1957–58

VICTORIA

COUNTRY ROADS BOARD

FORTY-FIFTH ANNUAL REPORT

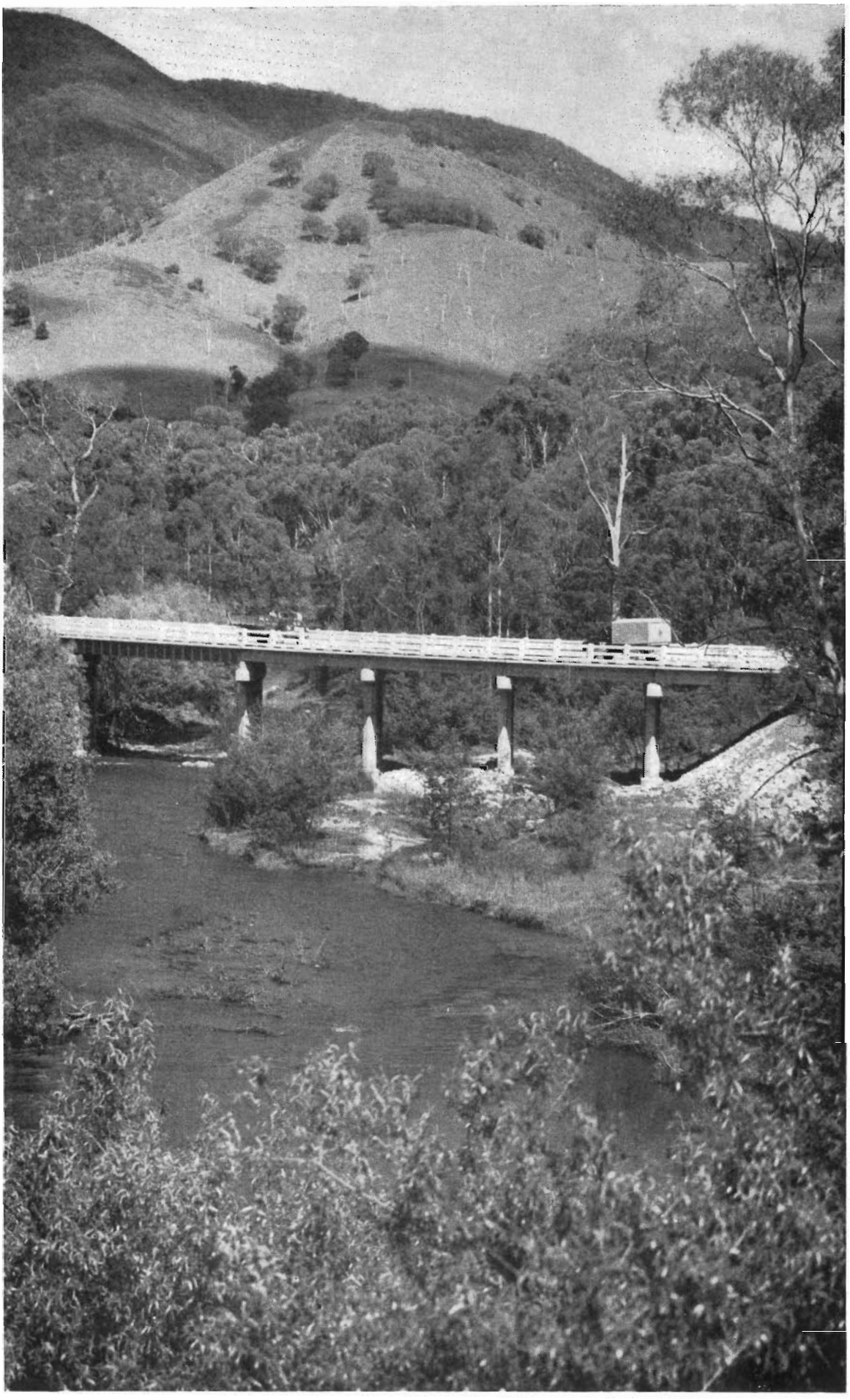
FOR YEAR ENDED 30TH JUNE, 1958

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

[*Approximate Cost of Report.*—Preparation, not given Printing (1,058 copies), £810.]

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

No. 35—[3s. 9d.]—8725/58.



FRONTISPIECE : Bridge over Tambo River on Ramrod Flat Main Road, Shire of Omeo.

COVER : Clifton Hill railway overpass at the junction of Heidelberg Main Road and Hoddle Street.

COUNTRY ROADS BOARD

FORTY-FIFTH ANNUAL REPORT, 1957-58

CONTENTS

CONTENTS—*continued.*

COUNTRY ROADS BOARD

FORTY-FIFTH ANNUAL REPORT

Exhibition Building,
Carlton, N.3,
19th November, 1958.

The Honorable Sir Thomas Maltby, M.L.A.,
Minister of Public Works,
Department of Public Works,
Melbourne, C.2.

SIR,

In accordance with the requirements of Section 96 of the *Country Roads Act* 1928, No. 3662, the Board has the honour to submit to you, for presentation to Parliament, a report of its proceedings for the year ended 30th June, 1958.

INADEQUACY OF ROAD FINANCE.

Despite the improvements in the Board's revenue in the last two years arising from new Victorian statutes increasing the basis of motor registration fees and imposing ton mile taxation, together with the new Commonwealth diesel fuel taxation for road purposes, the Board's operations are still unduly restricted by limitations of finance.

Although by spreading construction over four or five years some progress has been made on such projects as the duplication of the Princes Highway West between Melbourne and Geelong and of the Princes Highway East between Oakleigh and Hallam, the inadequate strength and width and unsatisfactory location of many other sections of State highways over the State are causing the Board constant concern. Not only on State highways but on all classes of roads further funds are needed urgently for reconstruction and development of the entire road network to provide the capacity, efficiency and built-in safety requisite for modern road transport and communications.

The accompanying photographs (Plates 1–3) illustrate the need for bridges strong enough and wide enough to carry modern loads, and for the extension of more stable and resistant road surfaces, with better shoulders or wider pavements replacing inadequate conditions which still to-day seriously harass and impede the increasing traffic.

Over a period of years numerous applications have been received from Councils for the declaration of further lengths of State highways and main roads. The Board is aware of the appropriateness of such proposals in some cases, but after close scrutiny of the situation regrets that the funds available to it are still insufficient to enable assumption of the additional statutory burden involved.

It may be thought surprising that in spite of statutory and natural increases the revenues devoted to road purposes are still deficient. This is due to four main factors, firstly the accumulation of work during the long period when despite depreciation of the £1 the basis of motor-registration fees remained at the 1926 level, secondly the long continued diversion to other States of fuel taxes derived from motor-vehicle usage of Victorian roads, thirdly the spectacular increases in volume and weight of traffic on the roads requiring correspondingly intensive maintenance and heavy reconstruction, and fourthly the reduced volume of work to-day from every pound of income as compared with the pre-war period. As indicated in Fig. 1 finance available to the Board has

INADEQUATE ROAD CONDITIONS

Plate 1.—Old bridge on Murchison-Violet Town Main Road. Loads limited to 6 tons gross. Replacement delayed by lack of funds.

Plate 2.—Corrugated section of State Highway carrying 300 vehicles per day. Reconstruction and sealing delayed by lack of funds.

Plate 3.—Ballarat Road north of Eganstown, showing dusty road—Shire of Glenlyon.

increased from £2,613,000, being the average of three years 1936–39, to £17,500,000 in 1957–58, i.e., by more than 6½ times, but the work which it was possible to do with the money year by year expressed in terms of 1936–39 values increased only to £4,320,000, i.e., by 1·65 times. In the same period the number of motor vehicles using the roads more than trebled. It is only by strict attention to practical economies in usage of men, materials, machinery and methods that in recent years any progress at all has been possible in improvement of the road network, in fact more and more has had to be devoted to maintenance and similar charges and even now improvements are proceeding at a rate much below that which is essential to cope with increasing traffic.

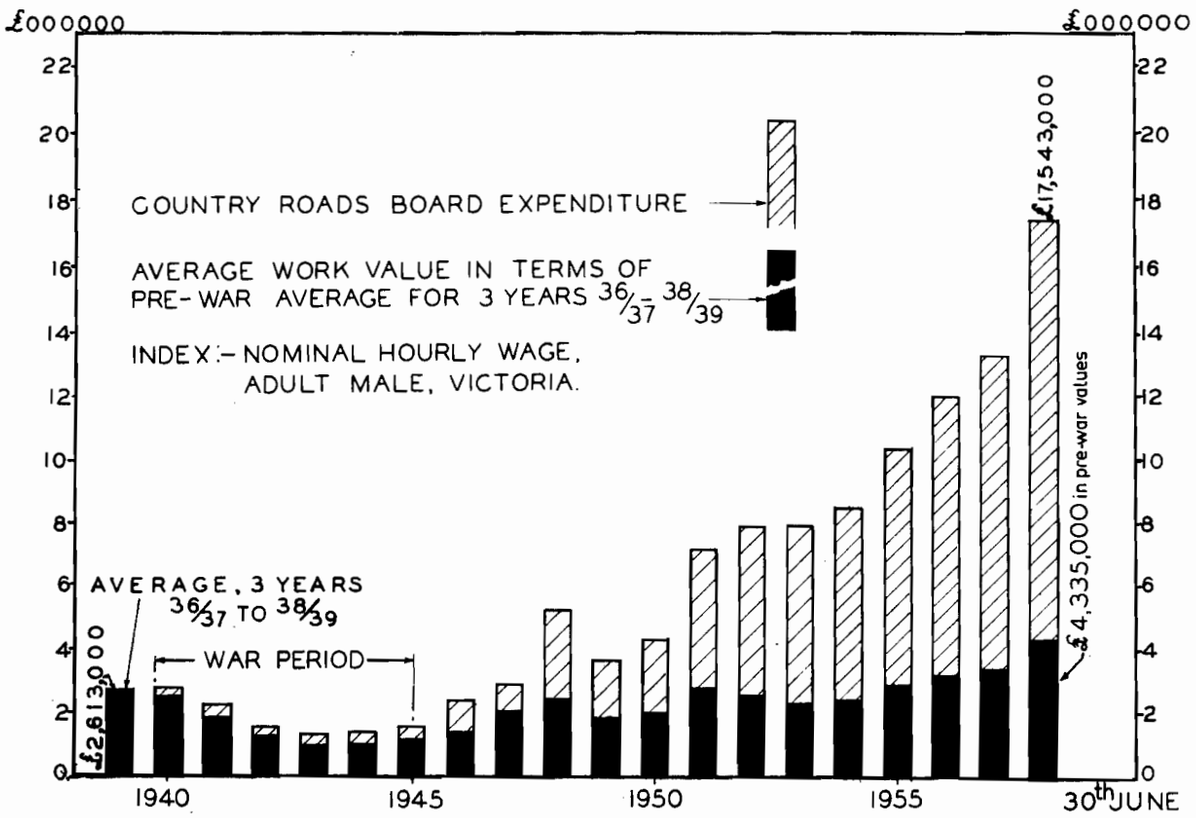


Fig 1. Relative growths of expenditure and equivalent work.

Ten Year Target.—In order to ascertain the minimum requirements for road works the Board has instituted two State-wide research surveys of road deficiencies and needs. The results of the first survey in 1949 showed that in terms of 1949 values £10,000,000 per year was needed for ten years on the arterial and rural road network. At that time the actual expenditure on these roads was only £7 million per annum, of which the bulk was merely for maintenance. By 1955 three factors had combined to render the 1949 survey obsolete, namely, the increase in traffic in many localities was much greater than allowed for in 1949, the community had become much more "road conscious" and with the depreciation of money values the 1949 estimates had become misleading. Considerable governmental expenditure for special road projects incidental to State development, e.g., of water and electricity supplies and for urban areas has also become essential.

A second survey was therefore carried out during the year 1956–57 and the Board's engineers again collaborated with local government engineers throughout the State in estimating reasonable requirements for the arterial and rural roads. More than 200 engineers have thus contributed to the work. This second State-wide research survey of road and bridge deficiencies showed that expenditure over the State road system as a whole at the rate of £38,000,000 per year for ten years is needed to achieve reasonable transport efficiency. Indeed, to meet the same objective, appropriate acceleration of progress with the scheme of metropolitan main roads devised by the Metropolitan Board of Works will involve increasing the estimated expenditure to £40,000,000 per year.

