made for a quota of students studying appropriate technical courses at Universities and Technical Colleges to gain requisite practical experience with the Board during their long vacations.

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CADETS.

The Board has attached a great deal of importance to the vacation experience given to its cadets at the end of each year.

The following table shows the number of cadets at Universities in the 1963 academic year :—

Cadets Under Training.	Civil Engineering.	Commerce.	Economics.	Total.
First Year	4	..	..	4
Second Year	8	..	1	9
Third Year	5	1	1	7
Fourth Year	5	..	..	5
Total	22	1	2	25

41. ACKNOWLEDGMENTS.

The Board desires to thank you, Sir, for your help and interest in its work.

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

We have the honour to be,

Sir,

Your obedient servants,

I. J. O'DONNELL, O.B.E., E.D., B.C.E., A.M.I.E., Aust., 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 987,399 an increase of 5·4 per cent. on the registrations effected during the previous year as compared with an increase in 1961–62 of 3·9 per cent. over the total for 1960–61.

Vehicles.	Financial Year 1961–62.		Financial Year 1962–63.		Increase.	Decrease.
Private—						
New	60,793		78,722		..	..
Second-hand—						
Reregistered	22,382		22,039		..	..
Renewals	640,482		668,527		..	..
		723,657		769,288	45,631	..
Commercial and Hire—						
New	9,687		11,618		..	..
Second-hand—						
Reregistered	4,492		4,396		..	..
Renewals	96,864		98,159		..	..
		111,043		114,173	3,130	
Primary Producers—Trucks—						
New	3,681		4,188		..	..
Second-hand—						
Reregistered	4,385		4,932		..	..
Renewals	61,719		64,137		..	..
		69,785*		73,257†	3,472	..
Licences under Motor Omnibus Act		791		776	..	15
Trailers		14,294		14,760	466	..
Motor Cycles		17,124		15,145	..	1,979
Total		936,694		987,399	52,699	1,994

* Includes 32,268 No Fee tractors. † Includes 35,116 No Fee tractors.

APPENDIX 2.

COUNTRY ROADS BOARD.

STATEMENT OF RECEIPTS AND PAYMENTS FOR YEAR ENDED 30TH JUNE, 1963.

(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, 1962		4,922	..	..	..	..	..	4,922
Motor Car Registration Fees	10,082,859							
Additional Registration Fees	707,526							
Drivers' Licence Fees ..	318,653							
Drivers' Licence Testing Fees	74,537							
Fines	284,129	..						
	11,467,704							
Less Cost of Collection	784,786							
		10,682,918	..	..	..	..	..	10,682,918
Municipalities Repayments—								
Permanent Works—Main Roads	35,436							
Maintenance—Main Roads	846,484							
		881,920	..	..	..	..	..	881,920
Moneys provided by *Commonwealth Aid Roads Act* 1959		..	..	6,324,769	4,350,797	..	..	10,675,566
Proceeds from Commercial Goods Vehicles Act 6222		..	2,459,557	..	..	..	..	2,459,557
Receipts from State Loan Funds—Act 6229		..	..	..	..	301,000	..	301,000
Fees and Fines under Country Roads Act ..		915	..	..	..	..	..	915
General Receipts		82,842	..	..	..	..	..	82,842
		11,653,517	2,459,557	6,324,769	4,350,797	301,000	..	25,089,640
PAYMENTS.								
Main Roads—								
Construction and Reconstruction ..		3,616,900	..	1,357,353	..	128,388	5,102,641	6,747,848
Maintenance		811,100	827,494	6,613	..	..	1,645,207	
State Highways								
Construction and Reconstruction ..		456,846	..	4,264,500	..	213,246	4,934,592	6,605,006
Maintenance		38,351	1,632,063	..	..	..	1,670,414	
By-pass Roads—								
Construction and Reconstruction ..		425,203	..	..	..	..	425,203	431,434
Maintenance		6,231	..	..	..	..	6,231	
Tourists' Roads—								
Construction and Reconstruction ..		274,653	..	..	..	40,634 Cr.	234,019	469,350
Maintenance		235,331	..	..	..	..	235,331	
Forest Roads—								
Construction and Reconstruction ..		..	..	..	152,708	..	152,708	276,261
Maintenance		87,154	..	..	36,399	..	123,553	
Unclassified Roads—								
Construction and Reconstruction ..		..	..	635,225	3,323,473	..	3,958,698	4,834,154
Maintenance		..	..	37,239	838,217	..	875,456	
Murray River Bridges and Punts ..		69,317	..	..	..	..	..	69,317
Traffic Line Marking		49,996	..	..	..	..	..	49,996
Plant Purchases		915,985	..	..	..	..	..	915,985
Traffic Lights		5,612	..	..	..	..	..	5,612
Payment to Tourist Fund		197,328	..	..	..	..	..	197,328
Contribution—Australian Road Research Board		..	..	23,839	..	..	..	23,839
Interest and Sinking Fund Payments ..		965,301	..	..	..	..	..	965,301
Kew Office and Laboratory		270,833	..	..	..	..	..	270,833
General and Administration Expenditure ..		1,826,854	..	..	..	..	..	1,826,854
		10,252,995	2,459,557	6,324,769	4,350,797	301,000	..	23,689,118
Balance at 30th June, 1963 ..		1,400,522	..	..	..	..	..	1,400,522

NOTE.—Relief to Municipalities granted under Act 6229 Section 32, amounted in 1962–63 to £31,140 11s. 1d.

R. G. COOPER,
Accountant.

29th November, 1963.

AUDITOR-GENERAL'S CERTIFICATE.

The accounts of the Country Roads Board for the year ended 30th June, 1963 have been audited. In my opinion the above statement of Receipts and Payments fairly presents in summary form the transactions during that period. However, the payments shown include certain retiring gratuities the legality of which is subject to audit query.

R. W. GILLARD,
Auditor-General.

2nd December, 1963.

APPENDIX 3.

COUNTRY ROADS BOARD

Loan Liability as at 30th June, 1963.

——	£ s. d.	Main Roads &c. £ s. d.	Developmental Roads. £ s. d.	Total. £ s. d.
Permanent Works—				
Main Roads	7,318,818 9 2			
State Highways	6,525,934 14 4			
Tourists' Roads	113,658 4 5			
Forests Roads	1,083 18 11			
		13,959,495 6 10	..	13,959,495 6 10
Developmental Roads	.. ..		6,425,757 10 11	6,425,757 10 11
Discount and Expenses	.. ..	271,257 8 8	268,753 15 9	540,011 4 5
Total amount Borrowed	.. ..	14,230,752 15 6	6,694,511 6 8	20,925,264 2 2
Less Redemption of Loans—				
Redemption Funds	.. ..	85,219 1 1	646,386 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	.. ..	1,240,007 0 3	..	1,240,007 0 3
National Debt Sinking Fund	.. ..	1,794,614 12 2	2,115,987 5 0	3,910,601 17 2
		3,405,529 1 1	2,817,456 12 6	6,222,985 13 7
Loan Liability at 30th June, 1963 ..	.. ..	10,825,223 14 5	3,877,054 14 2	14,702,278 8 7

APPENDIX 4.

CHIEF ENGINEER'S REPORT

Country Roads Board,
Melbourne,

20th December, 1963.

THE CHAIRMAN,

SIR,

I have the honour to report on matters of technical interest carried out during the year 1962–63. The report is divided into four major subdivisions corresponding to the four sub-branches of the Chief Engineer's Branch.

I—WORKS SUB-BRANCH

1. ROAD CONSTRUCTION WORK

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

Large Rock Excavation

Work to provide a cutting in solid rock on the Maroondah Highway at Alexandra involved the use of wagon drills and medium diameter explosive cartridges to loosen the rock.

Before the work started, a seismic survey indicated the need to blast 15,000–25,000 cubic yards. Investigations revealed that wagon drilling would be more economical than the use of small diameter drills and explosives. The work was done in the winter, necessitating the use of water resistant explosives, and $2\frac{1}{4}$-in. and $2\frac{1}{2}$-in. drill bits were employed in order to use $1\frac{7}{8}$-in. Semigel or 2-in. A.N. 60 gelignite cartridges.

It was decided to adopt a 10 ft. pattern for blasting, to provide about 0·4 lb. of explosive per cubic yard solid by column loading, and to drill to 3 feet below finished level in order to avoid the need for subsequent costly "popping" of surface irregularities. Drilling to the full width was necessary to reduce free face irregularities, and holes were drilled at a slope of $\frac{1}{2}$ to 1 at 3 feet from the batter, and at a slope of $\frac{1}{4}$ to 1 for intermediate holes. (See Diagram 1.) In order to provide the necessary delay pattern (see Diagram 2 and Plate 1), delay detonators with longer leg wires were used, and the circuit was detonated with a Beethoven dynamo-condenser exploder.

Loading and firing procedure was as follows:—

(i) Each hole was "depthed" in turn with a jointed wooden tamping rod of 2-ft. sections joined with sash cord.

(ii) One cartridge of A.N. 60 gelignite, or Semigel, with Cordtex threaded into its upper end was then lowered or pushed to the bottom of the hole, care being taken to avoid kinking the Cordtex.

(iii) One or two further cartridges were then placed in the hole, and "bottomed" on the initial plug. This procedure was repeated until within 5 to 8 feet of the surface.

(iv) The hole was then stemmed with drillings and a standard wooden tamping rod.

(v) Cordtex was cut about 3 feet above the top of the hole, and a tested electric detonator attached to it with adhesive tape. This was then joined to the circuit. (See Diagram 3.)

(vi) Safety precautions were then carried out, and the circuit exploded.

The method described successfully reduced hard sedimentary rock with seismic velocities in the 6,000 to 12,000 ft./sec. range to material capable of economic handling by push-loaded tractor drawn scrapers. The rock was reduced to small and acceptably regular fragments. (See Plate 2.)

Cement Treated Crushed Rock

A considerable volume of cement-treated crushed rock intermediate course was used in pavements on urban duplication on various State Highways, a total area of 120,000 square yards being laid at 6-in. or 8-in. compacted thickness after experience gained on two jobs on the Princes Highway East during the preceding year.

Alternatives of *in situ* or plant-mixed production were specified initially, but lower tender prices for plant-mixed material resulted in exclusive use of this method.

Basic materials used were first-quality graded crushed rocks of $1\frac{1}{2}$ inch or $\frac{3}{4}$ inch nominal size, screened into two or more separate fractions and recombined by weigh-batching or in continuous-mix plants to produce the appropriate maximum density grading.

Two per cent. of cement and 6 to 8 per cent. of water by weight were added at the mixing plant, the mixed material transported to the job in covered trucks, and spread using Blaw Knox self-propelled tamper-spreaders.

Compaction was achieved using tandem and three-wheel self-propelled smooth steelwheeled rollers, vibratory rollers being used also on thicker layers and rolling being completed within two hours of mixing.

A curing coat of bituminous emulsion was sprayed on finished work on the day of laying and bituminous concrete surfacing applied, generally within three to four days, before the new work was opened to traffic.

Wet Mix Crushed Rock

Approximately 75,000 square yards of plant-mixed wet-mix crushed rock has been used on various jobs on State Highways as an intermediate pavement course on both full-width construction and in widening trenches.

The procedure for producing the material is very similar to that for cement-treated crushed rock described above, except that cement is not added.

The laying procedure used was also very similar, except that as there is no cement in the material, no limit is placed on the laying and compaction time.

Machine Laid Kerbing

The successful tenderer on six-lane duplication of Princes Highway East at Oakleigh and Springvale specified machine-extruded portland cement concrete kerbs and kerbs and channels for median and separator construction.

The machine used was virtually a self-propelled slip form which is hand-steered, with height and tilt control also by hand-operated screws. Slip forms can be made to suit any of the commonly used kerb heights and shapes.

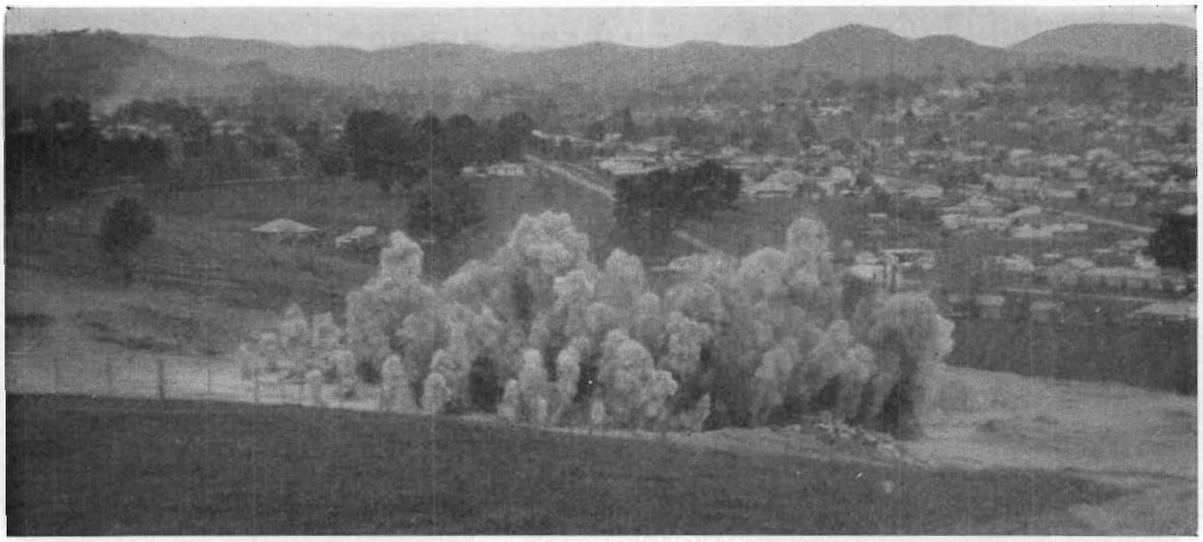


Plate 1.—Taken during explosion showing development of delay pattern firing from lower end back and from centre outwards.