On this latter basis, increased revenues from all sources have reduced the deficiency in finance available for road and bridge works to approximately £10,000,000 per year. In view of what has been done at the State level further reduction at this stage will depend on increased municipal expenditure and on increased contribution by the Commonwealth to the State of Victoria by varying the basis of distribution of petrol

tax moneys and by increasing the amount to be distributed to the States. If the deficiency of £10,000,000 per annum were permitted to continue the objectives stated in the ten-year target would not become realities until twenty years have passed. Long before this period has elapsed new and additional needs to those foreseen in the ten-year target will have become apparent.

Federal Aid for Roads.—Present Commonwealth Aid Roads legislation expires on 30th June, 1959, and to enable the Board's financial deficiencies to be overcome it is essential that the new legislation shall provide a formula which will distribute the proceeds of the petrol and diesel fuel taxes on a basis which is equitable to this State.

Since the inception of Federal aid for roads in 1926, £250,687,721 has been distributed to the States of which Victoria has received only £43,991,952 or 17·5 per cent. Consequently in this State it has been necessary for the Board and the Government to provide from loans for much of the developmental and even reconstruction works which in some other States have been financed from revenues. More recently with limitations on the availability of loan moneys a heavy burden has fallen on the revenues raised at the levels of State and local government in this State. Meanwhile with intense developments in both rural and urban sectors the usage of the road network throughout Victoria has been increasing at such a rate that approximately one-third of the nation-wide usage of roads is within the boundaries of Victoria.

The present formula for distribution of petrol tax amongst the States thus makes totally insufficient allowance for current comparative use and wear and tear of roads. Although over the years the amount distributed to States has increased, the 1924 formula of two-fifths area–three-fifths population has not been changed. During the financial year 1957–58 the Commonwealth collected £15,234,771 in petrol tax in Victoria whereas the amount received by Victoria from the Commonwealth was £5,608,908 only, not including £700,000 distributed from diesel fuel taxation.

Expenditure in Victoria on roads, from all sources, is of the order of one-quarter of the figure for the whole Commonwealth. Petrol usage in Victoria is approximately one-third of the total for Australia, but only one-ninth of the petrol tax collected in the Commonwealth is returned to Victoria.

A formula for distribution based on population or, better still, the amount of fuel used in the State would be more closely related to actual needs to-day. The amount of fuel used is an index of use made of roads and has been universally recognized by the imposition of fuel taxes for road purposes in many countries both on petrol and diesel fuel.

By granting Victoria a larger and more equitable share of the proceeds of petrol and diesel-fuel taxes a large proportion of the further funds required for road purposes could be obtained without further taxing the road users of this State.

Interest Charges.—The amount of £400,000 made available to the Board during 1957–58 from loan moneys for expenditure under the provisions of the Country Roads Acts (against a total application of £4,159,000) was applied chiefly to the carrying out of works on main roads and bridges in the metropolitan area, in respect of which half the expenditure is repaid by Councils over a period of 35 years, and to the reconstruction of State highways.

Interest and sinking fund charges on loan moneys are becoming an increasingly heavy drain on the Board's funds, £831,078 being paid in respect of the year 1957–58. From the inception of the Board to 30th June, 1958, a total amount of approximately £14,070,000 has had to be paid in meeting such charges. In view of the inadequacy of the Board's present finances to meet to-day's road requirements, payments of this order can be ill afforded. In somewhat similar cases of State water supply and railway development a major portion of the corresponding interest and sinking fund charges has been transferred to consolidated revenue. If similar action were taken in respect of road works, which have surely contributed as greatly to the State's productivity, the finance released for the Board's use would be applied to fresh road improvement and developmental works so necessary to the general economy.

ALLOCATION OF FUNDS FOR ROAD AND BRIDGE WORKS.

Each financial year after providing for interest and sinking fund charges and for general administrative expenses the Board makes an annual allocation of funds for the construction, reconstruction, maintenance and repair of roads throughout the State by the Board's engineers and municipal councils. Except for patrol maintenance items this allocation is intended to provide for commitments carried forward from the previous year and for all works proposed to be carried out up to the time an allocation is made for the succeeding financial year. Unless further funds are made available to the Board after the general allocation no additional allocations are made during the financial year except in the case of unavoidably urgent work. The allocations are made, however, with the knowledge derived from past experience that over the whole programme the expenditure achieved is generally less than the allocation. This is due chiefly to the necessity for making sure that the allocations will provide for works extending over more than one financial year with quite varying probable expenditures in the current year from item to item or from place to place.

Apart from works undertaken for other authorities the total allocation for road and bridge works on all classes of roads in the financial year 1957–58 including revotes and amounts already committed in respect of works authorized was £19,780,000 as compared with £13,115,891 in 1956–57. The allocation of £19,780,000 comprised £10,651,780 intended to be met in due course from the Country Roads Board Fund, £8,517,857 from the Commonwealth Aid Roads moneys and £610,363 from loan moneys.

Contributions by Municipalities.—Municipal councils are required to contribute towards the cost of works carried out with funds provided by the Board as follows :—

(*a*) Councils' proportion of the previous year's expenditure on main roads in accordance with the Country Roads Act.

(*b*) Councils' proportion of the current year's expenditure from Commonwealth Aid moneys on unclassified roads.

It is provided in the Country Roads Act that not more than one-third of the amount expended from the Country Roads Board Fund on the maintenance of main roads during the preceding year shall be apportioned to the municipalities, whose contributions are due and payable on the 1st January in the financial year next following that in which the expenditure was incurred. The Act also provides that the municipal contribution may be reduced below one-third where the cost of maintenance of a road is deemed to be excessive, and where such cost is due to motor traffic not of local origin, or to timber traffic. In dealing with the apportionment of the cost of works, the Board must take into account the revenue, valuation, and rating of the municipality concerned.

With the great development in motor traffic generally and with increased timber traffic in certain parts of the State, municipal contributions towards main-road maintenance have in many cases been reduced below one-third. This has operated for many years and has been of considerable assistance to the councils concerned. The Board has further assisted in reducing the contributions by providing portion of the grants from Commonwealth Aid Roads moneys, free from additional contribution by the councils, these complementary grants being made mainly in relation to larger items such as reconstruction and bridge projects.

The percentage of contributions by councils to the total expenditure for main-road maintenance for 1956–57 was 15·57 per cent. as compared with 14·8 per cent. in 1955–56. Details are as follows :—

	£
Expenditure from the Country Roads Board Fund	2,684,694
Expenditure from the Commonwealth Aid Roads moneys ..	800,540
	3,485,234
Amount apportioned to councils (based on expenditure from Country Roads Board Fund only)	542,651
Percentage of amount apportioned to the total expenditure from the Country Roads Board Fund	20·21%
Percentage of apportionment to total expenditure (including Commonwealth Aid Roads grants)	15·57%

Had the whole of the expenditure been financed from the Country Roads Board Fund and apportioned strictly on a one-third basis, the councils would have been required to contribute one-third of £3,485,234, that is £1,161,745. By reason of the reduced contributions and the grants from Commonwealth Funds, however, their contributions amounted to £542,651 only, a reduction of £619,094.

In determining each year the Councils' contributions and grants from Commonwealth Aid, consideration is given by the Board to the following factors :—

1. Size of the individual projects and of the Council's programme as a whole.
2. Traffic characteristics.
3. General financial position of the municipality.
4. Total funds available.

It will be appreciated that by this very flexible policy the Board's contributions to municipal works are based on the principle of meeting needs which vary from item to item and from year by year. The board is able to make adjustments for councils where special relief appears justified by reason of relative disadvantages of local environment or the relative magnitude of the road programme in particular areas.

In addition £4,931,754 was spent on State highways, £457,735 on tourists' roads and £127,717 on forest roads to which classes of roads councils are not required to contribute.

On unclassified roads most councils have submitted long lists of construction works in order of priority, usually of a total value two or three times greater than the available finance. However, the extent of the requests made is a genuine indication of the growing importance which ratepayers throughout the State are attaching to road and street improvements and to securing the benefits of better roads as quickly as possible. Provision has therefore been made for as many items as possible consistent with the ability of councils to contribute appropriately towards the cost of works which are generally of great local benefit. In some cases ratepayers have further demonstrated the desire to expedite particular works by providing additional assistance beyond that made available from rate revenues.

To assist councils in the maintenance of unclassified roads the Board has in the post-war period similarly included many more sections of road than were admitted into this category in earlier periods. Councils are generally very appreciative of the assistance so given which facilitates more consistent maintenance operations on the network of subsidiary roads. The basis of contributions has generally remained at two-thirds from the Board and one-third from the Council, which is consistent with the basic statutory proportions for main roads.

Urban Needs.—For many years applications for funds from the municipalities and the grants made by the Board were limited to works in rural areas, for the most part outside built-up areas. However, with the rapid increases in population not only in the metropolitan area but also in provincial cities and towns, there has been a great increase in traffic volume in and around urban areas. With decentralization and dispersal of heavy industry large factories have been and are still being erected in such centres as Geelong, Ballarat, Bendigo, Dandenong, Morwell, Wangaratta and many other cities and townships.

Such provincial cities and towns throughout the State are also the focal points for the surrounding rural communities. In consequence there is in this State a large increase in traffic on all roads conveying goods and persons to and from and converging on these centres in the course of private business or the affairs of the community.

To cope with the increased heavy traffic and a greater total volume of traffic and to relieve the congestion many large scale works in urban areas are urgently required. A few years ago the need for improving costly urban sections of so many roads had scarcely commenced to arise but now the municipalities concerned are making many more applications for assistance on this type of project. Arrears of such work have accumulated. In general, these works are costly owing to the need for fixing levels at kerb lines and building the road pavement in one stage to a suitable standard of load-carrying capacity. However, as a general rule the Board has required a somewhat larger contribution from Councils towards that class of improvement than in rural areas because of the relatively greater local benefit, a fact which Councils have readily recognized.

MAIN ROADS.

Allocation of Funds.

The total amount applied for both by 196 municipal councils for works under municipal supervision and by the Board's engineers for works under the direct supervision of the Board for the maintenance and improvement of the 9,789 miles of main roads in the State was £12,111,292. Allocations were made totalling £7,972,867, representing 65·9 per cent. of the total applications.

As compared with the previous year, provision was made for a somewhat larger programme of improvements as compared with the basic works of maintenance which are a first charge on available funds and in this State absorb such a high proportion thereof. The rate of improvement of main roads is however still considerably below that shown by the Board's " target " survey to be necessary.

The expenditure for the year on main roads was £5,343,020 equivalent to 67 per cent. of the allocation, compared with 79 per cent. in 1956–57, 57·7 per cent. in 1955–56, and 66 per cent. in 1954–55. Commitments outstanding at 30th June, 1958, amounted to £1,625,648.

Major Works.

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

Alberton Shire—Yarram–Traralgon Road.—Commencement of 2 miles of realignment to provide an 18-ft. sealed pavement near Carrajung Lower. (Plates 4, 5 and 6.)

Avoca Shire—Ararat–St. Arnaud Road.—A new concrete bridge was constructed over Wimmera River at Crowlands.

Box Hill City—Burwood Road.—Work proceeded on the duplication of the roadway and the construction of pavement and medians between McComas Grove and Greenwood Street. *Canterbury Road.*—The pavement between Birdwood Street and Middleborough Road has been widened and strengthened.

Camberwell City—Warrigal Road.—Duplication of roadway and construction of pavement and medians from High Street Road to Gardiners Creek.

Coburg City—Bell Street.—Reconstruction of pavement from Coburg Railway to Linsey Street.

Eltham Shire—Yarra Glen–Yea Road.—A contract was let for the construction of the first 2 miles of this road on an entirely new location.

Gisborne Shire—Mount Macedon Road.—A section of 0·7 miles was reconstructed and widened (Plates 7 and 8.)

Glenelg Shire—Casterton–Apsley Road.—Five miles were reconstructed and 5·8 miles were sealed.

Glenlyon Shire—Ballarat Road.—Work commenced by contract on the reconstruction and relocation of the roadway near Daylesford where on the existing road many sharp curves and steep grades occur, and the new road will provide flatter curves with a constant grade of 1 in 16. (Plate 9.)

Gordon and Cohuna Shires—Pyramid–Leitchville Road.—A reinforced concrete bridge was completed over the outlet from Kow Swamp.

Kara Kara Shire—Marnoo–St. Arnaud Road.—The balance of the sealing between Horsham and St. Arnaud, a total distance of 70 miles, was completed.

Lillydale Shire—Dorset Road.—The Victorian Railways Department completed the construction of a new overpass bridge.

Main Warburton Road.—Reconstruction was commenced of 1·1 miles between Wandin and Seville.

Lowan Shire.—Five miles were reconstructed and sealed on each of the Donald–Swan Hill and Lorquon West Roads.

Maffra Shire—Licola Road.—Reinforced concrete culverts were constructed at Jimmys Subway and Home Creek and the sealing completed to Licola.

Plates 4 and 5.—Heavy equipment on reconstruction of hilly section of Yarram–Traralgon Road near Carrajung Lower—Alberton Shire.

Plate 6.—Reconstructed hilly section Yarram–Traralgon Road near Carrajung Lower, showing old alignment on right.

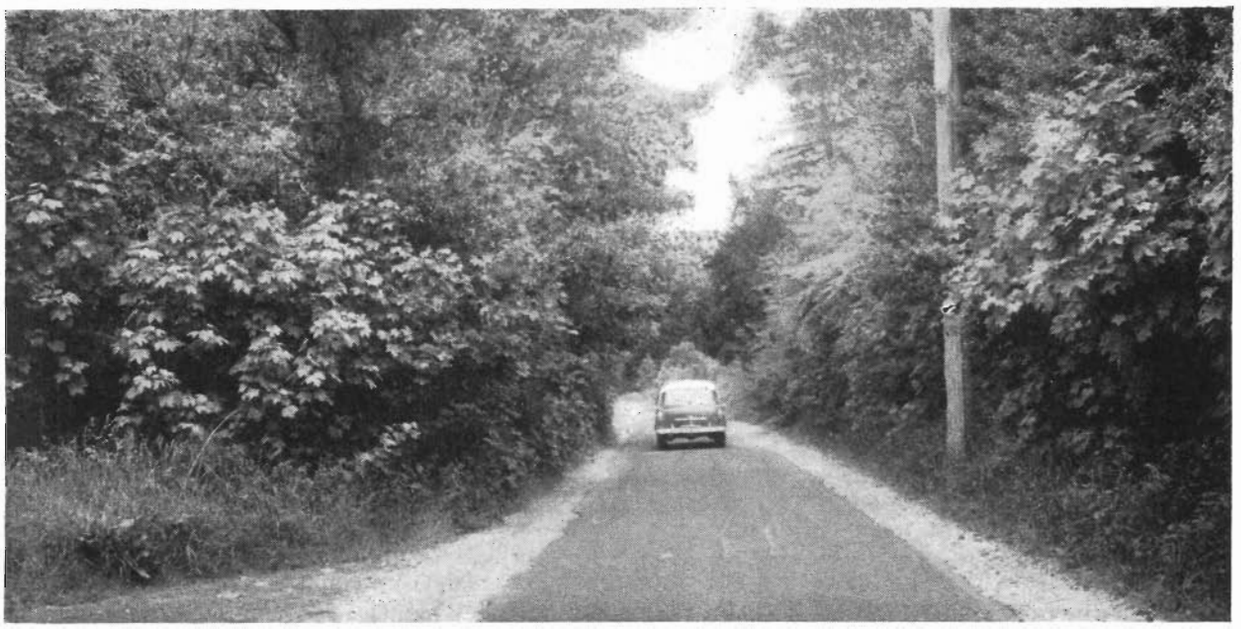


Plate 7.—Gisborne Shire–Mt. Macedon Road. Old narrow section one mile south of Camels Hump before reconstruction.

Plate 8.—Gisborne Shire–Mt. Macedon Road. Same section as in Plate 7 after reconstruction and widening.

Plate 9.—Realignment and reconstruction of Pescia's Hill, Ballarat–Daylesford Road—Glenlyon Shire.

Mansfield Shire—Mansfield–Woods Point Road.—A section of 2·6 miles was reconstructed.

Metcalfe Shire—Elphingstone–Harcourt Road.—A section of 1·7 miles was reconstructed.

Moorabbin City—South Road.—Duplication of roadway from East Boundary Road to Bignell Road.

Morwell Shire—Boolarra–Forster Road.—Three miles of alignment to provide an 18-ft. sealed pavement between Boolarra and Boolarra South.

Omeo Shire—Ramrod Flat Road.—Work progressed by contract on a large steel and reinforced-concrete bridge over the Tambo River.

Preston City—Bell Street.—Reconstruction and widening of pavement from Gilbert Road to Merri Creek.

Ringwood Borough—Canterbury Road.—The Victorian Railways Department commenced construction of a new overpass bridge at Heathmont which will eliminate the existing narrow timber bridge on this heavily trafficked road.

STATE HIGHWAYS.

For the most part, the regular patrol maintenance gangs employed by the Board throughout the State highway system over many years have been able to keep the road pavements in reasonable order in all seasons. The exceptionally wet periods which occurred two years ago damaged or weakened many sections, involving much more concentrated effort to restore and strengthen pavements. Even on long lengths of established bitumen sealing much resheeting was involved, followed by restoration of entirely new bitumen surfaces. A considerable volume of this heavy type of work was in progress at the commencement of the year and continued during the year. Some still remains to be completed. The whole system is now in much better shape than at any time previously in the post-war period, but there is still much costly reconstruction required to cope with traffic needs.

Practically the whole of the maintenance and improvement work on State highways is carried out under the direct supervision of the Board, whose Divisional Engineers were asked to submit programmes of works of greatest urgency. They applied for a total sum of £8,774,000 and were allotted a sum of £5,818,000, equivalent to 66 per cent. of the total applications.

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

Princes Highway West.—Duplication of the existing two-lane highway between Footscray and Geelong was further advanced by the acceptance of a contract for earthworks and paving of two sections totalling 18·83 miles, the contract amount being £340,000. This contract excludes all bridges and the Corio Overpass and also excludes all bituminous surfacing, which the Board proposes to do with its own plant and equipment. A section between Kororoit Creek Road and the approach to the overhead bridge over the railway at Laverton was widened and strengthened. Work on the Corio Overpass to eliminate the level crossing of the railway was commenced by direct labour. A contract has been let for the construction of this bridge, utilizing precast beams for the superstructure which are being produced in the Board's concrete precasting yard in the Divisional Depot at Geelong. Duplication of bridges over Skeleton Creek, Little River, and Hovells Creek is in progress by contract, whilst the Board is duplicating the bridge over the Explosives Subway at Truganina by direct labour. Reconstruction of the urban section through Belmont was commenced. (Plate 10.) Owing to the complexity of this job, which involves the adjustment of water and gas mains, removal of disused tram tracks and regrading of channels and footways in conjunction with the Council, the work was undertaken by direct labour. 3·1 miles east of Tyrendarra, 2·1 miles at Tyrendarra, 2·4 miles near Lyons railway crossing, and 4·2 miles between Dartmoor and Mumbannar were reconstructed and sealed.

Princes Highway East.—During the year, work was continued on the construction of the channelized intersection of Springvale Road and the Princes Highway, and the intersection treatment has now been completed with the exception of the kerbing. (Plate 11.) The duplication of 5 miles of highway pavement between Springvale and Dandenong was completed. (Plate 12.) An additional 24-ft. width of pavement was provided and, in addition, 0·6 miles of 24-ft. pavement was constructed in the immediate vicinity of Dandenong, providing two duplicate highway pavements separated by a

PRINCES HIGHWAY

Plate 10.—Reconstruction of Princes Highway West in Belmont to new levels after removal of tramline.

Plate 11.—Princes Highway East at Springvale. Duplication of pavement between Oakleigh and Dandenong. Channelization at intersection with Springvale main road, Centre Road, and Police Road.

STATE HIGHWAYS

Plate 12.—Princes Highway East one mile west of Dandenong. Duplication of pavement.

Plate 13.—Western Highway west of Pykes Creek Reservoir. Reconstruction of old, weak, tortuous section with extra up hill lane.

Plate 14.—Nepean Highway. Duplication between Frankston and Mile Bridge. View at Seaford Road intersection—new carriageway on right.

22-ft. median. Lengths of 3 miles between Yarragon and Trafalgar, 3 miles between Rosedale and Sale and 1·5 miles near Kalimna West were reconstructed and sealed. Work continued on the construction of the Mitchell River bridge at Bairnsdale. A major deviation between McKenzie River and Cann River was commenced and work is in progress on a contract for the construction of two reinforced-concrete bridges at Blue Nose Creek and Cann River.

Western Highway.—The deviation and new bridge at Toolern Creek were completed, together with widening and strengthening of a section just west of Melton. The short radius curves on the western approach to Pykes Creek reservoir near Ballan were realigned and a section was reconstructed with a third lane for slow-moving vehicles travelling uphill. (Plate 13.) Three sections of the highway, east of Ballan, near Llandeillo and east of Gordon, for a total length of 2½ miles were reconstructed where the pavement was failing. A truck-parking bay was constructed at the top of Woodman's Hill near Ballarat and a section of approximately 3 miles near Eurambeen was reconstructed and sealed. 8·5 miles at Dadswell's Bridge were reconstructed and sealed, together with the widening of 5·5 miles between Dimboola and Wail. 10·85 miles near the Lawloit Ranges were reconstructed and widened and 1·35 miles improved between Kaniva and the South Australian border.

Calder Highway.—Further work on the removal of decaying corduroy under the old pavement in the Black Forest and widening and improving the alignment was commenced. A new reinforced concrete bridge over the Campaspe River at Shamrock was completed together with approaches and realignment and regrading of the adjoining section of the highway. Work commenced on the replacement of the timber bridge over the Loddon River at Bridgewater with a steel girder and reinforced concrete structure. Between Wedderburn and Charlton 3·5 miles were reconstructed and sealed.

Northern Highway.—A reinforced concrete bridge over McIvor Creek at Heathcote was completed and a similar type of bridge has been commenced over Mount Pleasant Creek south of Elmore.

Hume Highway.—Widening of the old 20-ft. seal to 24 feet was continued, including sections between Craigieburn and Wallan and north of Pretty Sally Hill. On the section between Seymour and Benalla, road construction and widening has proceeded together with replacement and widening of bridges and elimination of floodways. On the section between Benalla and the River Murray, further reconstruction and widening has been carried out. The level crossing elimination project at Glenrowan has been completed. The No. 3 bridge between Wodonga and Albury has now been widened from 20 feet to 28 feet between kerbs plus provision of two 6-ft. cycle-ways.

Omeo Highway.—2·85 miles on Mitta River Flats north of Mitta Mitta were reconstructed.

Murray Valley Highway.—A length of 0·86 miles near Ebden, made necessary in part because of the raising of the Hume Weir, was reconstructed. 1·5 miles west of Wyuna, 4 miles between Turrumberry and Gunbower, and 1·65 miles between Lake Charm and Kangaroo Lake were reconstructed. Reconstruction of 3·58 miles between Swan Hill and Nyah was commenced.

South Gippsland Highway.—1·25 miles in the vicinity of Wireless Hill, Lyndhurst, was widened, strengthened and regraded to provide a 24-ft. wide sealed pavement. 2·8 miles of reconstruction east of Leongatha were commenced. A three-span reinforced concrete precast beam bridge over Black Spur Creek together with 0·8 miles of approaches was completed. A two-cell reinforced concrete culvert was completed over Bennison's Creek, together with 0·4 miles of approaches.

Midland Highway.—The deviation and regrading of the Batesford Hill was completed. Further widening and strengthening of the pavement immediately on the Geelong side of this deviation was completed. Other works included commencement of regrading of 3 miles of new road through the Bagshot Hills between Huntly and Bagshot, 2 miles of widening and reconstruction east of Elmore, and 2 miles of reconstruction west of Mooroopna. Contracts have been let for the widening of three reinforced concrete bridges between Shepparton and Mooroopna. Flood openings with prestressed slabs and construction of 3 miles of road near Lake Cooper were completed.

Henty Highway.—A length of 6 miles north of Ti Tree Creek was resheeted, 0·85 miles near Dooen was reconstructed and realigned, and 3·8 miles between Galaquil and Beulah was widened. Six miles of road from Gypsum to Bronzewing was reconstructed

and sealed and two sections, one of 3 miles north of Lascelles and the other of 2 miles from Bronzewing to the Calder Highway were reconditioned and sealed, having been reconstructed in the previous year.

Loddon Valley Highway.—Six miles north and south of Hawkinston were reconstructed, and 13½ miles of widening, resheeting and sealing south of Serpentine were completed.