Plate 2.—View of upper end of section after firing, showing comparatively larger size stone at end of section and small amount of stone thrown onto batter.

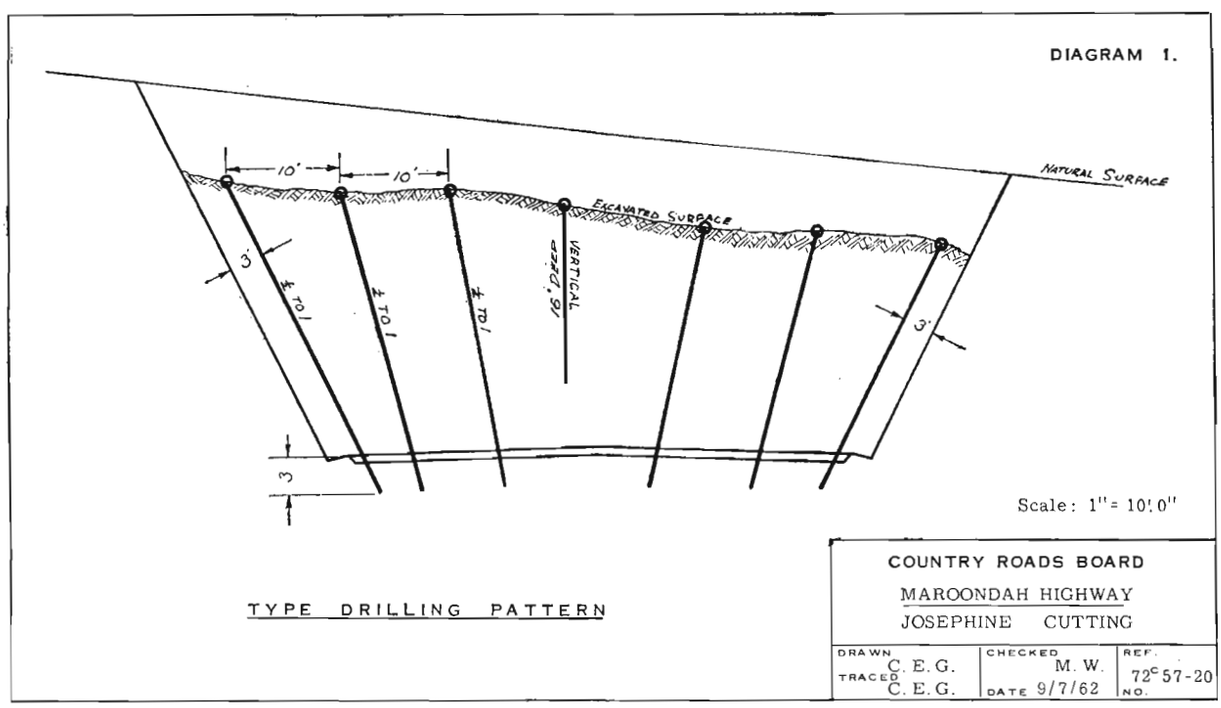


Diagram 1.—Type Drilling Pattern.

DIAGRAM 2.

DELAY PATTERN

O14	O13	O12	O11	O12	O13	O14	431200 CHAINAGE
O13	O12	O11	O10	O11	O12	O13	
O12	O11	O10	O9	O10	O11	O12	
O11	O10	O9	O8	O9	O10	O11	
O10	O9	O8	O7	O8	O9	O10	
O9	O8	O7	O6	O7	O8	O9	
O8	O7	O6	O5	O6	O7	O8	
O7	O6	O5	O4	O5	O6	O7	
O6	O5	O4	O3	O4	O5	O6	
O5	O4	O3	O2	O3	O4	O5	
O4	O3	O2	O1	O2	O3	O4	431100 CHAINAGE
O3	O2	O1	O0	O1	O2	O3	

84 HOLES
NO MISFIRES
NUMBERS 1, 2, 3 ETC. ARE DELAYS IN MILLISECONDS

ELECTRIC CONNECTION DELAY DETONATORS

COUNTRY ROADS BOARD

Survey by —	Plan by C.E.G.	Date 10·7·62	MAROONDAH HIGHWAY	Datum adopted and location —	Total Sheets 1.
F.B. —	Designed by C.E.G.	Date 10·7·62	JOSEPHINE CUTTING DEVIATION		Sheet No. 1.
L.B. —	Traced by B.K.H.	Date 10·7·62	JOB No. 721 H5/372	Engineer for D'nong Div.	Plan No. 72c·58·20
	Checked by M.L.W.	Date 10·7·62	SCALES { HORIZONTAL —N.T.S. FEET TO AN INCH; VERTICAL — FEET TO AN INCH		

Diagram 2.—Delay Pattern.

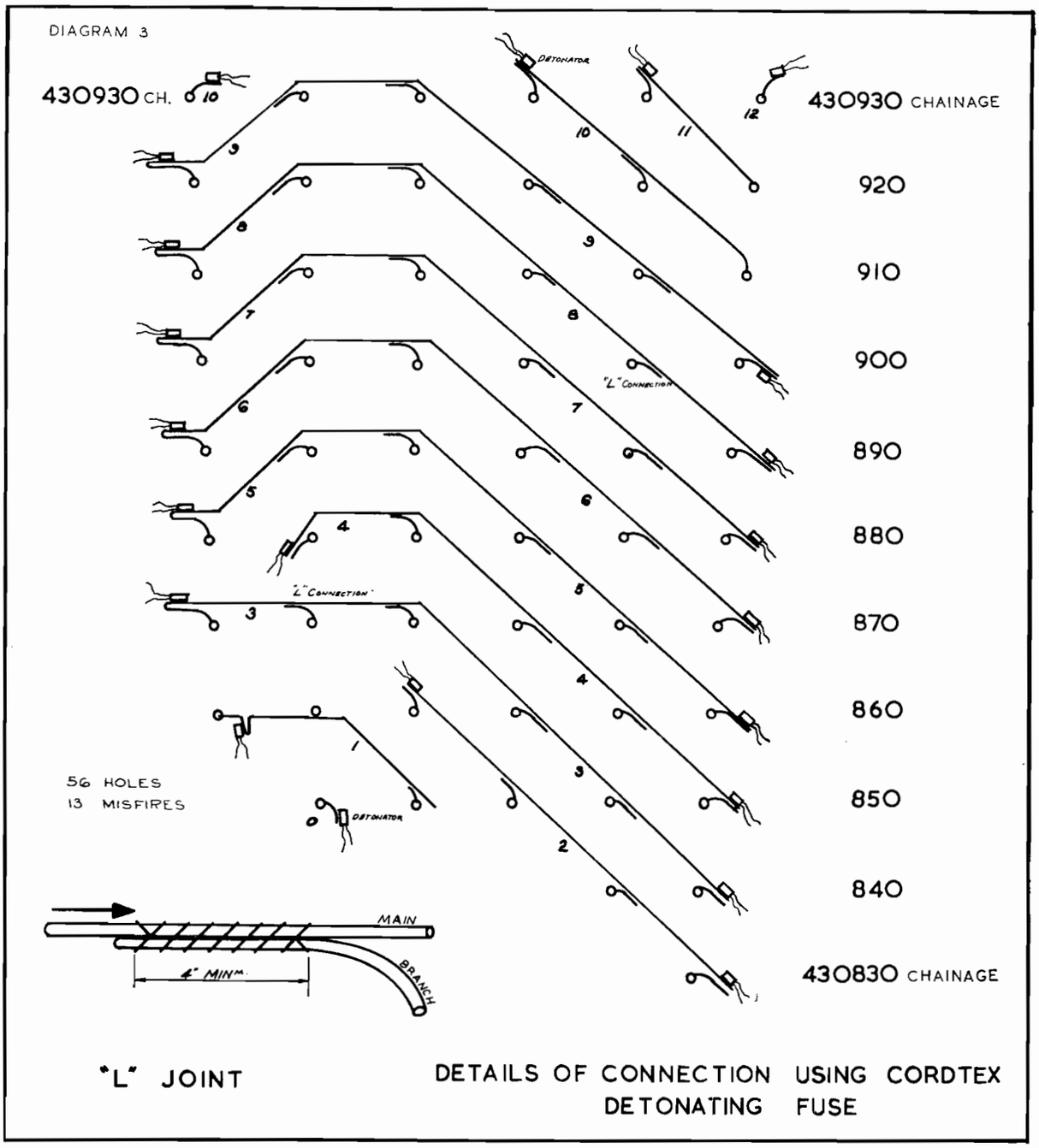


Diagram 3.—Details of connection using Cordtex Detonating Fuse.

The concrete used was gap-graded mix of ½-in. maximum size screenings with a fine sand mixed to zero slump and delivered from transit mixer trucks into a small hopper on the top of the machine.

Concrete is compacted by the ramming action of an eccentric operated plate on the end of the kerb already extruded aided by the vibration of the eccentric-drive motor, the reaction from the eccentric thrust on the end of kerb already laid producing the forward motion of the machine.

An auxiliary hopper at the rear of the machine applies a coating of mortar with final finishing by hand trowelling after contraction joints are formed by insertion of an ⅛-in. thich steel plate at 8-ft. intervals. Quality of work and finish achieved has been equal to the best quality convential work, the machine being particularly suited to production of smooth vertical curves and combined vertical and horizontal curvature.

Kerbing at sharp curvatures (such as occur at median and separator openings) still requires to be formed and the concrete placed by other means.

The machine is hand-steered and raised or lowered to keep a metal pointer opposite a string line, which is set to the desired profile on closely spaced stakes, and kept level against an attached plate bubble.

Forward motion is stopped simply by preventing a further charge of concrete from entering the top of the eccentric-operated tamper plate.

Lime Stabilization of Heavy Clay Subgrade

In the contracts let for the duplication of approximately 1¾ mile of the Hume Highway near Somerton, it was specified that the upper 6 inches of the heavy clay subgrade be stabilized by the addition of 4 per cent. by weight of hydrated lime.

The untreated subgrade was first trimmed to shape and grade, then scarified thoroughly, using a power-driven single-axle rotary pulverizer.

Four per cent. by weight of lime was hand-spread evenly over the loosened surface, then mixed thoroughly, with water being added at the rate of between 18 per cent. to 22 per cent. by weight. Two passes of the pulverizer were normally sufficient provided the subgrade was reasonably dry when the initial scarifying was carried out. The surface was then lightly rolled with a pneumatic-tired roller to seal the surface against loss of moisture and carbonation of the lime.

After between 24 and 48 hours had elapsed, the material was thoroughly remixed with the pulverizer, until at least 70 per cent. would pass a $\frac{3}{16}$-in. B.S. sieve. It was then graded to shape and finally rolled to the required compaction using a sheepsfoot roller, a 4½-ton vibrating roller, and a multi-wheel roller.

The material was then cured for five to seven days, during which period the surface was kept moist, and lightly rolled occasionally.

The process resulted in an improvement in the subgrade C.B.R. from 2–3 per cent. to 10–15 per cent. and a material improvement in the Plasticity Index.

Lime/Cement Stabilization

During the year a number of streets in the Borough of Echuca were reconstructed and sealed. The reconstruction was carried out by a lime/cement stabilization process.

The general shortage of suitable roadmaking materials in the vicinity makes it desirable to reduce pavement thickness as far as possible. This can be done if subgrades are strengthened, and this strengthening is normally done by stabilization techniques. Alternatively, there may be stabilization of the existing plastic pavement materials.

In the works referred to, the treatment consisted in general of stabilizing a 5 inch depth of the natural clay subgrade with 2 per cent. by volume of Limil, this small percentage of Limil mainly being used to assist in the pulverization of the clay. The two layers were then mixed and 5 per cent. by weight of cement incorporated, employing a single pass stabilizer for mixing and the application of the necessary water.

Physical properties of the materials used were :—

(*a*) Untreated Clay Subgrade

Sieve Analysis

Sieve size	No 7.	No. 36	No. 200
% by Wt. Pssg.	100	87	70

Liquid Limit .. 45
Plasticity Index 25
Linear Shrinkage 10
C.B.R. .. 6

(*b*) Clay Subgrade after the addtion of 2 per cent. lime

Liquid Limit .. 31
Plasticity Index 12
Linear Shrinkage 6

(*c*) Imported Sand

Sieve size	No. 7	No. 36	No. 200
% by Wt. Pssg.	99½	64	16

Non-Plastic

(*d*) Final result sand/clay lime mix, stabilized with 5 per cent. by volume of cement.