Goulburn Valley Highway.—3·8 miles south of Murchison East were reconstructed.

Ouyen Highway.—A length of 6·4 miles to Walpeup was sealed and through Murrayville 4·1 miles were reconstructed. The Carina deviation was constructed.

Nepean Highway.—The pavement between Patterson Road and South Road in Moorabbin and Brighton Cities was reconstructed and widened and the railway level crossing elimination project at Moorabbin was commenced. Between Frankston and Mile Bridge, a new 24-ft. sealed pavement was constructed for Melbourne bound traffic, thus duplicating this congested section. (Plate 14.) The work involved the removal of the Avenue of Honour, regrading of the central median and replacement of the Avenue of Honour with suitable trees. It was necessary to move a two-story wooden shop in the vicinity of the Mile Bridge in order to complete the duplication and this was done with a minimum of inconvenience to the shopkeeper.

Glenelg Highway.—Three miles near Langi Willi east of Skipton were reconstructed, and realignment of the railway crossing will provide greater visibility. Three miles of pavement near Streatham and 3 miles in and beyond Lake Bolac were reconstructed and sealed. 7·6 miles between Hamilton and Wannon were widened. 4·1 miles east of Mount Koroite and 1·9 miles west of Coleraine were widened and strengthened. 2·7 miles at Campbell's Cutting east of Casterton were reconstructed.

Borung Highway.—1·45 miles, east of Warracknabeal, was reconstructed and a further 9 miles widened. (Plate 15.)

North Western Highway.—10·3 miles between Watchem and Birchip were reconstructed and sealed.

Bass Highway.—The existing sealed pavement for a length of 3 miles east of Wonthaggi was widened and resheeted to provide a 24-ft. sealed pavement within the Wonthaggi township and 20-ft. sealed pavement outside the township area.

Maroondah Highway.—Widening of 1·1 miles of this highway at Melbourne Hill west of Lilydale was completed, three traffic lanes thus being provided, including two for traffic moving uphill.

Bellarine Highway.—The programme of widening between Geelong and Queenscliff was virtually completed with the finishing of the work between Marcus and the Portarlington–Queenscliff Road junction including regrading of Wilson's Hill to improve visibility.

Plate 15.—Borung Highway. Reconstruction of failed section east of Warracknabeal.

TOURISTS' ROADS.

Tourists' roads are those which are proclaimed as such under the *Country Roads (Tourists' Roads) Act* 1936, No. 4405. Municipal councils are not required to contribute towards the cost of work on this class of road. The works of maintenance and improvement are carried out under direct supervision of the Board.

For the 416 miles of proclaimed tourists' roads in this State a total sum of £839,090 was applied for and £612,842 was allocated.

The worst curves between Eastern View and Lorne on the Ocean Road were improved to facilitate the operation of 33-ft. passenger buses of the rigid type and this work was sufficiently advanced in December, 1957, to permit the withdrawal of the ban on the operation of vehicles in excess of 28 ft. 6 in. in length between Anglesea and Lorne. Only the minimum amount of work to allow this traffic to proceed with reasonable safety has been done at this stage.

Widening and curve improvement continued between Lorne and Apollo Bay as part of a programme to permit eventually the operation of 33-ft. passenger buses over this section of the Ocean Road. (Plate 16.) The sealed pavement was also increased this year by sealing 1·1 miles on Mount Defiance where widening and realignment has been continued. Construction of a new reinforced concrete bridge has been commenced to replace the floodway at Cumberland River.

On the Grampians Road 4·17 miles of narrow pavement were widened and a new reinforced concrete bridge was constructed over Mount William Creek at Mokepilly. Sealing on the Mount Victory Road was extended to Reed's Lookout and a further 2 miles were reconstructed and sealed. The sealing of the Silverband Road was completed. More than half of the 71 miles of tourists' roads in the Grampians area have now been sealed.

A parking bay was constructed on the Mount Buffalo Road and 2·75 miles of the "Horn" section were reconstructed. (Plates 17 and 18.)

Plate 16.—Ocean Road. Widening in progress east of Wye River.

Plate 17.—Mount Buffalo Road. Narrow section leading to "The Horn" before widening.

Plate 18.—Mount Buffalo Road. Widened section leading to "The Horn".

FOREST ROADS.

Forest roads are those which are so proclaimed under the *Country Roads (Forest Roads and Stock Route) Act* 1943 (No. 4953) which provides that they shall not be proclaimed " except in such areas in the State as are within or adjacent to any State Forest or as the Board considers to be timbered mountainous or undeveloped areas ".

No contribution is required from municipal councils towards the cost of work on forest roads, although in most cases the works are carried out under council supervision.

Applications totalling £263,893 were received this financial year for the 377 miles of proclaimed forest roads and the sum of £207,475 was allocated.

Further widening and minor realignment was carried out on the Dean Marsh–Lorne Road between Benwerrin and Lorne.

UNCLASSIFIED ROADS.

As has been the practice for many years the Board continued to assist councils with grants for works on unclassified roads under two general headings :—

1. Works of major improvement and construction.
2. General maintenance.

For major works applications amounting to £9,102,248 were received by the Board and £4,423,224 was allotted. Expenditure of £2,734,527 was reimbursed by the Board.

The work done represents a considerable improvement of the subsidiary road network in a great variety of projects such as replacement of dilapidated, weak, old bridges, construction of roads to serve new settlements, and reconstruction of existing roads and streets. In an increasing number of cases extension of bituminous surfacing is provided for, the basis of assistance being not very different from that on main roads. However, as heavy traffic to-day makes use of all roads, even those serving only one or two farms, and tends to use them in all weathers, a reasonably high standard of improvement of subsidiary roads is necessary, not much different from that for main roads. Lesser widths are generally appropriate but pavements cannot safely be made much thinner. The rate of improvement as a whole is far less than has been shown to be necessary by the " target " survey.

For maintenance £1,478,841 was applied for and £602,990 allotted. In giving this assistance to councils the Board does not accept responsibility for the entire maintenance of the roads as on main roads but rather makes a contribution towards the cost of maintenance with a stipulation that the council contribute generally at least £1 towards each £2 provided by the Board. These grants which have been much appreciated by councils tend to encourage the adoption of better standards of maintenance than the councils could otherwise provide. The expenditure reimbursed by the Board was £560,829.

Requests were received during the year from councils for the declaration of certain unclassified roads as main roads but the Board is still unable to carry the additional financial burden which such action would involve.

BRIDGES.

During the year to 30th June, 1958, 234 new bridge projects were initiated, having a total value of £1,894,000. This brings the total number of bridges either erected or in the course of erection with funds provided by the Board since its inception to 4,944. Of the new bridge projects, 165 costing £623,000 were under municipal supervision and 69 costing £1,271,000 were under the supervision of the Board.

In the same period, an amount of £176,000 was expended on the purchase of precast reinforced concrete pipes and box culverts, and £20,000 on the purchase of corrugated galvanized steel pipes.

Though the amount of work done on construction and maintenance of bridges during the financial year reached the maximum since the inception of the Board both in number and value, there still remain hundreds of old structures requiring replacement and many subject to load limitation.

The problem of maintaining the staff of the Bridge Division at a number sufficient to meet the problems of design and construction is still unsolved. During the year, the Bridge Division lost nine engineers with 32 man-years of experience and gained nine engineers with four man-years of experience.

Tendering.

Competition between bridge contractors has been extremely keen, resulting in a downward trend in prices for both large and small jobs. In some cases the prices tendered have been so low as to considerably reduce the profit margin and endanger the financial position of the tenderers. In one case the Board terminated a contract and continued the work by direct labour. Several interstate firms, new to bridge work in this State, have successfully tendered for work during the year.

It is, however, still rather difficult to obtain satisfactory tenders for complicated foundation works and the Board has employed direct labour gangs on three large jobs to do this part of the work.

Tenders for manufactured articles such as plate girders and concrete slabs have also been influenced by competition and have shown a downward trend in prices.

Damage to Bridges.

During the year a small number of old timber bridges collapsed under load but no injuries resulted. At Harrow on the Glenelg River, an old timber bridge subject to 8 tons load limit was being repaired by a maintenance gang, when a vehicle loaded to 19 tons attempted to cross the bridge, causing collapse of a stringer and adjacent pier and two spans, the vehicle falling into the stream. Replacement of the bridge with a concrete structure was at that time under consideration and work has since commenced. A similar accident occurred to an old timber structure in the Shire of Seymour.

The need for thorough and rigid supervision of bridge works was brought out during a recent inspection of the bridge over the Ovens Rivers at Rocky Point. In this case the bridge had settled about 5 inches over a short period. When the foundations were exposed it was found that practically all the rubble foundation material had been washed away by the current and only approximately 24 1-inch diameter mild steel rods were supporting the pier. Repairs are being effected to restore support on a sound foundation. The Board's Bridge Inspecting Engineer and other personnel undertook the detailed examination of the damage. Some 24 old dilapidated structures at sites throughout the State were subjected to thorough examination by this officer during the year, his detailed reports forming the basis for estimates of necessary repairs or replacements and also for allocation of appropriate priorities in undertaking the works.

Country Bridges.

At Seven Mile Creek on the Watta Wella Parish North Boundary Road, Stawell Shire, a very old timber bridge was replaced by a reinforced concrete structure of two 26-feet spans with a roadway width of 12 feet between kerbs. (Plate 19.) The handrails of a novel type consist of unserviceable railway rails placed vertically in reinforced concrete and surmounted by horizontal " Armco " railings placed at a height of 2 ft. 6 in. to facilitate movement of farm machinery.

Work has continued on the very necessary widening of the five bridges on the Hume Highway crossing of the River Murray flats between Wodonga and Albury.

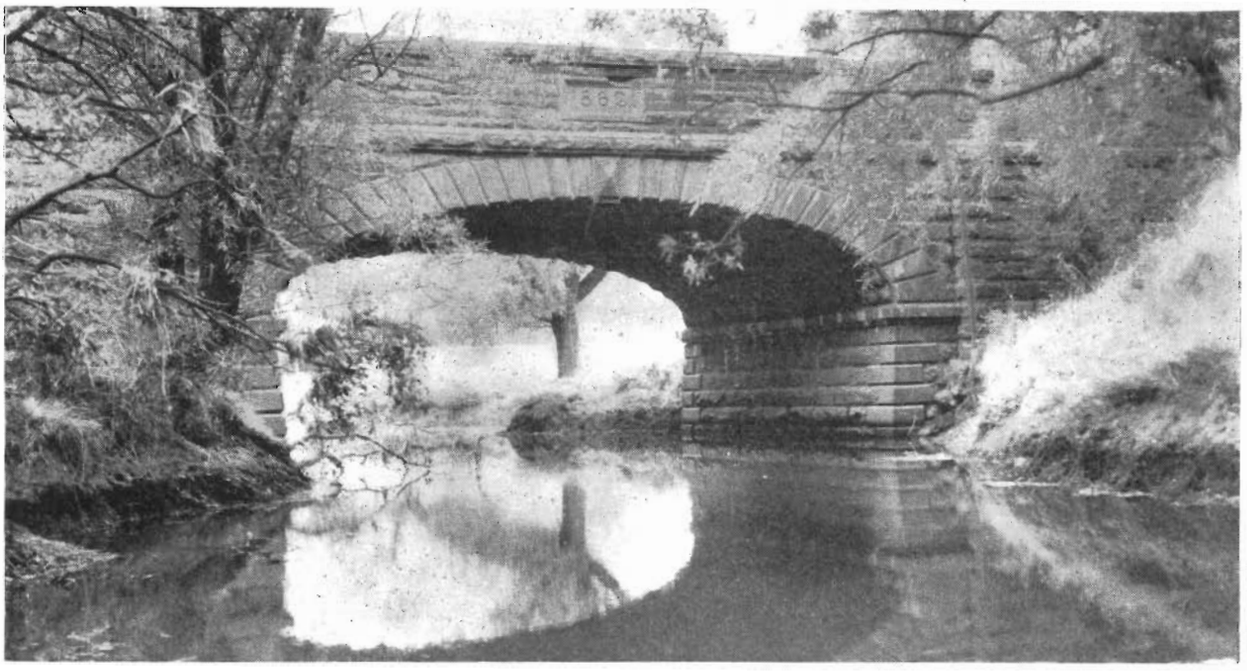
The duplication of the Princes Highway East through Dandenong has necessitated the provision of two new bridges over Eumemmerring Creek. Work has commenced on the construction of the northern bridge which when completed will carry traffic during the construction of the southern bridge. The widening of the remaining bridges over the floodway on the Midland Highway between Shepparton and Mooroopna, viz, Nos. 5, 6 and 7, has continued and this section should be complete, with the exception of widening the Goulburn River Bridge, by the end of this financial year.