Liquid Limit .. 20
Plastic Limit .. 15
Plasticity Index 5
Linear Shrinkage 3
C.B.R. after 72 hrs. .. Min. 40

Compaction by 72 cwt. vibrating roller, giving a minimum of 95 per cent. Modified AASHO compaction.

Moisture content was rigidly controlled during stabilization, the Optimum Moisture Content being between 12 to 13 per cent. Compressive strength was 243 p.s.i. after seven days.

In the Shire of Cohuna, where the small remaining supplies of granitic sand are of doubtful quality and crushed stone is expensive, the Council in conjunction with the Board has resorted to lime stabilization of the natural clay subgrade to conserve supplies of pavement material and for economy.

In this process, the natural clay subgrade was stabilized to a depth of 7 inches by the addition of 3 to 4 per cent. by weight of Limil, increasing the bearing value of the subgrade, thereby reducing the depth of pavement required.

After stabilization a two layered pavement consisting of 2½ inch consolidated base course of granitic sand with a 1½ inch consolidated top course of fine crushed rock was applied.

The improvement of the subgrade by this lime stabilization is indicated by the following test results :—

Natural Untreated Clay Soil, Classification A6–10.

Grading

Sieve size	No. 7	No. 25	No. 36
% by Wt. Pssg.	100	99	98½
Sieve size	No. 100	No. 200	
% by Wt. Pssg.	96½	85	

Plasticity Index 18
C.B.R. 4·5

Addition of 3 per cent. by weight of lime.
P.I. reduced to 11
C.B.R. of 42
O.M.C. 19·8

Addition of 4 per cent. by weight of lime.
P.I. reduced to 4·5
C.B.R. of 69
O.M.C. 16·9

Control of Drift Sand at Fairhaven

Traffic on the Ocean Road has increased by about 50 per cent. since 1959, and the growing popularity of surfing beaches at Airey's Inlet has led to the disturbance of the sand dunes by foot traffic and subsequent wind erosion. On occasions sand up to 1 foot in depth has been deposited on the road pavement, and removal has become a constant and costly task.

The solution to this hazard lay in restoration of the natural vegetation. To achieve this, fences 5 feet high of 1 in. wire netting, were erected to surround the dunes (see Plate 3), and access to the beach was restricted to signposted tracks.

CONTROL OF DRIFT SAND AT FAIRHAVEN

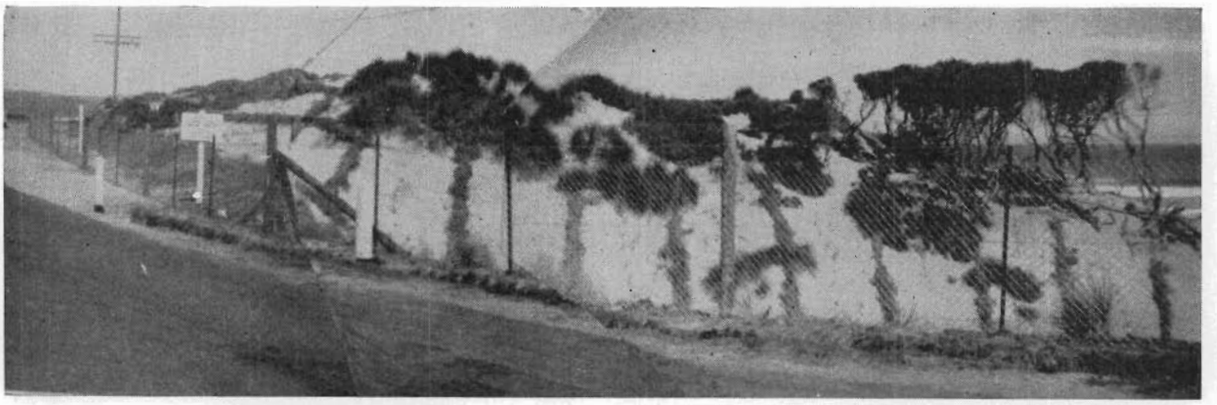


Plate 3.—A view of the work looking south, showing wire fence and brush fences in position. 16th November, 1962.

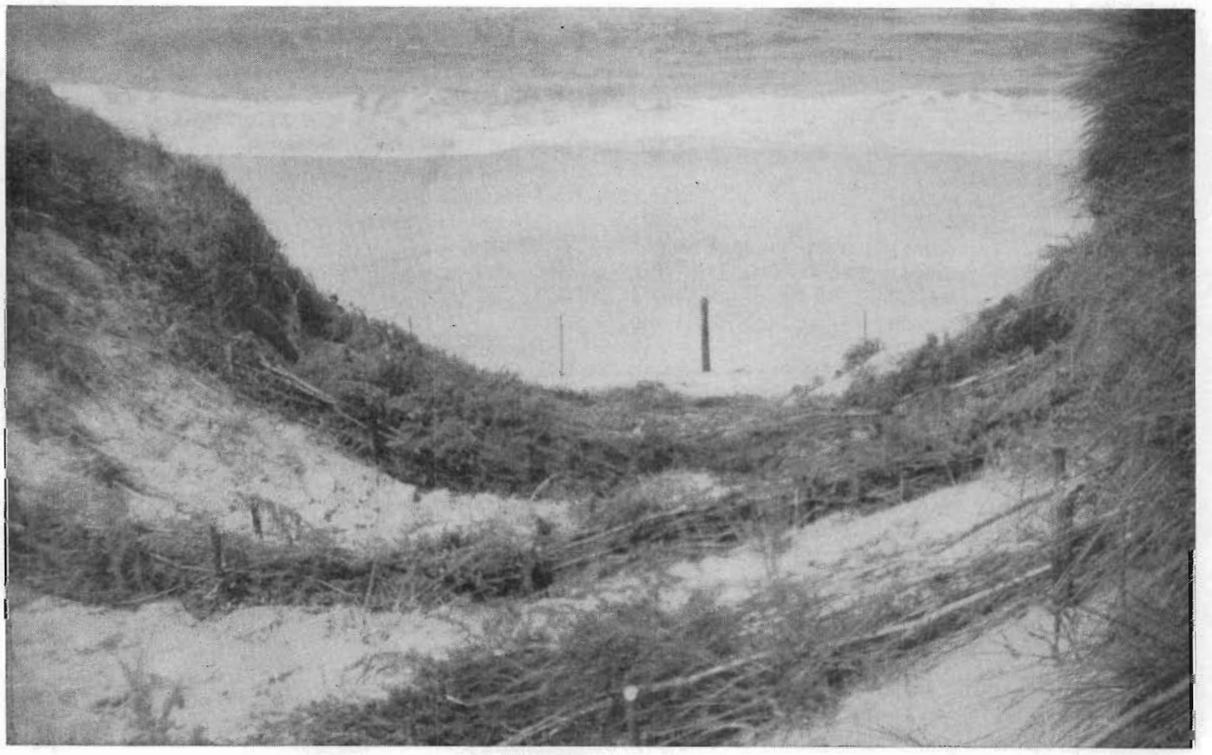


Plate 4.—Brush fences laid at 10-ft. intervals in one of the gullies on the windward side of the dunes. The close spacing was necessary because of high wind velocity in this particular gully.

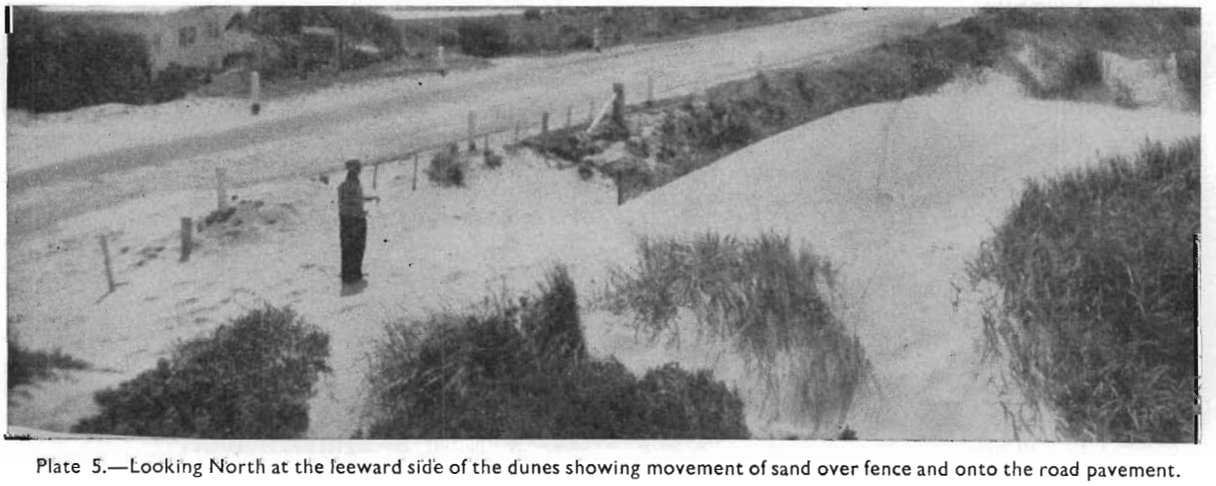


Plate 5.—Looking North at the leeward side of the dunes showing movement of sand over fence and onto the road pavement.

CONTROL OF DRIFT SAND AT FAIRHAVEN

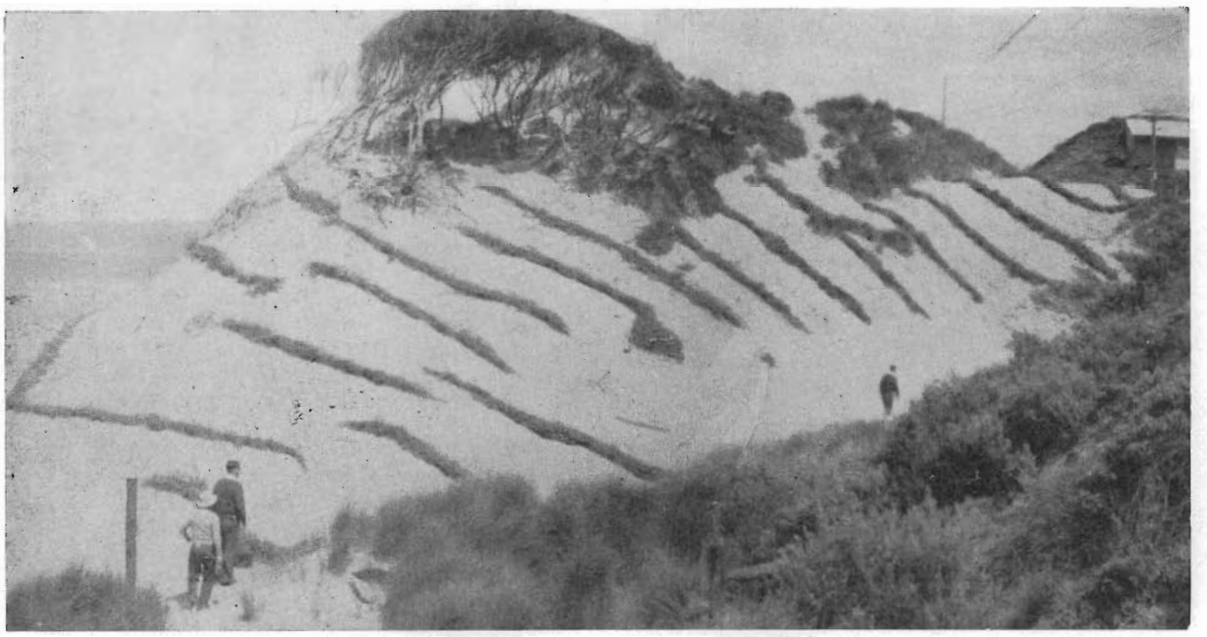


Plate 6.—Brush fences laid at 20-ft. intervals on the Northern end of the dunes. 30 October, 1962.

Plate 7.—The work at the Northern end of the dunes, 15 May, 1963. All tea-tree fences have been lifted and thickened with additional brush and three more fences have been laid at right angles to the original fences to prevent sand entering the gully.

Plate 8.—The condition of the work on the 3rd June, 1963. Showing the reconditioned tea-tree fences, the vigorous growth of the native vegetation and the extensive replanting of marrum and spinifex grasses.

The dune area was at the same time (early November, 1962) covered with brush fences (see detail in Plate 4) at 20-ft. intervals except in one gully where higher wind velocities made closer spacing desirable (see Plate 4). Marram grass was planted at 2-ft. intervals between the brush fences. Plate 5 shows the condition of the dunes at the start of work, with sand burying existing fences and encroaching on the road. Plate 6 shows brush fences in position.

In the next four months, most of the brush fences were partially covered; those on the windward side had been completely covered and about 70 per cent. of the marram grass had died. Despite this considerable sand movement, no new sand had reached the lee side of the dunes or the road surface. The grass failure was due to it having been planted at an unseasonable time.

In April, 1963, the brush fences were lifted, or where buried in sand, new fences were laid on the mounds so formed. Some additional fences were provided to control the movement of a new dune in one gully (see Plates 4 and 7). Some additional fences were also provided to keep pedestrians from the vicinity of the wire fence, and to collect and settle sand blowing up the gully. The whole area was replanted with marram grass and hairy spinifex (*Spinifex hirsutus*), and a general view of the present condition of the dunes is shown in Plate 8.