At Harrow, pile-driving for the new bridge over the Glenelg River on the Coleraine–Harrow–Apsley Road has commenced under the Board's direct supervision and tenders will be called for the construction of the remainder of the bridge.

Work has proceeded by direct labour on the bridge over the Mitchell River on the Princes Highway East at Bairnsdale and traffic is expected to be using the bridge during August, 1958.

BRIDGES

Plate 19.—Watta Wella Parish Boundary Road, Stawell Shire. Bridge over Seven Mile Creek.



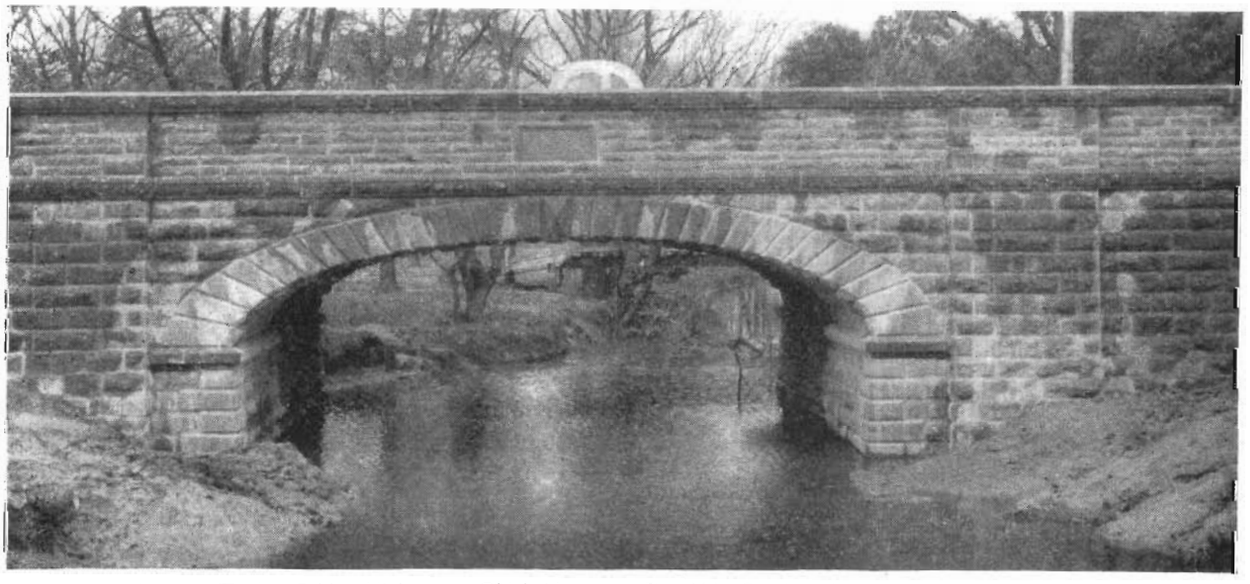


Plate 20 (Top).—Calder Highway. Old bridge over Five Mile Creek at Woodend prior to widening.
Plate 21.—Five Mile Creek Bridge after widening.

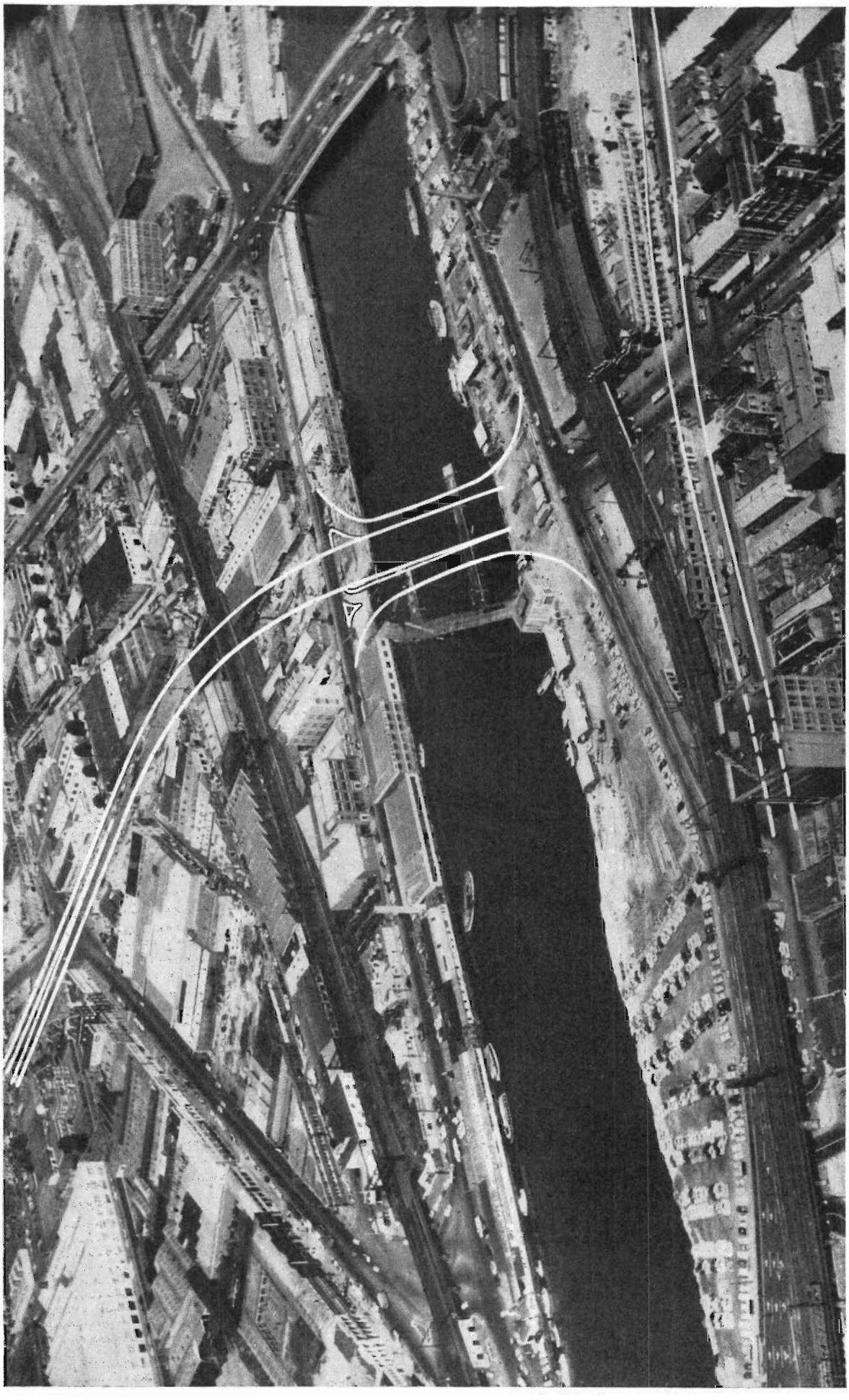


Plate 22.—King Street Bridge Site showing temporary bridge across Yarra River. White lines show construction area in Flinders Street (right foreground) and across river to Hanna Street, South Melbourne.

At the Five Mile Creek at Woodend on the Calder Highway an old basalt masonry elliptical arch bridge which was built in 1862 was widended this year, retaining the masonry facing. (Plates 20 and 21.) On the Hume Highway another masonry arch bridge of 29-ft. span was widened from 20 feet to 28 feet by using the face masonry from a second arch nearby which was demolished. The barrel and walls were cast in concrete.

Metropolitan Bridges.

The bridge over the Yarra River at King Street is proceeding in accordance with the *King Street Bridge Act* 1957, No. 6156.

After negotiations with some eighteen occupiers of premises affected the necessary demolition work and clearing of the site between Flinders Street and Grant Street was almost completed by 30th June, 1958. By the same date, negotiations between the Melbourne City Council and some sixteen occupiers of affected premises in Flinders Street were also nearing completion. Considerable preliminary work was also involved in relocation of the Melbourne and Metropolitan Board of Works main drain for the South Melbourne area. The major part of this work was completed by that authority.

The contractors for the main project (Utah Australia Ltd.) began their operations on the the site on 25th November, 1957. A temporary bridge was built across the stream to give access to the locations of the river piers and for general access along the works. (Plate 22.) Welded steel cylinders, 5 feet in diameter, lined with concrete are being sunk to firm foundations as the first stage in constructing the reinforced concrete piers, commencing with piers adjacent to Riverside Avenue and at the north bank of the river.

For the main bridge and the elevated carriageway to the south the cylinders will be founded on silurian siltstone at depths varying from 100 to 170 feet below natural surface or water level. For the piers of the Flinders Street Overpass foundation levels will vary from 10 to 40 feet below existing street levels.

Under the provisions of the *Napier Street Bridge Act* 1954, No. 5822, work proceeded during the year by direct labour on the construction of the sub-structure portion of the new bridge 520 feet long at Napier Street over the Maribyrnong River, Cities of Melbourne and Footscray. By March, 1958, the foundation work was above ground or river level and a rigid frame span was built over the railway. (Plate 23.) Tenders were then invited for the completion of the sub-structure and the erection of the superstructure. A contract for this work was signed in April, 1958, and it is expected that the bridge will be completed early in 1959.

As the direct labour work on the Napier Street Bridge approached completion, the construction gang was transferred to Heidelberg where work was started on the piers and abutments for a new bridge over the Yarra River on the Heidelberg–Warrandyte main Road (Banksia Street). The existing weak old iron arch bridge has deteriorated and its replacement is now urgent. The new structure will consist of a three-span continuous steel and reinforced concrete bridge 278 feet long with a roadway of 28 feet and one 6-ft. footway. The sub-structure will consist of reinforced concrete piers on pile foundations with a superstructure of mild steel plate girders composite with the reinforced concrete deck.

With the development of Warrigal Road as an important distributory road it was necessary to widen the bridge over Gardiner's Creek to take four lanes of traffic The original bridge was a single span cast in place concrete T-beam structure, a form of construction which has been repeated in the widened section to match the old structure. An unusual measure adopted was the cutting and jacking over to a new position of the footway and handrailing of the existing structure. (Plate 24.) This procedure cost £1,000 less than would have been the cost of demolishing the footway and casting a new section.

FLOOD DAMAGE.

The Commonwealth–State Flood Relief Agreement referred to in the Board's Forty-fourth Annual Report provided an amount of £726,000 on a £1 for £1 basis from the Commonwealth and State Governments for the restoration of roads and bridges in the Murray Basin. This money was not to be applied to the Wimmera region or areas south of the Great Dividing Range.