The total cost of the work, involving 935 feet of fencing, planting of 10,000 marram shoots and construction of 28,000 feet of tea-tree brush fencing, was approximately £1,200. The work done appears to date to be successful.

2. Testing of Materials and Research

Testing Equipment

During the year a new single channel seisomograph was placed in service by the Materials Research Division. It is capable of providing satisfactory results in locations where extraneous noise would interfere with the similar type of single channel instrument. Equipment for soil resistivity measurements has also been obtained and is used in conjunction with seismic apparatus in the location of gravel deposits.

A petrological microscope with an integrating stage is being used in the investigation of the presence of secondary minerals in basaltic rocks of the Melbourne area. A small diamond saw and a diamond lap enable slides to be prepared quickly, and have greatly facilitated the work. Some trouble has been experienced with the breakdown of stone particles in the surface of bituminous concrete. These weak stones have been found to contain secondary minerals of a clay like nature. The percentage of secondary minerals has been found to vary considerably both within the one quarry and between different quarries in basalt of the same geological age. The acquisition of this equipment has facilitated investigation of these problems.

Seismographic Foundation Investigations

At the request of the Bridge Sub-branch, foundation investigations were undertaken by the geologists of the Materials Research Division for the proposed new bridge between San Remo and Phillip Island. Subsurface exploration in the tidal channel posed several problems, with water up to 40 feet deep, tidal rise and fall up to 8 feet, and a tidal stream as fast as 6 knots—all of these conditions existing along a distance of 1,100 feet of the possible centre-line.

Drilling and penetrometer work were carried out on the shore platforms which are exposed at low tide. But for the 1,100 feet of deep water investigation by seismic methods was the most feasible rapid method available.

To do seismic work, two boats were employed. The larger diesel-engined 20-ft. fishing boat carried the seismograph, and the smaller dinghy with outboard motor was used to place the sounding charge in position. Two-way transistorized radio sets were used for communication between the two boats For safety and speed this equipment was invaluable.

Twelve hydrophones spaced 25 feet apart on two multi-core screened cables were attached to buoys and floated with the tidal stream from the larger boat, which was anchored in such locations that for each traverse the centre-line cut the centre of the hydrophone spread.

Using the dinghy the shots were then placed one at a time at 100, 200 or 300 feet from each end of the hydrophone spread. A calibrated cable was used to obtain the correct distance for the shot. Placement of the shot was simple on the tide flow down stream, for being supported by a buoy if floated until the cable was taut. Against the tidal stream it was necessary to anchor the dinghy well upstream and haul the shot line taut with a nylon cord.

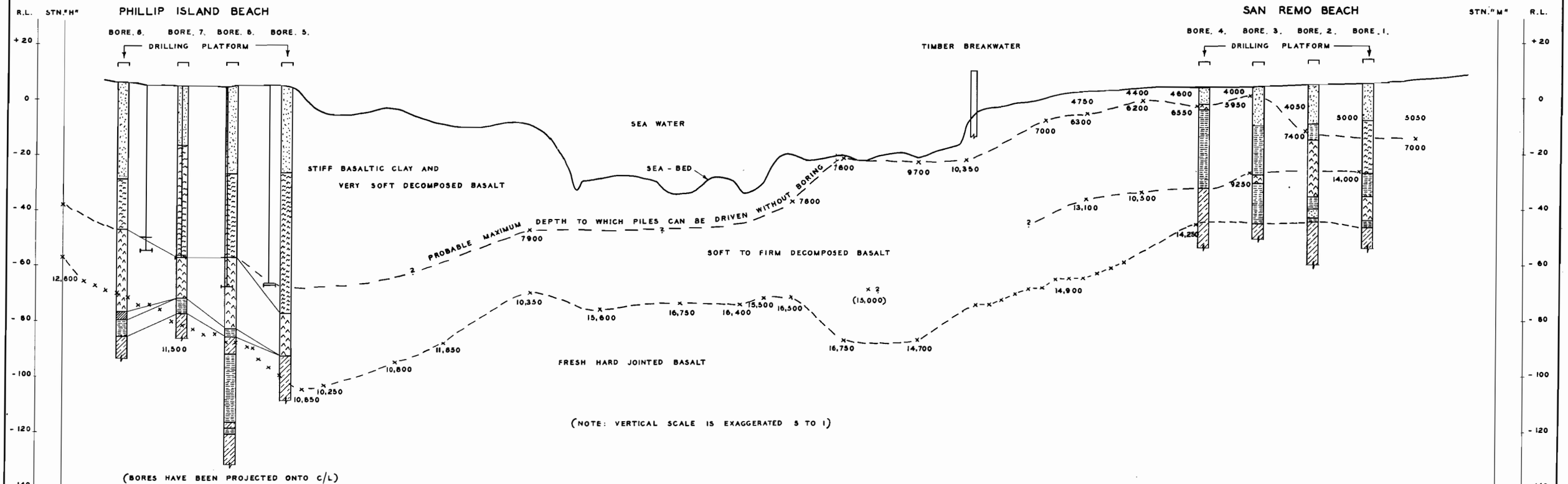
The seismic work was not only carried out in the deep tidal channel but on the shallower shore platforms as well. By checking where practicable by selective drilling the seismic work was calibrated, enabling a section of the various layers to be determined for the entire centre-line of the proposed bridge. (See Diagram 4.)

While seismic work does not eliminate the need for drilling, it is rapid and cheap, and for preliminary investigation of a site it can greatly reduce the number of drill holes required. It can also be employed in locations relatively inaccessible for drilling.

Determination of Consistency of Asphaltic Binders

A process has been developed by the Board's Materials Research Division for the determination of the consistency of the binders in small samples (about 10 gram) of asphalt. The process has considerable advantages over the existing methods which require large samples (usually 1 kilogram or more) of asphalt.

The binder is dissolved in carbon disulphide which is then separated and centrifuged to remove filler particles. The binder solution is then applied with a syringe onto a microviscometer plate resting on the bottom of a small vessel partly immersed in a boiling water bath. The solvent is evaporated in an atmosphere of carbon dioxide which flows through the system at a controlled rate. When the evaporation of solvent is complete, the binder film is sandwiched between two glass plates and worked into a uniform film. The viscosity at 25°C. is then determined by means of the sliding plate microviscometer and compared with that of the original bitumen to determine the degree of hardening.



DRILLING

- LIGHT GREY-LIGHT BROWN STIFF BASALTIC CLAY + A FEW HARDER NODULES.
- VERY SOFT DECOMPOSED BASALT. (RECOVERED AS "SANDY" CLAY.)
- SOFT DECOMPOSED BASALT.
- MEDIUM DECOMPOSED BASALT.
- FIRM DECOMPOSED BASALT.
- FRESH HARD JOINTED OLDER BASALT.

PENETROMETER

- SURFACE
- PENETROMETER TEST
- DEPTH AT WHICH LOAD OF 2000 P.S.I. RECORDED.
- MAX. DEPTH OF PENETRATION.

SEISMIC

- × INTERFACE DETECTED BY SEISMIC WORK.
- 16,400 WAVE VELOCITY IN FEET/SECOND OF APPROPIATE LAYER.
- PROBABLE LAYER BOUNDARY.

DIAGRAM 4

COUNTRY ROADS BOARD
MATERIALS RESEARCH DIVISION

SAN REMO BRIDGE, SECTION ALONG PROPOSED C/L
SHOWING, DRILLING, PENETROMETER AND SEISMIC RESULTS

DRAWN	TRACED	DATE	SCALE	CHECKED	DRG. N°
A.H.B. & J.F.	L. L.	June, 1963	100' = 1" Horz. 20' = 1" Vert.		65,337

TABLE 1—INDICATION OF RELIABILITY OF METHOD FROM TYPICAL RESULTS

Sample.	Bitumen Source and Grade.	Measured Penetration at 25° C. Original Bitumen.	Viscosity at 25° C. Original Bitumen (poise).	Viscosity of Recovered Bitumen (poise at 25° C.).	Penetration 25° C. of Recovered Bitumen (inferred).
Bitumen	Kuwait (80–100)	76	$1{\cdot}7 \times 10^6$	$1{\cdot}6 \times 10^6$	77
„	Aramco–Safaniya (85–100)	96	$1{\cdot}0 \times 10^6$	$1{\cdot}3 \times 10^6$	90
„	Kuwait (30) ..	27	63×10^6	53×10^6	about 22*
„	Kuwait (300) ..	236	$0{\cdot}12 \times 10^6$	$0{\cdot}16 \times 10^6$	215*
Asphalt (laboratory mix) ..	Aramco–Safaniya (80–100)	96	$1{\cdot}0 \times 10^6$	$1{\cdot}7 \times 10^6$	83
Asphalt from failed section of Western Highway	Kuwait (85–100)	90–95	circa $1{\cdot}0 \times 10^6$	17×10^6	33
	„ „	90–95	circa $1{\cdot}0 \times 10^6$	70×10^6	about 20*

* Relationship doubtful at extreme values.

So that the readings obtained with the micro-viscometer might be translated into more commonly understood terms, curves have been established to relate viscosity at 25°C. to penetration at 25°C. over a penetration range from 30 to 300 (hundredths of a centimeter) for bitumens from two local refineries, one of which uses a Kuwait crude oil and the other a mixture of crudes from four Aramco wells and Safaniya.

It is believed that the accuracy of this method is as good as that of standard methods of recovery for which a variation of ± 10 units of penetration in the (85–100) penetration range is considered acceptable.

In situ Moisture and Density Determination

Effective compaction is an important factor in pavement construction. This involves measurement of the *in situ* density and moisture content of the material, which is commonly determined by the sand-replacement density test, and oven-drying of a sample for moisture content.

These tests are laborious time-consuming and destructive, and there is considerable incentive to obtain more satisfactory ones. Instruments which use radio active isotopes to determine density and moisture content are coming into common use.

In one type of instrument use is made of the characteristic of granular or earthly materials whereby incident gamma rays from a radio active source are back-scattered in proportion to the density of the material and of the property of moisture in such material to slow down and back-scatter incident fast neutrons. The back-scattered slow neutrons and gamma rays are detected and counted by electronic means and the number of impulses in a given time is correlated with moisture content and density.

During the year an instrument of this kind was obtained and the results obtained in use to date have been promising. A determination of density and moisture content of a subgrade or pavement at a project site can be accomplished in approximately five minutes, and the results appear to be within acceptable ranges of accuracy. Development of methods of calibrating the instrument for use with coarse grained pavement materials in the first instance is proceeding.

3. BITUMINOUS WORKS

Extent of Work

Table 2 sets out the mileage of all types of bituminous surfacing carried out during the past two years, and indicates that the length of work done in 1962–63 was slightly less than that done in 1961–62. The work added 428 miles of sealed road to the declared system and provided another 646 miles of sealing on unclassified roads. The rate of retreatment of the sealed length on the declared system has remained fairly steady for the past few years. In 1962–63 it amounted to 2·8 per cent. of reconstruction to a higher standard and 7 per cent. of bituminous retreatment.

TABLE 2—LENGTH OF BITUMINOUS SURFACING WORK CARRIED OUT IN 1961–62 AND 1962–63

Type of Road and Plant Used.	Miles. 1961–62.	Miles. 1962–63.
(*a*) Work on C.R.B. declared roads—		
(i) Board's Plant ..	1,636	1,706
(ii) Municipal Plant ..	65	49
(iii) Contractors' Plant ..	63	46
	1,764	1,801
(*b*) Work on undeclared roads to which to Board contributes—		
(i) Board's Plant ..	858	773
(ii) Municipal Plant ..	50	48
(iii) Contractors' Plant ..	23	24
	931	845
(*c*) Work done for other Authorities by Board's plant—		
(i) Municipalities ..	114	90
(ii) State Instrumentalities	6	4
(iii) Commonwealth Works	2	4
	122	98
	2,817	2,744

Table 3 summarizes the lengths of different categories of bituminous work carried out on all roads to which funds are contributed by the Board.

TABLE 3—SUMMARY OF THE MILAGES OF DIFFERENT CATEGORIES OF BITUMINOUS WORK CARRIED OUT ON ALL ROADS TO WHICH THE BOARD CONTRIBUTED FUNDS DURING 1962-63

—	State Highways.	By-pass Roads.	Tourists' and Forest Roads.	Main Roads.	Unclassified Roads.	Totals.
Initial Treatments—						
Extensions to sealed system—						
(*a*) Sprayed work	29·67	..	34·75	363·44	645·19	1,073·05
(*b*) Plant mixed work	..	..	..	..	1·36	1·36
Reconstruction of lengths of previously sealed pavements—						
(*a*) Sprayed work	162·27	..	5·10	134·82	27·05	329·24
(*b*) Plant mixed work	8·19	..	..	6·06	9·37	23·62
Widening of existing sealed pavements—						
(*a*) Sprayed work	75·84	..	2·01	165·07	7·85	250·77
(*b*) Plant mixed work	..	..	..	1·31	..	1·31
Duplication of existing sealed pavements—						
(*a*) Sprayed work	1·90	..	..	..	..	1·90
(*b*) Plant mixed work	2·85	..	..	0·95	..	3·80
Retreatments—						
(*a*) Sprayed reseals	326·25	4·66	7·76	417·77	137·80	894·24
(*b*) Plant mixed work	38·51	0·95	..	10·89	16·45	66·80
	645·48	5·61	49·62	1,100·31	845·07	2,646·09

Types of Work

Ninety-eight miles of work was undertaken with hot mixed machine-spread bituminous concrete, which represents an increase of 14 per cent. on the length of similar work carried out in 1961–62. Sixty-seven miles of this type of work was done in retreating some of the more trafficked roads, thus providing a higher class treatment and better surface roughness correction than the sprayed work which predominates in the annual bituminous programme.