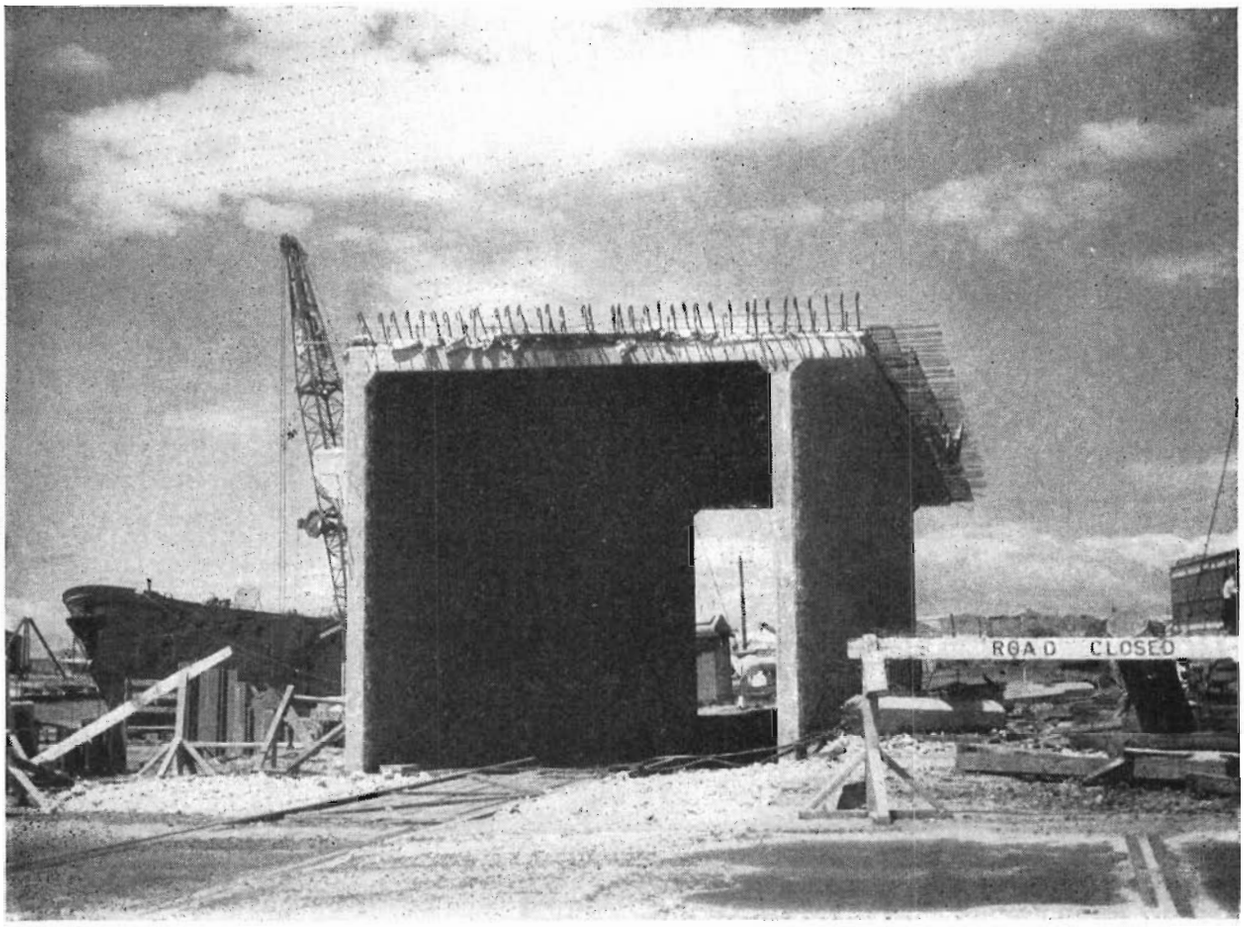


Plate 23.—Napier Street Bridge over Maribyrnong River, Cities of Melbourne and Footscray. Section over railway at Footscray end of bridge.

Plate 24.—Widening bridge over Gardiner's Creek, Warrigal Road, by jacking over handrails and footway.

LEVEL CROSSING ELIMINATION

(See also Cover.)

Plate 25.—Hume Highway. New deviation through Glenrowan which eliminates two railway level crossings.

Plate 26.—Dandenong Shire. Dandenong–Frankston main road—Railway overpass at Dandenong.

The work of restoration has been proceeding steadily during the year under review, and at 30th June, 1958, a total amount of £697,093 had been expended. It is expected that the balance of the work will be completed at an early date.

Under the Agreement a sum of £274,000 was also initially made available to the State Flood Damage Relief Committee for the purpose of carrying out emergency flood protection and other allied works as distinct from road and bridge restoration. When all claims had been met in respect of emergency flood protection a sum of £40,000 still remained unspent. The Board having suggested that the money be utilized in assisting councils in other areas of the State in the restoration of flood damage, approval was given to distribute this sum towards the cost of restoration of roads and bridges in the Wimmera area where very severe damages had been sustained.

ELIMINATION OF RAILWAY LEVEL CROSSINGS.

One of the first projects undertaken under the provisions of the *Country Roads and Level Crossings Act* 1954, No. 5791, was the construction of the deviation of the Hume Highway for a distance of 3·92 miles through Glenrowan township to eliminate two level crossings. This work has now been completed at a total cost of £88,000. (Plate 25.) Two level crossings were also eliminated on the Ouyen Highway by the construction of the Carina deviation west of Murrayville, a total length of 3·5 miles.

The Victorian Railways Department completed the construction of a four-lane concrete overpass bridge to eliminate the level crossing on the Dandenong–Frankston Road near Dandenong. The construction of two lanes of the approaches was completed by the Dandenong Shire Council, work on the remaining two lanes being still in progress. (Plate 26.)

The bridge carrying the Heidelberg main road over the railway at Clifton Hill, consisting of a four-lane overpass, a two-lane left-turning ramp down to Hoddle Street from Heidelberg Road and a two-lane right-turning loop from Hoddle Street to Heidelberg Road, was opened to traffic. This is the first major rail overpass project to be completed in the metropolitan area. (See cover.)

Work has commenced on the bridge over the Melbourne–Geelong railway at Corio. This overpass will carry four lanes of traffic with provision for widening to six lanes should the growth of traffic warrant it.

WORKS FOR OTHER AUTHORITIES.

The Board's organization and equipment were fully availed of as in previous years by Commonwealth and State Governments and Authorities for carrying out certain special projects at their cost.

The total expenditure involved was £1,671,592 as shown on the statement hereunder and included :—

Ballarat Division.—Portion of the runway, taxiway, aprons and the internal roads at the R.A.A.F. School of Radio, Ballarat, were resealed.

Benalla Division.—Because of the construction of the new Eildon Weir, reconstruction of the Eildon–Jamieson Road has been necessary and a further 3 miles of the new route in the vicinity of Jamieson have been completed. Works rendered necessary because of the raising of the Hume Weir included construction of an embankment over Sandy Creek and provision of 8 ft. 9 in. diameter "Armco" pipe near Red Bluff, construction of 2·25 miles of deviation east of Tallangatta, completion of an embankment at Koetong Creek bridge east of Granya, and construction of 1·75 mile of deviation east of Koetong Creek, all on the Murray Valley Highway. On the Murray Valley Main Road deviations were completed at Wise's Creek, near Wymah Punt and near Granya. Construction of embankments on the Bonegilla Main Road at Bonegilla, on the Yabba Main Road near Tallangatta, on the Bethanga Road over the Mitta River at Tallangatta and construction of a deviation of 1·65 mile were also completed.

Dandenong Division.—Work was commenced on the construction of access roads and a skid pan for the Police Department Driving School at Broadmeadows. (Plate 27.) An overpass is being constructed for the Housing Commission over the Melbourne–Wodonga railway at Barry Road in the City of Broadmeadows. This will provide a connecting link between the Hume Highway and Pascoe Vale Road.

Traralgon Division.—In Maffra Shire 4·75 miles of deviations were carried out on the Licola Road and the Tinamba–Glenmaggie Road, necessitated by the raising of the Glenmaggie Weir.

WORKS EXECUTED ON BEHALF OF COMMONWEALTH AND STATE GOVERNMENTS AND AUTHORITIES FOR YEAR ENDED 30TH JUNE, 1958.

——	Description of Works.	Expenditure.	
		£ s. d.	£ s. d.
Victorian Departments.			
Department of Public Works	Roadworks and Bridgeworks—Chandler Highway, Longerenong College	2,427 4 10	
Forests Commission ..	Roadworks—Maffra Shire	82 10 7	
Gas and Fuel Corporation ..	Roadworks—Morwell Shire	3,749 9 1	
Housing Commission ..	Roadworks and Bridgeworks—Morwell and Norlane Housing Estates; Barry's Road Overpass, Broadmeadows	61,058 1 1	
Lands and Survey Department	Roadworks—Glenelg Shire	13,821 3 4	
Latrobe Valley Development Advisory Committee	Roadworks—Morwell Shire	143 3 11	
Melbourne and Metropolitan Board of Works	Roadworks and Bridgeworks—Healesville Shire and Box Hill City	2,417 8 1	
Melbourne and Metropolitan Tramways Board	Bridgeworks—Moonee Ponds Creek Bridge	2,400 0 0	
Premier's Department ..	Roadworks—Rosedale Shire	2,206 9 5	
Soldier Settlement Commission	Roadworks—Estates throughout Victoria	99,633 9 9	
State Electricity Commission	Roadworks and Bridgeworks—Narracan Shire, Kiewa Valley Roads	639 4 7	
State Rivers and Water Supply Commission	Roadworks and Bridgeworks—Eildon and Hume Projects, Goulburn Valley Highway, Buln Buln and Wimmera Shires	425,670 10 5	
Victorian Railways ..	Roadworks—Moe, Traralgon, Maryborough	3,510 17 1	
Victoria Police	Roadworks—Police Driving School, Broadmeadows ..	15,685 6 10	
			633,444 19 0
Commonwealth Departments.			
Department of Works ..	Construction and Sealing Works	13,051 2 2	
			13,051 2 2
Special Projects.			
King Street Bridge ..	Construction of bridge over the Yarra River, with southern viaduct approach and overpass in Flinders Street, including land acquisition. Cities of Melbourne and South Melbourne	766,178 0 11	
Napier Street Bridge ..	Construction of bridge over the Maribyrnong River and rail overpass in the Cities of Melbourne and Footscray	113,791 4 9	
Railway Level Crossings ..	Elimination of various railway level crossings	122,607 7 2	
Municipalities Forest Road Improvements	Improvement of various roads adjacent to State forests to facilitate the extraction of forest produce	22,519 4 5	
			1,025,095 17 3
	Total	.. ..	1,671,591 18 5

SOLDIER SETTLEMENT ESTATE ROADS.

During the year a considerable volume of works was put in hand or continued to provide subdivisional roads in estates purchased by the Soldier Settlement Commission. Since the inception of the Commission in 1946–47, the Board has been responsible, in conjunction with municipal councils, for the investigation of the roading proposals for the various estates and has exercised general supervision through its Divisional Engineers over the works undertaken by the Councils. Plates 28 and 29 illustrate work on the Yanakie Estate in South Gippsland Shire.

The bulk of current expenditure is now apportioned on the basis adopted during 1953, viz., four parts Commission, three parts Board, and one part Councils. The total expenditure during the year 1957–58 on road and bridge works to serve soldier settlement estates was £171,305 of which £99,633 was paid by the Commission, £51,662 by the Board and £20,010 by the Councils. The total expenditure on all roads and bridge works associated with soldier settlement estates since the inception of the scheme is £1,394,835, of which £824,306 was contributed by the Commission, £402,222 by the Board, and £168,307 by the Councils.

MUNICIPALITIES FOREST ROADS IMPROVEMENT FUND.

In 1955 this fund was established by the Government with a contribution of £50,000 for the purposes of improvement and protection of subsidiary roads under control of municipalities adjacent to State forest areas and to facilitate the extraction of forest produce.

The whole of the amount has been allocated and representations have been made by the Forests Commission for a further contribution by the Government of £50,000. The Board has strongly supported the provision of such additional funds.

The expenditure to the end of 1957–58 was £43,778.