In this retreatment work the bituminous concrete surface courses were laid after appropriate regulation work and the total average rate of spread was 1 ton to 15 square yards, which represents an average compacted depth of about $1\frac{1}{4}$ inches. The remainder of the bituminous concrete work was utilized in binder and surfaces courses on new pavement construction.

Cost of Work

Table 5 sets out the average costs of sprayed work carried out by the Board's mobile spraying units during the year. There have been no significant changes in costs of work when compared with last year. A very slight reduction in the average cost of initial treatment work can be attributed to the availability and use in some areas of cheaper priming material.

Materials

(*a*) Aggregate.

A quantity of 271,031 cubic yards of covering aggregate was used in the sprayed work during the year and Table 4 indicates that the downward trend in the average costs of aggregate has continued. The total quantity used was less by 2·3 per cent. than the quantity used in 1960–61. This is partly because of the slightly smaller programme of work in 1961–62. and also because of the steady trend in the past ten years towards the use of less $\frac{5}{8}$ and $\frac{3}{4}$ aggregate and more of the smaller sizes. This is graphically depicted in Diagram 5.

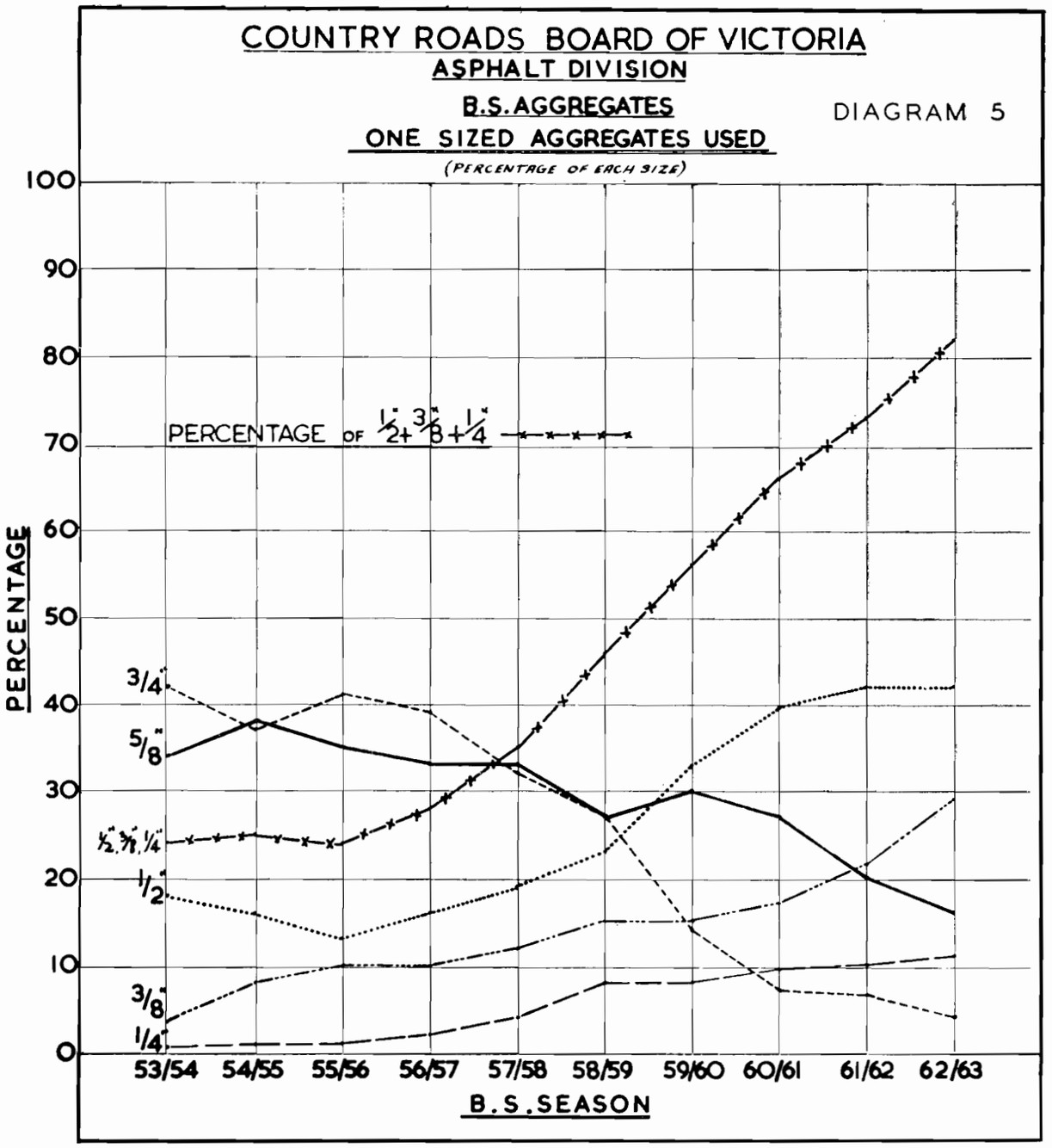
TABLE 4—AVERAGE PRICE OF AGGREGATE FOR BITUMINOUS SURFACING AT PER CUBIC YARD IN STACKS BY THE ROADSIDE FOR THE YEARS 58–59, 59–60, 60–61, 61–62, 62–63

Material.	Prices per Cubic Yard.				
	1958–59.	1959–60.	1960–61.	1961–62.	1962–63.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Screenings	47 9	48 6	47 2	46 7	44 10
Gravel	46 1	42 2	43 0	44 1	42 7
Sand	32 6	27 4	21 1	19 3	21 7
Scoria	8 6	27 1	21 3	31 4	32 8
Average price all aggregates	47 0	46 5	45 8	44 11	42 9

TABLE 5—AVERAGE COST OF SPRAYED BITUMINOUS SURFACING CARRIED OUT BY C.R.B. PLANT ON ROADS TO WHICH THE BOARD CONTRIBUTED FUNDS DURING 1962–63

(COST IN PENCE PER SQUARE YARD)

Item.	Nature of the Work.																					
	I.T.P. and S. ⅝-in. and Over.		I.T.P. and S. ½-in.		I.T.P. and S. ⅜-in.		I.T.P. and S. ¼-in. and Sand.		I.T.P. and Two Application Seal.		I.T. Seal Only.		I.T. Two Application Seal Only.		Reseal ⅝-in. and Over.		Reseal ½-in.		Reseal ⅜-in.		Reseal ¼-in. and Sand.	
Square Yards Costed	2,104,399		2,626,489		1,251,650		1,397,392		75,681		4,999,888		167,729		490,649		1,427,204		2,824,014		3,438,612	
	d.	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%
Material	21·2	58·7	19·5	57·5	19·5	64·6	14·2	61·2	28·2	59·4	14·8	61·4	21·9	72·8	18·0	62·7	14·6	60·8	12·2	62·5	9·9	65·2
Stores	1·2	3·3	1·0	3·0	0·9	3·0	0·8	3·5	1·4	2·9	0·7	2·9	0·8	2·7	0·8	2·8	0·6	2·5	0·5	2·6	0·4	2·6
Plant Hire	6·2	17·2	6·1	18·0	4·6	15·2	3·9	16·8	8·4	17·7	3·8	15·8	3·0	9·9	4·6	16·0	3·9	16·3	3·1	15·9	2·3	15·1
Labour	7·5	20·8	7·3	21·5	5·2	17·2	4·3	18·5	9·5	20·0	4·8	19·9	4·4	14·6	5·3	18·5	4·9	20·4	3·7	19.0	2·6	17·1
Totals	36·1	100·0	33·9	100·0	30·2	100·0	23·2	100·0	47·5	100·0	24·1	100·0	30·1	100·0	28·7	100·0	24·0	100·0	19·5	100·0	15·2	100·0



(*b*) Bitumen.

All work was again carried out with 85/100 penetration bitumen, forming the basic binder. The bitumen, derived from Middle East crude oils, was drawn from the two Victorian refineries, supply and delivery being contracted for by three marketing companies from either these two refineries or to a small extent, from a bulk installation at Wodonga.

(*c*) Priming Materials.

For initial treatment of a gravel or crushed rock base considerable use is made of coal tars and light grades of cut back bitumen as priming material. The choice of material generally depends on the type of base to be treated, the availability of the material, and the period which might elapse before the seal coat can be applied. A great deal of the cutback bitumen used is made up in the field by the Board's Mobile Units, and this is often augmented by the marketers of standard medium curing grades of cutback produced by the oil refineries. In 1961–62 some experimental priming was undertaken with a material developed by one of the marketers of bitumen and cutback bitumen with the object of producing a satisfactory primer at a more economical cost than either standard or field produced cutback bitumen.

The material known as "Socony Primer," is composed of a hard bitumen residue cutback by a kerosene-type cutter and thus has somewhat similar characteristics to the standard cutback, but in the field trials it set up a faster rate, and the residue was harder. The primer held grit very well, which is an advantage when for any reason it is necessary to grit a primer.

Following these trials a quantity of this primer was used this year in areas to which it was possible to transport the material in bulk by rail or road, as a substitute for materials used hitherto. The work was quite satisfactory and resulted in a substantial saving in cost.

It is expected that the use of this material can be extended as availability and facilities for its distribution are expanded.

Plant Mixed Work

(*a*) General.

Reference was made in the Forty-ninth Annual Report to the acquisition of a complete mobile hot mix plant with the object of undertaking plant-mixed instead of sprayed work in areas remote from fixed plants, and where traffic and other conditions warranted the higher class of bituminous treatment.

The plant is an all electric powered mixer of the continuous type complete with four bin cold feed dryer, three bin gradation unit and 5,000-gallon bitumen tank with a hot oil heating system, and has a rated capacity of 40 tons per hour under average working conditions.

This plant was set up at three locations—Warrnambool, Horsham and Wangaratta during the year and approximately 26 miles of work was done in the vicinity of these provincial centres.

The work was generally in the nature of retreating of existing sealed pavements with a thin layer of between $\frac{3}{4}$ inch and 1 inch of machine spread hot mixed bituminous concrete, and in all some 15,000 tons of hot mixed material were laid, including some regulation work to first of all correct abnormal surface shape. Before the work was carried out the strength of the existing pavement was examined with the aid of the Benkelman beam, and where weaknesses were detected the asphalt layer was thickened. Over all, the average rate of spread of material for the whole programme of work was 1 ton to 23 square yards or just a little under 1 inch compacted thickness.

(*b*) Mix Characteristics.

The object was to produce a reasonably dense bituminous concrete utilizing the most economical materials available near each locality, and for this reason many alternative materials were investigated and laboratory mixtures tested before deciding on a mixture for the particular requirements in each locality.

Because of the generally thin carpet to be laid, it was necessary to restrict the maximum size of aggregate to about $\frac{3}{8}$ inch and Table 6 sets out the characteristics of the materials and paving mixture used in the initial set-up of the plant at Warrnambool. The mixture is fairly typical of the work carried out at the other centres.

TABLE 6—CHARACTERISTICS OF PLANT MIXED WORK MATERIALS

B.S. Sieves.	Types of Material. Percentage by Weight Passing. Panmure Crushed Basalt Screenings.	Panmure Basalt Crusher Dust.	Childers Cove Sand.	Mineral Aggregate Combination.
$\frac{3}{8}$-in. ..	100	..	..	100
$\frac{1}{4}$-in. ..	88	..	..	95
$\frac{3}{16}$-in. ..	45	100	..	72
No. 7 ..	6	98	..	57
No. 14 ..	4	70	100	43
No. 25 ..	3	52	98	36
No. 52 ..	2	38	52	23
No. 100 ..	1	27	10	12
No. 200 ..	1	18	1	7
Percentage of each in aggregate combination	% 46	% 38	% 16	% 100

85/100 Bitumen Content—6·25 per cent. by weight of total mix.

Experimental Work

Experimental bituminous work was carried out on a section of a heavily trafficked State highway where concrete widening strips 2 ft. 6 in. in width had been constructed some years ago on either side of an old but relatively sound macadam pavement. The full width had subsequently been surfaced with bituminous macadam or sand asphalt mixtures, but bad cracking and distortion had occurred at the junction between the old pavement and the concrete strips, and at the transverse joints in the longitudinal slabs. This cracking appeared to be caused by either differential settlement of the old macadam pavement and the concrete or by "rocking" of the concrete slabs, or both.

The experiment was designed to explore the minimum weight of retreatment which might resist reflection in the surface, of the cracking which had occurred and which may still continue in the old pavement.

Seven short experimental sections were therefore laid down with different types of material and in different thicknesses. The surface course used was specially designed to accomodate a higher bitumen content than used hitherto in such mixtures, with the object of imparting more flexibility to the mixture while still retaining adequate stability. This was done by opening up the aggregate gradation and including approximately 50 per cent. of crushed fines instead of natural sand in the fine fraction of the mixture.

Details of the various treatments, and the job mixtures designed are set out in Tables 7 and 8.

TABLE 7—DETAILS OF TREATMENTS: CRACKED PAVEMENTS

Section.	Treatment.	Comment.
1	1 in. thickness of $\frac{3}{8}$ in. nominal size bituminous concrete	Special mix, Design No. 1
2	2 in. thickness comprising 1 in. of binder and 1 in. of surface course	Binder course—bituminous macadam, Design No. 2; Surface course, special mix, Design No. 1
3A & 3B	3 in. thickness comprising 2 in. of binder and 1 in. of surface course	Binder course—bituminous macadam, Design No. 3; Surface course—special mix, Design No. 1
4	4 in. thickness comprising 3 in. of fine crushed rock treated with emulsion and 1 in. of surface course	Fine crushed rock contained 4 per cent. by weight of bitumen emulsion; Surface course—special mix, Design No. 1
5	2 in thickness of $\frac{3}{8}$ in. nominal size bituminous concrete including rubber	Special mix, Design No. 1 with the addition of rubber latex in the binder. 5 per cent. by weight of binder
6	1 in. thickness of $\frac{3}{8}$ in. nominal size bituminous concrete including rubber	As for section 5

Table 8—Details of Bituminous Mixtures: Cracked Pavement

B.S. Sieves.	Types of Mixtures. Percentage Passing Sieves.		
	⅜-in. Bituminous Concrete Special Mix. Design No. 1.	½-in. Bituminous Macadam. Design No. 2.	¾-in. Bituminous Macadam. Design No. 3.
1 in.	..	..	100
¾ in.	..	100	95
½ in.	100	95	60
⅜ in.	96	60	25
¼ in.	78	25	..
3/16 in.	70	..	..
No. 7	54	5	5
No. 14	43	..	..
No. 25	31	..	..
No. 52	17	..	..
No. 100 ..	9	..	..
No. 200 ..	5	0–1	0–1
85/100 penetration bitumen by weight of total mix	6½ and 6¼ when rubber added to binder	4	3¾

Note.—In Design No. 1 the minus No. 7 material comprised approximately 50 per cent. of crushed and 50 per cent. of natural sands.

Approximately 2 per cent. of agricultural lime dust filler was added to provide the required quantity of minus No. 200 material.

The remainder of the length of pavement concerned was given a normal ⅜ inch nominal size sprayed treatment which may be regarded as an extension of the experiment.

This work was undertaken in February, 1963, and to date although there is no sign of the longitudinal cracking in the new work, the transverse cracks which are in the concrete widening strips have already reappeared in all sections except section 3B which comprises 2 inches of bituminous macadam concrete. Even section 4, which is 4 inches thick, shows a faint transverse crack over the concrete. At this stage it would appear that the thicknesses used are not adequate to completely stop the reflection cracking.

4. Construction Costs

The following tables provide information of works cost under similar headings to those shown in the report for 1961–62, and sets out comparative figures for several years in each case.

Table 9—Distribution of Expenditure

Financial Year.	Plant Cost.	Labour Cost.	Materials Cost.	Stores Cost.
	%	%	%	%
1959–60	38·6	32·1	19·6	9·7
1960–61	39·1	33·4	16·6	10·8
1961–62	37·5	33·0	20·8	8·6
1962–63	38·25	35·25	16·68	9·82

Table 10—Formation Costs, Including all Expense Charges

Financial Year	Rock.		Earth—Unclassified.		Total.	
	Quantity.	Unit Cost.	Quantity.	Unit Cost.	Quantity.	Average Cost.
	cub. yds.	£ s. d.	cub. yds.	£ s. d.	cub. yds.	£ s. d.
1959–60	5,230	1 3 8	418,299	0 10 4	423,529	0 10 6
1960–61	30,300	1 5 11	983,643	0 12 11	1,013,943	0 13 5
1961–62	103,121	1 0 4	1,245,419	0 10 5	1,348,540	0 11 3
1962–63	96,518	0 12 0	909,578	0 7 11	1,006,096	0 8 4

Table 11—Payment Costs, Including all Expense Charges

Financial Year.	Fine Crushed Rock.		Coarse Crushed Rock.		Gravel, &c.		Total.	
	Quantity.	Unit Cost.	Quantity.	Unit Cost.	Quantity.	Unit Cost.	Quantity.	Average Cost.
	cub. yds.	£ s. d.	cub. yds	£ s. d.	cub. yes.	£ s. d.	cub. yds.	£ s. d.
1959–60	52,102	2 1 7	34,806	1 4 4	325,138	0 19 2	412,046	1 2 5
1960–61	59,778	2 6 10	25,128	2 5 5	762,148	1 0 4	847,054	1 2 11
1962–62	72,944	2 4 2	43,450	1 9 8	779,783	0 18 6	896,177	1 1 1
1962–63	110,445	1 10 5	11,241	1 2 11	841,063	0 16 8	962,749	0 18 4

II—BRIDGE SUB-BRANCH

1. Design

Recent Practice in the Design and Fabrication of Welded Steel Girders

In the design of welded structural steel plate girders, the practice hitherto has been to avoid the use of flange plates greater than 1 inch in thickness because of the lower ductility found in thick plates, and to employ cover plates to increase flange thicknesses as required.

A departure from this practice has been incorporated in the design of plate girders for bridges over the Avon River at Stratford, the Barwon River at Geelong, and the Ovens River at Wangaratta, where butt-welded flange plates up to 1½ inches in thickness have been employed without the addition of cover plates. This has been made possible by the use in tension flanges of plates conforming with the requirements of BS 2672 for Grade ND II notch ductile steel; the significant feature of the specification for this material being the provision for compliance with the Charpy V-notch Impact Test at a test temperature of—15°C.

Additional safeguards against brittle fracture have also been introduced by the application of rigorous testing procedures (including magnetic particle inspection and radiographic inspection) at welded joints. The aim of these procedures is to ensure the absence of residual cracking, lack of penetration, and incomplete fusion; to limit the number and size of inclusions in welds, and to ensure that inclusions are evenly dispersed.

To reduce future maintenance costs the completed girders are sand-blasted to clean, bright metal and then sprayed with a coat of zinc in an inorganic silicate vehicle. A top coat of any desired paint can be applied over the zinc coating if required for aesthetic reasons.

Elastomeric bearings such as neoprene pads with internal steel shims are now being adopted in lieu of the cast steel rockers and bearing plates used formerly. The initial costs of the elastomeric bearing pads are lower than for cast steel rockers, and the neoprene pads are expected to require less future maintenance.

2. Construction

Pedestrian Footbridge—Pascoe Vale Road, Strathmore

A footbridge for the use of school children attending the Strathmore High School is to be constructed by the Country Roads Board as part of the Strathmore Overpass Project, to eliminate the railway level crossing. This structure will give safe access, without interference to traffic, to the school grounds which are isolated between Pascoe Vale Road and the railway line.

The footbridge will be constructed in concrete and will consist of a single Tee section throughout with the central stem supported on columns at intervals and with flanges cantilevered symmetrically on both sides to provide a footway of 6 feet clear between railings. To enable the crossing to be used by children wheeling bicycles and by adults with perambulators, the approaches at both ends will be ramps with 1 in 8 grades (see Plate 9 which depicts a model of this bridge).

Interference with road traffic will be avoided during construction by making the main span 62 feet over the roadway as a prestressed concrete Tee beam. This member will be precast as a unit away from the site and lifted into position on the columns.

The approach spans will be reinforced concrete cast in place with the same cross-sections as the main span and continuous over the columns. Differing lengths and curvatures of the approach spans are required to accommodate the structure to the site and these introduce a number of complications into the design calculations, most important of which are the effects of torsion in the main member.

Coal Canal Bridge—New Footscray Road

The construction of a 242-ft. long prestressed concrete bridge over the Moonee Ponds Creek in Footscray Road (Plate 10) involved the used of 96 steel shell concrete piles 18 inches in diameter and approximately 90 feet long.

Incorporation of a reinforced concrete lifting beam, and hollow jacking recesses in the piers will allow the complete bridge deck to be raised to a new grade line thus forming part of the approach ramp for the future overpass at the Appleton Dock railway line.

The deck is composed of precast pretensioned hollow slabs 42 feet long. These are the longest prestressed deck slabs used by the Board to date.

To ensure that a satisfactory key between slabs was obtained, the contractor developed a modified pavement breaker which was used to ram high strength concrete into preformed shear key recesses.

Use of "Delmag" D12 Diesel Pile Hammer

The Board has purchased a Diesel Pile Hammer for driving reinforced concrete and steel shell piles. (See Plate 11.)

The hammer is used in conjunction with triangulated lengths of hanging leaders up to 70 feet suspended from the jib of a rubber-tyred or crawler crane. The leaders were manufactured in the Board's steel fabrication section.

The complete pile-driving rig is readily positioned and provides high speed driving of piles on most sites. The hammer delivers 50 to 60 blows per minute, and the manufacturer's energy rating is 22,400 foot pounds per blow.

Observed comparisons between the diesel hammer and a drop hammer indicate that the "Delmag" is at least as effective as a 2-ton drop hammer, and it has been successfully used in driving concrete piles up to 5 tons in weight, where formerly a 3-ton drop hammer was required.

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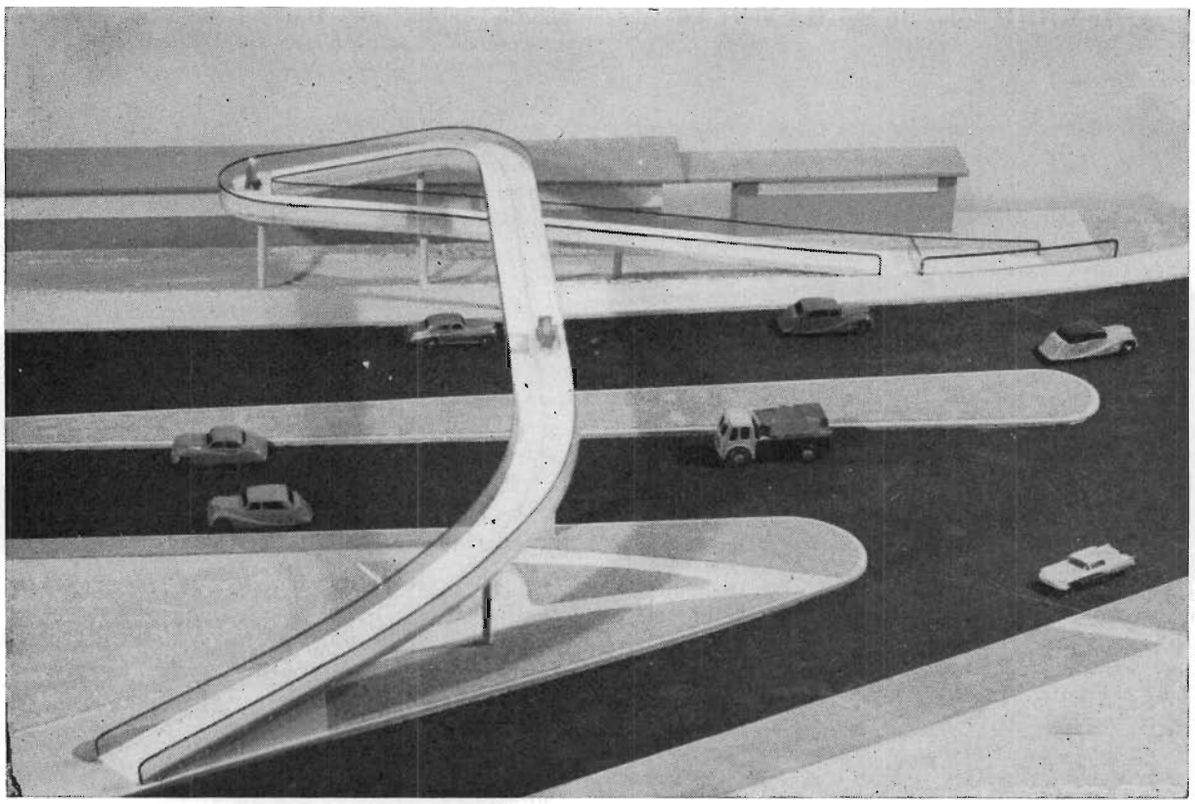


Plate 9.—Model of pedestrian footbridge—Pascoe Vale-road, Strathmore.