WORK FOR OTHER AUTHORITIES

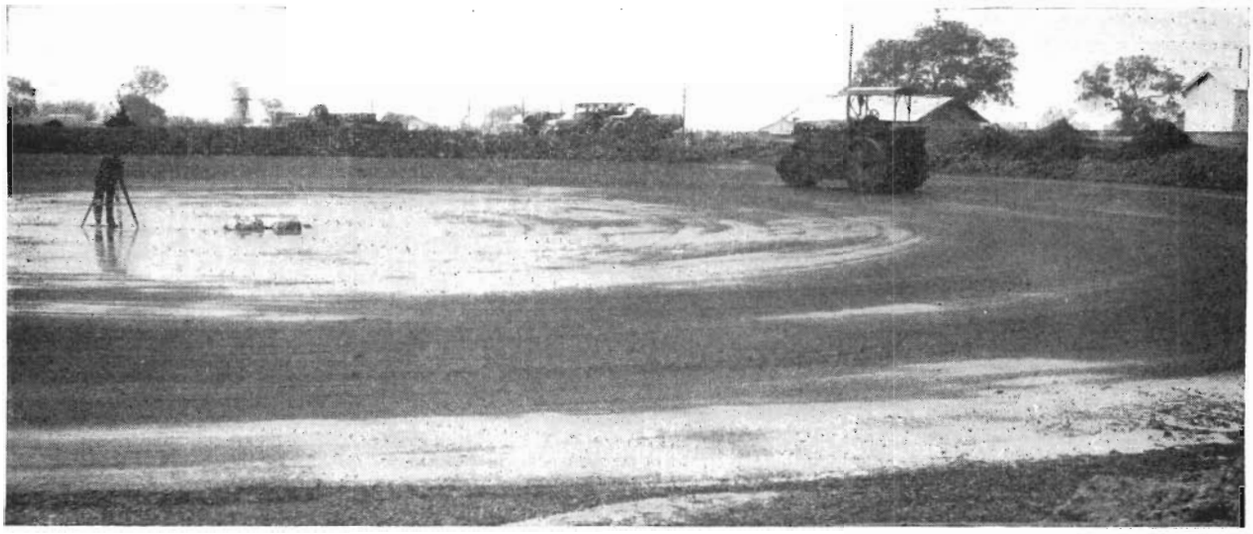
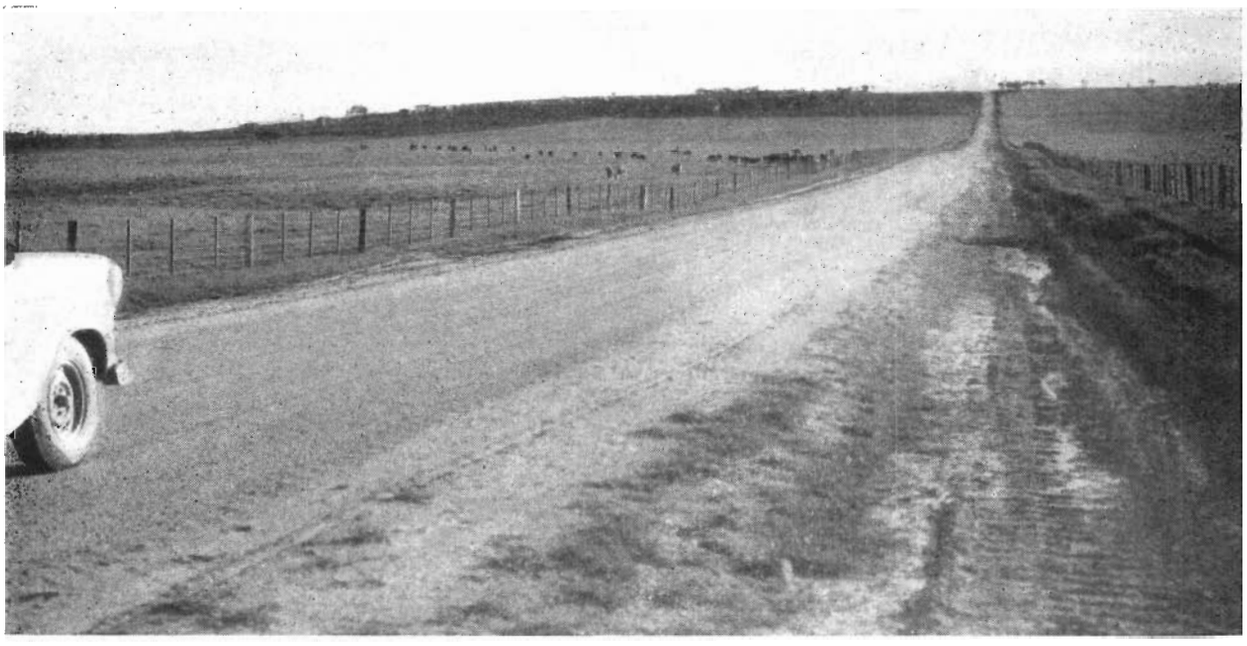


Plate 27.—Construction of skid pan, Police Department Driving School at Broadmeadows.



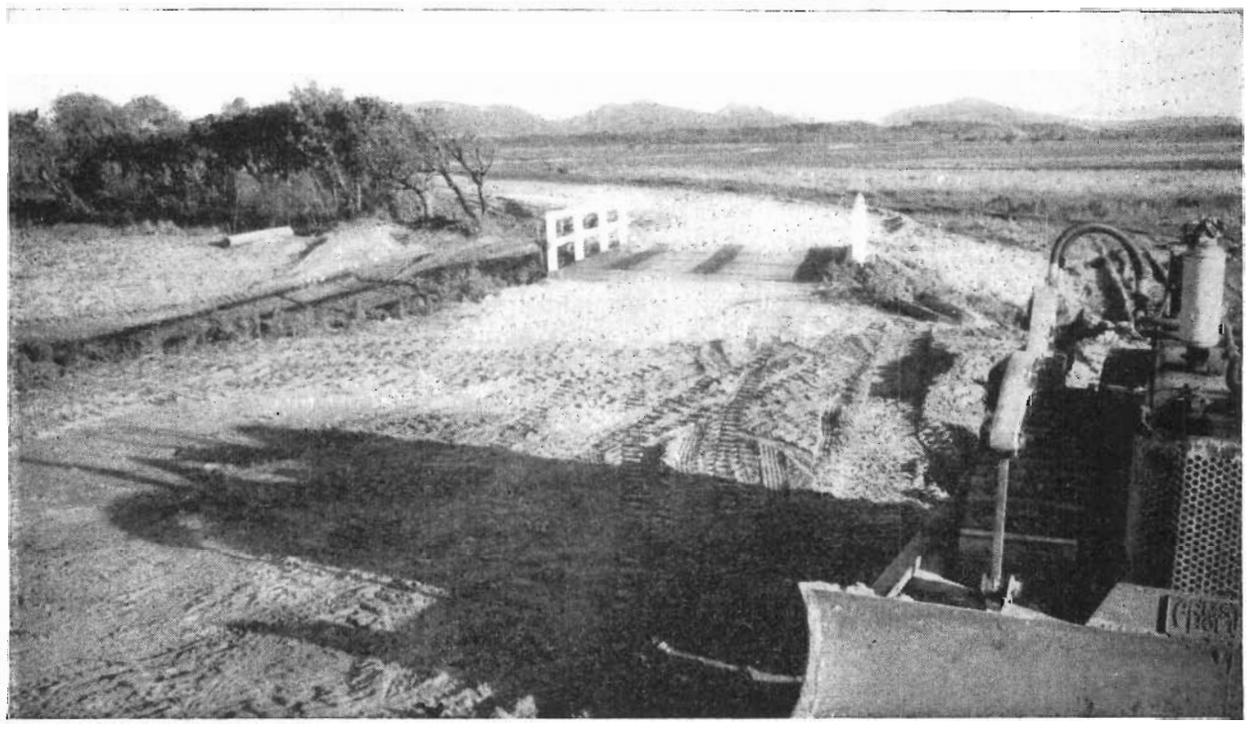


Plate 28.—Millar's Road in Yanakie Soldier Settlement Estate, South Gippsland Shire.
Place 29.—Bridge on Millar's Road over outlet drain from Red Swamp, Yanakie Soldier Settlement Estate.

DECENTRALIZATION.

On establishment of Horsham Division in June, 1948, temporary accommodation was secured in an old building owned by the Horsham City Council. This had become extremely congested and moreover the space was required by the Horsham City Council to enlarge the Municipal Library. The Board having purchased a site in a good position in Firebrace Street, the Public Works Department prepared plans for new offices which were almost completed during 1956–57 and were opened by the Hon. A. G. Rylah, M.L.A., Acting Premier, on 2nd August, 1957, the ceremony being attended by representatives of all local government councils and their officers throughout the Division. (Plate 30.)

The new accommodation provides adequately for the present staff comprising the Divisional Engineer and seven other engineering officers, the Divisional Accountant and eight other officers. There is a suitably equipped laboratory on the ground floor and the roof has been so constructed as to permit of another floor being added later.

Plans were also prepared by the Public Works Department for a new Divisional Office at Bairnsdale and a contract was let for the erection of the building. Temporary office accommodation was provided in prefabricated huts at the rear of the old building, which was sold for removal, enabling the new two-story brick office to be built on the site. Construction was well advanced during the year.

A new residence was completed at Gelantipy to accommodate the Board's patrolman who maintains the Bonang–Gelantipy, Suggan Buggan and Black Mountain Roads.

In the Bendigo Divisional Depot the increased demand for precast concrete bridge units has necessitated construction of an additional casting platform and erection of a flying fox over two of the existing platforms to handle production.

ROADMAKING MATERIALS.

The Board's "Goodwin Barsby" primary and secondary crushers were used to crush sandstone for the Midland Highway near Lake Cooper and subsequently transferred to Bendigo to crush mine tailings. The product has been used as crushed rock in pavements on the Loddon Valley Highway and the Midland Highway, thus relieving local gravel resources for use in roadworks by the City of Bendigo and neighbouring municipalities.

During the year production of aggregate for bituminous surfacing was continued at the Stawell Quarry and in the past year a total quantity of 54,400 cubic yards of screenings has been produced. Considerable experience has been obtained in working this very difficult quarry with modern equipment. The aggregate is being produced for less than the rates charged at other quarries in this part of Victoria. In all, 86,000 cubic yards of aggregate have been produced since the quarry was reopened by the Board.

Owing to the shortage of aggregate in the districts around Donald and St. Arnaud it was necessary to install a washing and screening plant in the area. The site chosen was at St. Arnaud North, adjacent to an old mine and close to the town water supply main. Ordinary quartz hill gravel is loaded at the pits and transported 10 miles to the washing plant. Water was at first obtained from the town main, but when dry weather prevented the use of this source it was necessary to install a deep well pump down the old mine shaft to a depth of 170 feet. A storage dam was constructed and a recirculating pump installed. The quantity of water required in the washing plant is at least 18,000 gallons per hour. Difficulties encountered in disposing of the sludge were overcome by the installation of a gravel pump which pumps the dirty water to the far end of the settling dam. The average daily delivery from the plant is 100 cubic yards. Although the gravel is very dirty and difficult to wash, thus somewhat restricting the output, a quantity of 10,000 cubic yards has so far been produced. The material costs less than half the price of alternative supplies at St. Arnaud, where it was difficult to obtain aggregate at any price.

8725/58.—3

Plate 30.—New Horsham Divisional Office in Firebrace Street, Horsham.

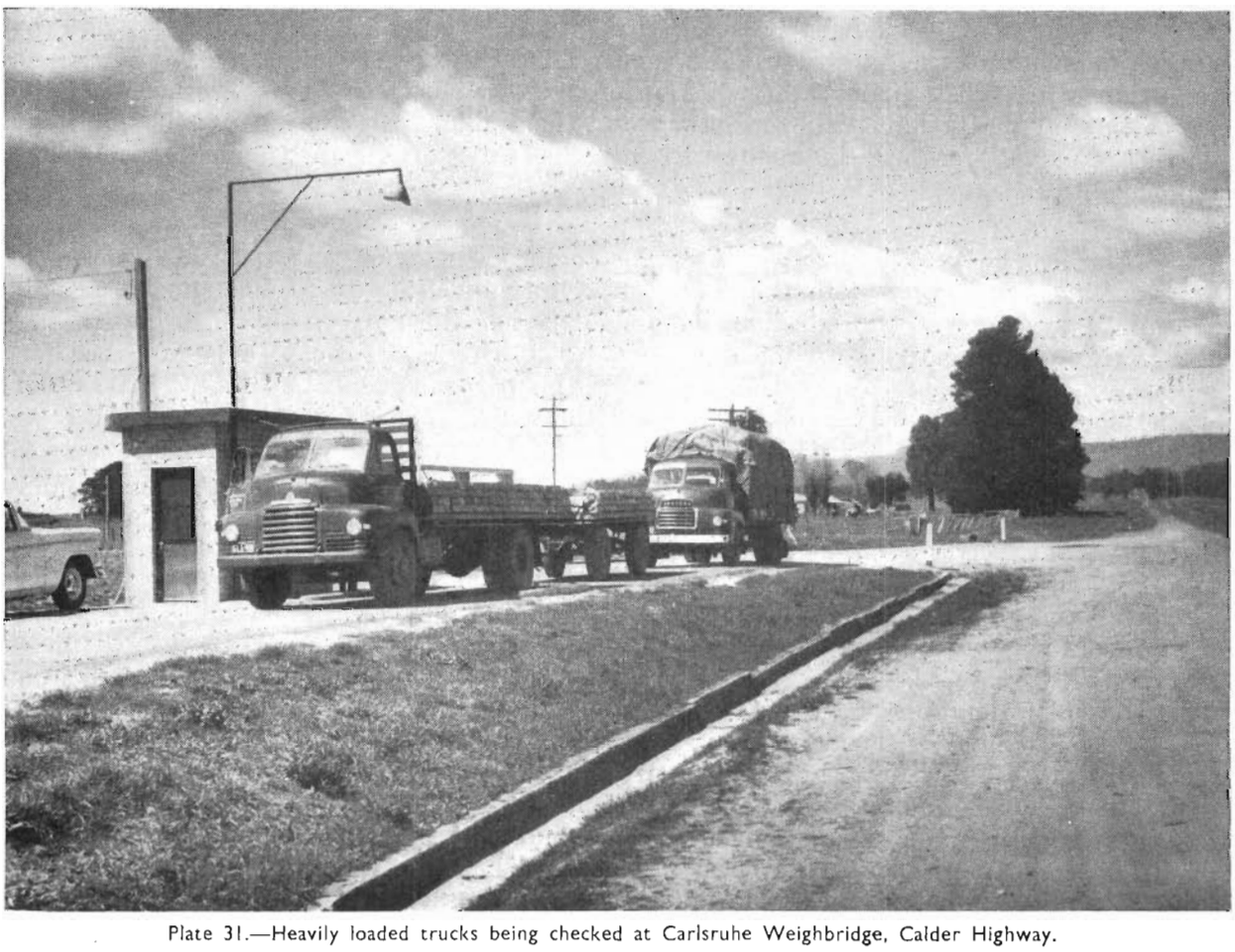


Plate 31.—Heavily loaded trucks being checked at Carlsruhe Weighbridge, Calder Highway.