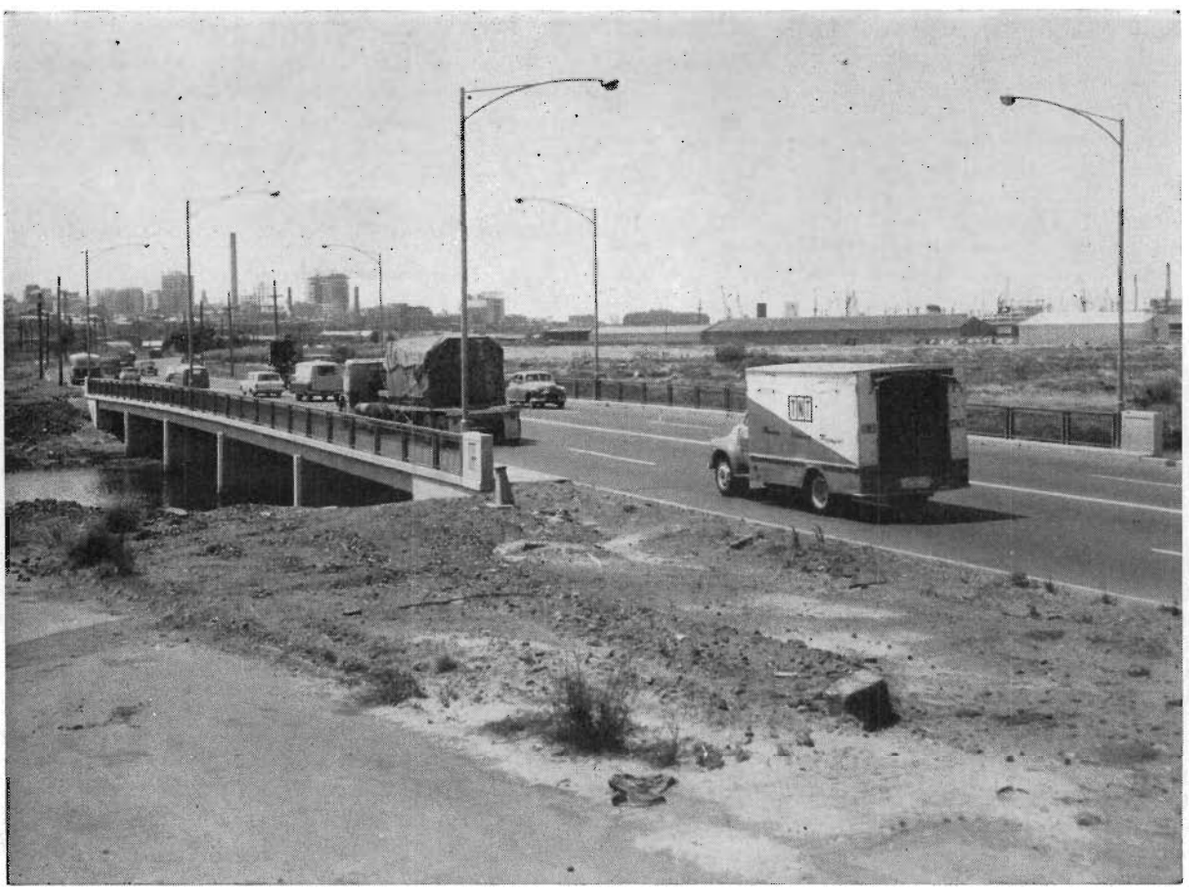


Plate 10.—Coal Canal Bridge—New Footscray Road.

The recent purchase of a 16-ton mobile crane by the Board will enable the use of the complete unit without depending on hired cranes, except where a crawler crane would be required. As the largest single item of the expenditure with this method of pile driving is the crane hire, economic success depends on suitable site preparations and careful planning of the operation, as well as suitable choice of pile lengths.

The use of this hammer and rig on several bridge projects has shown that savings in cost and time can be achieved compared with the previous methods.

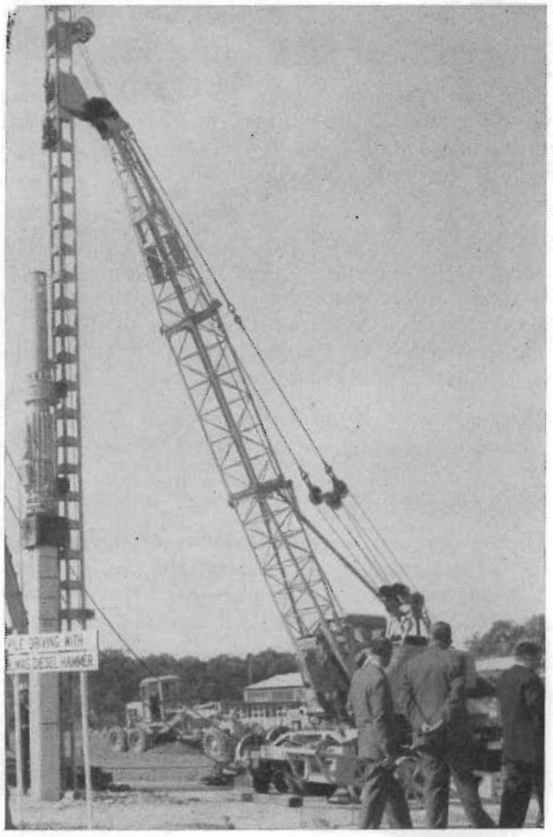


Plate 11 "Delmag" D 12 Diesel Pile Hammer

III—ROAD DESIGN SUB-BRANCH

1. Line Marking

The total route mileage of striped roads maintained during the year 1962–63 was 4,184 miles, an increase of 270 miles over 1961–62.

This total comprised State highways 3,170, other declared roads 870 miles, and unclassified roads 145 miles. The total mileage of equivalent standard 3-in. stripe, i.e., 10 feet line 30 feet gap, painted in the year was 7,456 miles, representing an increase of 18 per cent. over the previous year. This increase was partly due to a small machine having been put into operation this year for the purpose of assisting the original unit by performing limited striping work in the metropolitan area.

The total expenditure on line marking during the financial year was £49,618, the average cost per mile of equivalent standard stripe being £6 13s. 1d. The total quantity of paint used was 25,586 gallons, with an average application rate of 3·4 gallons per mile of standard stripe.

Extended trials of glass beaded traffic lines are being made, the second unit applying this type of line exclusively. The method used is application of glass beads to paint by the "drop-on" method. Results of these trials have so far proved very satisfactory.

A new line-marking machine with modern operating characteristics is being designed and constructed by the Board's mechanical sub-branch, and is expected to be in service by early 1964. This unit will be equipped to reflectorize lines and is expected to substantially increase available line marking capacity.

2. Traffic Studies and By-pass Road Location

The following traffic studies were completed during the year :—

Driver Eye Heights

Studies were made during the year of the height of the driver's eyes above road level when seated in the various types of motor vehicles now using the road system. This was done to assess the suitability of the height of 4 feet used at present in calculating stopping and overtaking sight distances.

A preliminary report submitted to the ninth meeting of the Traffic Engineering Committee of N.A.A.S.R.A. indicated a downward trend in the seat height of modern passenger cars, resulting in an average eye height of almost 50 inches for 1952–55 models to under 47 inches for 1962 models.

The report further shows that the mean driver eye-height for all cars is 48·5 inches with a standard deviation of 3·3 inches. This result suggests that the figure of 48 inches used in vertical curve design could be re-examined, together with other factors such as stopping distance and height of object.

Data were collected using an automatic camera with photo-electric cell trigger, and recorded on punch cards for digital computer processing.

Truck Performance on Grades

The purpose of this study was to determine whether the speed curves published by the Texas Highway Department were applicable to Australian conditions for the design of truck climbing lanes on grades.

The study was conducted in conjunction with the November, 1962 Hume Highway Truck Survey, and 80 trucks were weighed and identified at Seymour and later timed over measured distances on selected grades on the Hume Highway.

A report submitted to the ninth meeting of the Traffic Engineering Committee of N.A.A.S.R.A. indicated reasonable agreement between Australian conditions and the Texas data.

Annual Traffic Census

The annual traffic census was conducted on 13th March, 1963. Twelve-hour counts were taken at a total of 688 stations on State Highways and 1,441 stations on other roads, including some unclassified roads in the metropolitan area.

The traffic index (100 in base year 1933) rose from 701 in 1962 to 729 in the current year. This result is close to that predicted in 1959 (Technical Bulletin No. 17).

By-pass Roads

During the year detail design work has continued on previously announced by-pass routes, and preliminary design commenced on some new routes. Among projects in the first category are the Mulgrave by-pass road, Scoresby by-pass road, Princes by-pass Road and the Greensborough–Diamond Creek by-pass

road. Considerable care is taken with the detailed design to ensure adequate local traffic circulation and minimum property damage compatible with economical construction costs.

Because of the urgent need to provide relief for traffic in the near future on Maroondah and Burwood Highways and Canterbury main road, a new by-pass road (known as the Healesville Freeway road) is being planned. It is estimated that the three arterial routes referred to, even when developed as fully as economically practicable, will become congested within the next five to ten years. Planning of this new route is now well advanced.

Approximately 105 miles of by-pass roads were in various stages of design at the end of the financial year.

Intersection Design—Princes Highway East

The current development of about 9 miles of this major arterial route from Oakleigh to Dandenong to the six-lane stage, includes the reconstruction of most of the major intersections and the introduction of an 18 feet wide central median.

The intersections were designed to a uniformly high traffic capacity to cater for the future volumes which the highway is likely to carry. (See Plate 12.)

Whilst median crossings were located to serve present and future land use as effectively as possible, the more important crossings between controlling intersections were primarily located at suitable spacings to enable future traffic signals to be co-ordinated in both directions for speeds of 35 to 40 m.p.h. To facilitate access, some uni-directional median crossings were provided adjacent to selected heavy traffic generators, and U-turns openings were provided in the median and separator in advance of some intersections, which are—or will be in the future, provided with signals.

3. Engineering Plan and Surveys

During the financial year 1962–63, the following engineering survey work and plans together with preparation of both construction and material supply specifications have been completed.

Engineering Surveys

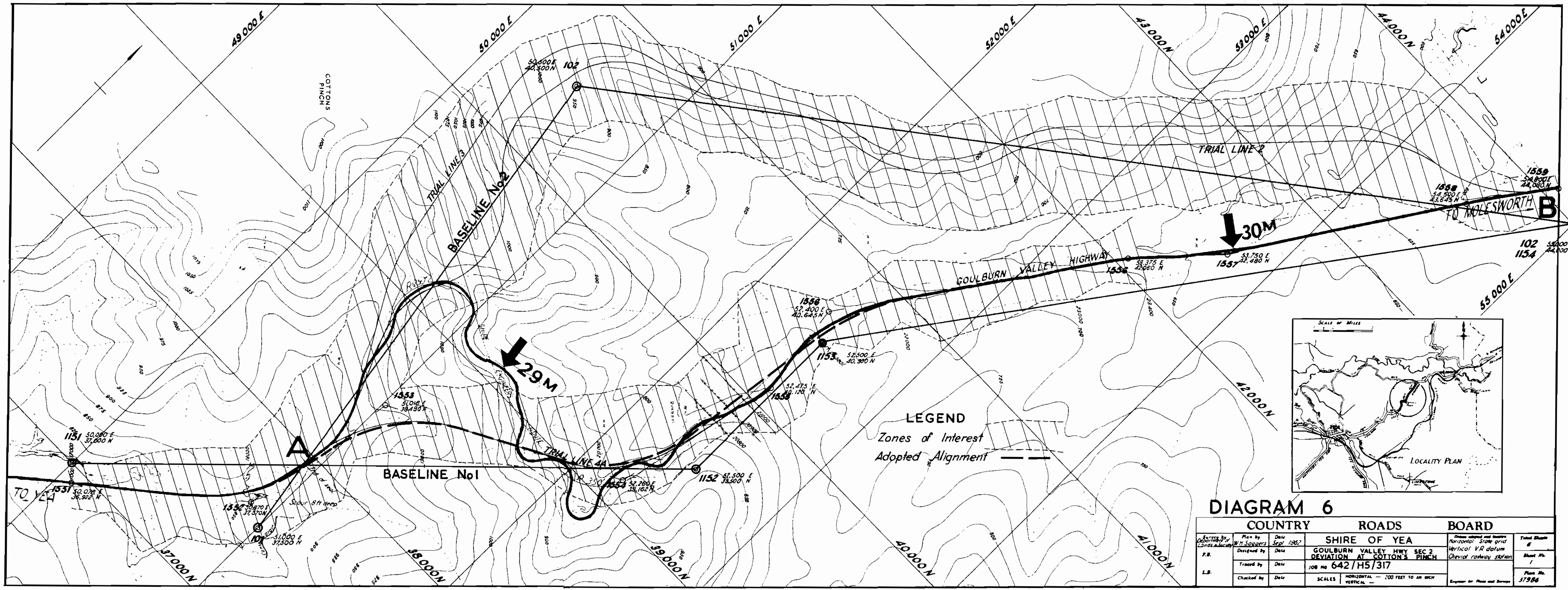
Head Office engineering survey parties completed 309 miles of surveys, which included 125 miles of photo-control surveys, the remainder of 184 miles being centre line or feature surveys, principally on State highways or by-pass roads.

Divisional staff completed surveys of 375 miles of road and quite a number of intersections and bridges.

Specifications

During the year, a record number of specifications have been prepared and advertised for contract. The total value of supply and construction contracts was approximately £3,000,000.

Plate 12.—Aerial view of Princes Highway East and North Road, Clayton, Intersection with adjacent service roads.



COTTONS PINCH
TRIAL LINE 3
BASELINE No 2
TRIAL LINE 2
TRIAL LINE 4A
BASELINE No1
GOULBURN VALLEY HIGHWAY
TO YEA
TO MOLESWORTH
A
B
29M
30M
49 000 E
50 000 E
51 000 E
52 000 E
53 000 E
54 000 E
37 000 N
38 000 N
39 000 N
40 000 N
41 000 N
42 000 N
43 000 N
44 000 N
LEGEND
Zones of Interest
Adopted Alignment
LOCALITY PLAN
SCALE OF MILES
DIAGRAM 6
COUNTRY ROADS BOARD
Survey by Department of Lands & Survey
Plan by W.H. Soggers
Date Sept 1962
Designed by
Traced by
Checked by
SHIRE OF YEA
GOULBURN VALLEY HWY SEC 2
DEVIATION AT COTTON'S PINCH
JOB No 642/H5/317
SCALES HORIZONTAL — 200 FEET TO AN INCH
VERTICAL —
Horizontal State grid
Vertical V.R datum
Cheviot railway station
Sheet No. 1
Plan No. 37986

Twenty-nine major construction contract specifications were prepared and advertised for contract, and, in addition, four minor construction contract specifications were prepared in the Divisions. The total number of 33 construction contracts were let for £1,370,000 as compared with eight contracts let for £330,000, 1961–62.

Plans for Road Construction

Final plans were completed during 1962–63 for 120 miles of road involving the preparation of over 1,200 final plans.

The following are some of the larger jobs for which such plans were prepared :—

Road	Description
Princes Highway East, Section 1	Wellington Road to Springvale Road. 6 lanes divided.
Princes By-pass Road ..	Haunted Hills Section
Princes Highway East—Sections 5 and 6	East and West of Cann River
Princes Highway West—Section 1	Brooklyn Overpass—Ashley to Duke Street, South side.
Calder Highway—Section 4	North of Wycheproof
Calder Highway—Section 4	South of Sealake
Omeo Highway.. ..	Between Swifts Creek and Omeo (Gibson's Deviation)
Murray Valley Highway ..	Between Piangil and Boundary Bend
Loddon Valley Highway..	North of Bendigo
Goulburn Valley Highway	North of Seymour
Ouyen Highway ..	Boinka to Tutye. Tutye to Cowangie.
Maroondah Highway ..	Duplication Springvale Road to East of Mitcham.
Maroondah Highway ..	Duplication East of Ringwood
Maroondah Highway ..	Channelized Intersection at the Warburton Highway.
Maroondah Highway ..	Through Buxton and at Acheron Flats.
Heytesbury Soldier Settlement Roads	
Yarra Glen–Yea Road ..	

Investigations survey and/or plan work has been commenced on the following jobs.:—

Phillip Island Tourist Road	San Remo Crossing
Goulburn Valley Highway	Cottons Pinch
Tallangatta-Corryong Road	Keotong to Shelley
Nepean Highway ..	Oliver's Hill southwards.
South Gippsland Highway	Charlton's Lane to Falls Road.

Design Developments

In the Chief Engineer's report for the year 1960–61, a resumé was given regarding the introduction of the new techniques of digital terrain modelling to locate new roads in undulating or hilly terrain, and the use of electronic computers.

During 1962–63 these methods have been further developed and their fields of use expanded.

Digital terrain modelling has proved a particularly useful tool to the road designer with its ability to convert information available from stereo models into usable data.

Terrain data can either be obtained direct from the punch card output from the stereo plotter or collected manually from a contour plan plotted by the stereo machine.

The latter method has been used frequently where topographical plans are available, and it is relatively easy to assemble this information over a zone of interest and prepare it in a form suitable for input to a computer.

A trial alignment, complete with curves and intersection points, is now selected and drawn on the contour plan.

All known information, and details of the new alignment are fed to the computer, and the output at each selected chainage point gives :—

(i) new chainages along the centre line of the trial line ;

(ii) reduce levels on the centre line, and also at a defined distance either side.

The centre line levels are then fed into a tabulator which automatically plots the centre line profile to a selected scale. A trial guide line is manually drawn on this profile, fixing intersection points of tangent grades and lengths of vertical curves, and a type cross-section is selected.

At this stage all basic information in respect of the trial alignment and profile is known.

The output data from the computer gives the following information regarding the selected route :—

(i) finished reduced levels along centre line and at edges of pavement and formation ;

(ii) depths of cut and heights of fills ;

(iii) batter points and their reduced levels ;

(iv) earthworks quantities.

The advantages of this method are that it obviates the necessity to draw general cross-sections, and gives the designer flexibility to try various arrangements of alignment, grade and cross-section, and choose a final acceptable line without using arduous and time consuming manual means. The result is that there are appreciable savings in drafting hours and other labour. If construction of the road is to proceed, then a field survey party is required to peg the centre line and take all the usual cross-section information so that plans for the adopted line can be finalized.

To illustrate briefly the method of procedure, Diagram 6 has been prepared as an example. It reproduces the investigation of a proposed major realignment of the Goulburn Valley Highway at Cottons Pinch, near Yea.

4. TITLE SURVEYS AND PLANS

Title Surveys

During the year 404 surveys were completed including 44 for the acquisition of land for new by-pass roads.

Aerial Photography for Highway Record Surveys

The Board's Title Survey section has further developed the use of aerial photography as a basis for the rapid production of plans of new State highways for office and record use.

An accurate odometer towed by a motor car is used to mark the correct positions for mile posts, and a white stripe is painted across the road at each position. This stripe can be readily seen and identified on the photograph and the distance between the painted stripes used to determine the scale of the photograph.

Strip flights are then flown along the highway, taking photographs at a scale of approximately 300 feet to 1 inch with 20 per cent. overlap and high contrast prints.

After prints are checked for quality, overlap and cover, strip photo mosaics are assembled. Azimuth is controlled by checking angles on road reserve boundaries shown on the photographs, against Parish plan details. Scale is obtained accurately by measurement between mile marks.

The employment of modern photographic and printing equipment has made possible the production of detailed and accurate plans of highways for the use of supervising engineers and for the maintenance of records.

The team carrying out this work and preparing the ultimate record survey plans is able to complete approximately 200 miles of State highway record survey annually, and the resulting plans are a considerable improvement on those previously produced by conventional methods.

IV—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 results of this activity :—

(*a*) A contract was let for nineteen aggregate loading and screening machines, of which ten are for the use of the South Australian Highways and Local Government Department. Sixteen loaders have been received to date.

(*b*) Tenders have been called for the manufacture and erection in Horsham of two 8,000-gallon capacity insulated bitumen tanks, to be heated electrically (night tariff schedule).

(*c*) The design of a new line-marking machine, utilizing three spray guns and suitable for the production of reflectorized lines, is almost complete. Manufacture of some parts has commenced.

(*d*) The manufacture of a simple profileometer for the mechanical registration of small departures from a 10 ft. straightedge in pavement finishes.

In addition, the following new plant, not previously owned by the Board, was obtained :—

(*a*) P. and H. mobile slewing crane mounted on a 6 x 6 chassis capable of lifting 4 tons at a 30-ft. radius, for bridge works.

(*b*) Goodwin-Seaman self-propelled combined steel drum and pneumatic-tyred roller with ballasted rolling pressures of up to 2 tons per pneumatic tyre and over 400 lb. per inch width with the steel drum.

(*c*) Moore-Scoopmobile pneumatic-tyred, four-wheel driven front-end loaders with 1½ cubic yard bucket capacity and torque converter power shift tranmissions.

(*d*) A.C.E. front-end loaders fitted to Chamberlain Champion tractors and complete with rear power take-off driven 125 c.f.m. Atlas-Copco compressors carried on the tractor three point linkage.

(*e*) Moore-Ferguson pneumatic tyred, eleven-wheeled rollers with ballasted weights of up to 31,000 lb., powered by Fordson engines with Funk torque converter transmissions.

(*f*) South Pacific pneumatic-tyred, eleven-wheeled rollers with ballasted weights of up to 33,000 lb., powered by Fordson engines and Borg-Warner torque converter transmissions.

(*g*) Welling and Crossley ½ cubic yard capacity dumpers, powered by Wisconsin engines.

(*h*) McDonald 7/9-ton tandem roller with stepless infinitely variable hydraulic transmission.

(*i*) Case model "1,000" track type bucket loader of 1½ cubic yard bucket capacity and torque converter power shift transmission, powered by a 100 h.p. Continental engine.

(*j*) Consolidated Pneumatic portable rotary compressors of 210 c.f.m. free air output capacity powered by Fordson engines of 95 h.p.

(*k*) Schied self-propelled, steel-tyred, vibrating roller of about 4 tons maximum weight and a somewhat similar roller made by Dingler.

(*l*) Caterpillar model D7 crawler tractors fitted with hydraulically operated angle dozers and integral rippers powered by 160 h.p. engines through torque converter power shift transmissions.

(*m*) Galion model 118 heavy duty tandem-drive power graders powered by 125 h.p. Cummins engines.

(*n*) Galion model 503 patrol graders fitted with trailing type windrow eliminators.

(*o*) South Pacific towed type 30 cwt. vibrating rollers.

PUBLICATIONS

During the year the following papers were presented in connexion with the Board's engineering work :—

Paper.	Author.
Refraction Seismic Surveys in Civil Engineering Presented at the First Biennial Conference of the Australian Road Research Board, Canberra, 1963.	A. H. Bartlett, B.Sc., A.I.M. and M.
Trends in Geometric Design in the Country Roads Board, 1913–1963. Presented at a Meeting of the Institution of Engineers, Australia, Melbourne Division, May, 1963	G. J. Dempster, B.C.E., A.M.I.E. Aust., C.E., M.A.P.I.
Widening of Pavements with Particular Reference to Macadam. Presented to the 19th Conference of Municipal Engineers, and published in the Australian Road Research No. 6, June, 1963	F. W. Docking, A.M.I.E. Aust., C.E.
Aerial Photography Applied to the Preparation of Highway Record Surveys. Published in Australian Road Research No. 5, March, 1963	P. H. Gange, Cert. G.A., Assoc. I.S. Aust., A.M.A.I.C., M.A.P.I.
Permeable Sub-Bases : Applications to Winter Construction of Metropolitan Roads. Presented at the First Biennial Conference of the Australian Road Research Board, Canberra, 1963	A. H. Gawith, M.C.E., A.M.I.E. Aust.
Development in the Design and Construction of Bituminous Surfaced Pavements in the State of Victoria, Australia. Presented at the International Conference on Structural Design of Asphalt Pavements ; Michigan, U.S.A., August, 1962	A. H. Gawith, M.C.E., A.M.I.E. Aust., and C.C. Perrin, C.E., A.M.I.E. Aust.
Road Location : 1913–1963 Presented at a Meeting of the Institution of Engineers, Australia, Melbourne Division, May, 1963	H. P. George, A.M.I.E. Aust., C.E., F.A.P.I., A.M.I.T., London, C.H.T. Yale
Construction of the Hume By-Pass near Chiltern. Presented to the Highways and Traffic Engineering Branch of the Melbourne Division of the Institution of Engineers, Australia, August, 1962	H. S. Gibbs, M.C.E., A.M.I.E. Aust., C.E., L.A.P.I., A.A.S.A.
Is the Los Angeles Abrasion Test Reproducible ? Presented at the First Biennial Conference of the Australian Road Research Board, Canberra, 1963	J. N. Hanks, B.S.C.
Driver Eye Height. Published in Australian Road Research No. 6, June, 1963	R. E. Lee, Grad. I.E. Aust., C.T.P. and C. N.S.W.
Fundamentals of Freeway Location and Design. Presented to the Highways and Traffic Engineering Branch of the Melbourne Division of the Institution of Engineers, Australia, November, 1962	J. L. Loder, A.M.I.E. Aust., C.E.
Stage Construction of Roads in Victoria. Presented at the First Biennial Conference of the Australian Road Research Board, Canberra, 1963	K. G. Moody, B.C.E., M.Eng. Sc., Ph.D., A.M.I.E. Aust.
Flexible Pavements for Roads. Presented at the Annual Conference of the Institution of Engineers, Australia, Adelaide, 1963	K. G. Moody, B.C.E., M.Eng. Sc., Ph.D., A.M.I.E. Aust.
Tests on the Corrosion Protection of Steelwork. Published in Australian Road Research No. 5, March, 1963	T. H. Russell, M.Eng.Sc., B.C.E., A.M.I.E. Aust.
Traffic Flow and Bunching Published in Australian Road Research No. 6, June, 1963	R. T. Underwood, B.C.E., Dip. T.R.P., C.H.T. Yale, C.E., A.M.I.E. Aust., M.A.P.I.
Development of Pavement Design in the Country Roads Board, in Victoria, 1913–1963. Presented at a Meeting of the Institution of Engineers, Australia, Melbourne Division, May, 1963	F. West, B.C.E., M.I.E. Aust., C.E.

The following Engineering Notes were issued during the year :—

No.	Title.	Date.
73	*In Situ* Stabilization	12th June, 1963
74	Box Cut in Rock—Method of Construction	15th March, 1963
75	Epoxy Resins and their Application to Road Works	11th April, 1963

STAFF

The volume and complexity of work continues to increase. The position is both challenging and stimulating. It is desired to thank all staff for the manner in which this position has been met during the year under review. Total staff of the Chief Engineer's Branch rose from 661 at the commencement of the financial year to 676 at its end. Total expenditure on works directly by the Board and by Municipalities with funds provided partly by the Board was £21,610,000 for the same period.

H. S. GIBBS,

Chief Engineer.

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