In Wimmera areas use of sandstone broken without mechanical crushing has been continued in pavement construction throughout the year. The method of handling the material has now been further modified, the stone being generally ripped rather than drilled and blasted to loosen it and break it up. A total of 20,000 cubic yards of broken sandstone was produced at Dimboola. The average daily output was 660 cubic yards, the maximum daily output being 972 cubic yards. The price on trucks was 3s. per cubic yard. As well as reducing the price of the material from 15s. per cubic yard for crushed material to 3s. per cubic yard, it is possible to carry out the work at a greatly increased rate and thus enable a considerable saving on construction costs.

The Board's crushing and screening plant at Bald Hills, 7 miles north of Ballarat, operated throughout the year in providing quartz aggregate for sealing work.

WORK STUDY.

For some time the Board has been giving consideration to the matter of intensifying the practices of " Organization and Methods " technique used in the Board's organization.

In exercising in the normal course of their duties the professional training in economics and management which is inherent in both engineering and accounting, the executive officers have year by year carried out a certain amount of what has now become the more specialized treatment of " O and M " practice. However, it is considered that the Board's organization and responsibilities have grown too large for placing reliance on these part-time practices only. A systematic and continuous review is warranted in order to introduce as quickly as possible whatever elements of work simplification may be found reasonable.

Accordingly the firm of W. D. Scott and Co. Pty. Ltd. was invited to make, at no cost to the Board, a preliminary survey of the Secretary's and the Accountant's Branches with the object of determining the benefits of a programme of Work Simplification.

Following a study of the detailed report submitted by the company the Board has decided to establish an Office Methods Section on a full-time basis. The company has been requested to institute a course of instruction for senior officers of the Board including those to control the Office Methods Section and then to guide the Board's staff through a limited number of investigations.

In addition, Work Study and " O and M " practices have been brought to the notice of many of the Board's senior staff who have been encouraged to study literature and texts dealing with these subjects and have been required to attend lectures organized by the Australian Institute of Management and Swinburne Technical College.

BOARD'S INSPECTIONS.

During the year the members of the Board accompanied by the Divisional Engineers concerned inspected roads and bridges in 30 municipalities in all parts of the State. Those visited were the Shires of Arapiles, Bacchus Marsh, Yackandandah, Minhamite, Broadford, Wimmera, Tullaroop, Avoca, Romsey, Flinders, Upper Murray, Hampden, Woorayl, Keilor, Orbost, Mortlake, Bulla, Chiltern, Rutherglen, Yarrawonga, Karkarooc, Alexandra, Melton, Wodonga and Beechworth; the Boroughs of Koroit, Maryborough, Camperdown and Wonthaggi; and the City of Horsham. As usual, two or more neighbouring municipalities were visited consecutively where possible to save travelling time. For the 30 inspections listed, 21 journeys were made.

The Board appreciates the detailed arrangements made for the inspections by the municipalities visited and the co-operation and hospitable reception extended to it by members of the Councils and their officers. These inspections are of mutual benefit to the Board and the Councils and as many as possible are completed each year. However, it takes approximately six years to complete in this way the inspection of all country municipalities in the State, whereas the Board's regional Divisional Engineers are available at all times to assist Councils and their officers in matters either broadly affecting the programme and progress of work or involving detailed engineering investigations. By keeping in touch with municipal problems the Divisional Engineers are in turn able to assist the Board more efficiently in the exercise of its general supervision of works on a State-wide basis.

CONFERENCE OF STATE ROAD AUTHORITIES OF AUSTRALIA.

The Twentieth Conference was held at the Board's office from the 18th to the 22nd November, 1957. Representatives of each State Road Authority throughout the Commonwealth and the Director-General of the Commonwealth Department of Works attended, whilst officers of the Commonwealth Department of Shipping and Transport were present when items of special interest to that Department were being discussed.

The Chairman of the Board introduced the Honorable Sir Thomas Maltby, E.D., M.L.A., who extended a welcome to the members of the Conference. Sir Thomas in opening the Conference spoke briefly on Australian transport matters and road finance, commenting on the great value of the Conference activities to the nation through " pooling " of information.

Fifty-nine items on the agenda were discussed. These included the attendance of the Professors of Highways Engineering and Traffic Engineering, New South Wales University of Technology, to co-operate in appropriate meetings of technical committees of the Conference; principles of State Road administration; programme of co-ordinated research by State Road Authorities in the field of traffic engineering; an Australia-wide " Road Needs Survey " and the publication of a booklet on the principles and practice of bituminous surfacing treatment.

Arrangements were made for the next Conference of the State Road Authorities of Australia to be held in Perth in October, 1958, and for the various Committees of the Conference to meet during the year, i.e., Principal Technical Committee, Material Research Committee, Plant and Equipment Committee, Bridge Design Committee and Traffic Engineering Committee.

The Conference of State Road Authorities of Australia has for over twenty years co-ordinated Australian road policy and research and prescribed standards for Australian road and bridge practice. It has also prepared authentic statistics of the road network and the finance devoted to road works and estimates of requirements for the future. It acts as the Roads Standards Committee of the Australian Transport Advisory Council, and keeps constantly in view the standards fixed by State statutes for legal vehicle limits of load and dimensions, factors which greatly affect road and bridge construction and maintenance costs.

CONFERENCE OF MUNICIPAL ENGINEERS.

The Fourteenth Conference of Municipal Engineers, convened by the Board, was held in the Royal Ballroom, Exhibition Building, Melbourne, on 14th and 15th May, 1958. Approximately 220 attended, including engineers from most of the 206 municipalities throughout the State, senior engineers of the Country Roads Board and representatives of various Commonwealth and State Government Departments which were interested in certain items on the agenda.

The Chairman of the Board welcomed the delegates and officially opened the Conference. Items on the agenda included a discussion of the Traffic Code (introduced by the Chairman of the Traffic Commission); preparation of granitic sand pavements with armour coating of fine crushed rock prior to sealing; recent developments in the design of flexible pavements; the design, construction and use of pre-stressed concrete slabs and units for bridge works; and " Finn " Erosion Control equipment.

The programme also included the screening of a selection of colour slides taken by the Chairman during his visits to other States as President of The Institution of Engineers, Australia. The slides depicted major engineering works being carried out in various parts of Australia and interesting details of the particular works were given by the Chairman, together with brief comments on new equipment or methods used in construction.

MUNICIPAL ASSOCIATION CONFERENCES.

The Municipal Association of Victoria convenes each year a conference of municipal councils from all parts of the State and the Board appreciates greatly the Association's customary invitation to the members to attend the opening session. In addition, municipalities in Victoria have formed five District Associations (Northern, North-Eastern, North-Western, Western and Gippsland) and a conference of members of each district association is also held each year to discuss items of concern to municipalities in the area or dealing with Local Government generally. The Board is regularly invited to be represented at these conferences, no doubt because many of the items on the agenda are of interest or directly concern it, and whenever possible a member of the Board attends to assist in consideration of such items. This year conferences were held as follows :—

Municipal Association of Victoria	At Melbourne on 9th and 10th October, 1957—attended by the Chairman and Members of the Board.
Northern District	At Creswick on 22nd April, 1958—attended by Mr. D. V. Darwin, Chairman.
North-Eastern	At Benalla on 9th May, 1958—attended by Mr. Darwin.
North-Western	At Charlton on 28th May, 1958—attended by Mr. W. H. Neville, Member.
Western	At Warrnambool on 6th May, 1958—attended by Mr. C. G. Roberts, Deputy Chairman.
Gippsland	At Pakenham on 13th February, 1958—attended by Mr. Roberts.

The Board values the opportunity afforded it to attend these conferences as they provide another link in the chain of close co-operation between the Board and Local Government.

PHOTOGRAPHY.

The Board's mobile film unit equipped with its own electrical generator services Board's camps in locations remote from townships. Films hired from commercial distributors together with Board films made up thirteen programmes. A total of 125 screenings were given throughout the year at 40 different locations, to audiences totalling 2,300.

Screenings of Board films to schools, clubs and interested organizations were given on 33 occasions to audiences totalling 5,000. In addition Board films were loaned to 34 borrowers and were viewed by total audiences estimated at 2,700.

During the year a 16-mm. colour sound film entitled " Roadworks " was produced. This is a news review of recently constructed pavements, bridges and duplications of heavily-trafficked routes. The setting back of houses to enable widening of roads in settled areas is shown together with the advantage of divided highways for densely-trafficked routes.

For the period of the Queen Mother's tour in Victoria the " still " and " cine " photographers co-operated with the State Film Centre in providing a photographic coverage of the tour.

MOTOR REGISTRATION.

Registrations effected during the year under the Motor Car Act totalled 756,161 an increase of 5¾ per cent. on the registrations effected during the previous year, as compared with an increase in that year of 4⅓ per cent. over the total for 1955–56.

Details of registrations are set out hereunder :—

Vehicles.	Financial Year 1956–57.		Financial Year 1957–58.		Increase.	Decrease.
Private—						
New	47,029		53,530			
Second-hand—						
Re-registered	20,502		20,142			
Renewals	454,569		482,878			
		522,100		556,550	34,450	..
Commercial and Hire—						
New	9,680		10,904			
Second-hand—						
Re-registered	4,973		4,566			
Renewals	84,379		86,369			
		99,032		101,839	2,807	..
Primary Producers—						
New	3,858		4,403			
Second-hand—						
Re-registered	3,832		4,295			
Renewals	49,935		51,953			
		57,625		60,651	3,026	..
Licences under Motor Omnibus Act ..		748		990	242	..
Trailers		11,203		11,820	617	..
Traction Engines, &c.		4		3	..	1
Motor Cycles		25,585		24,308	..	1,277
Total		716,297		756,161	41,142	1,278

CONTROL OF HEAVY TRAFFIC.

The number of trucks of all categories using the State's roads has increased by approximately 10 per cent. in the past twelve months, resulting in a greater number of offences being detected.

The total number of offences under the Motor Car Act reported during the year was 6,816, a rise of 1,533 or 29 per cent. Of this number 5,733 or 81·5 per cent. were successfully prosecuted. Fines imposed were £74,124, an increase of 18·7 per cent. on last year. Of the successful convictions under the Motor Car Act, 526 or 9·5 per cent. were for speeding trucks, 3,752 or 67·7 per cent. for overloading in various manners, 1,218 or 22 per cent. for exceeding vehicle and load dimensions and 47 or 0·8 per cent. for miscellaneous offences.

Offences under the Country Roads Act numbered 222, of which 200 were in respect of unattended stock on State highways. Successful prosecutions numbered 186, the average fine being £5 6s. 9d., an increase of 27·6 per cent. on last year.

Section 31 of the Motor Car Act No. 5616, under which the Board imposed permanent 6 tons gross load limits on various roads which were considered to be in an insufficiently advanced stage of construction to cater for normal vehicle loadings, was amended by Parliament in December, 1957. The amendment substituted a limit of 5 tons gross weight on any one axle of a motor car, thus obviating the necessity to issue permits for the carriage of divisible loads on such roads as are considered to need limitation, and making the procedure sounder in principle and easier for operators to understand.

Advantage was taken of the changed circumstances to review the list of roads on which limits were enforced, and whilst no additions were made thereto, a considerable mileage was deleted, chief of which were the Loddon Valley Highway (the whole) and the Murray Valley Highway (from Strathmerton to Nyah).

At the present time the following mileages of roads are limited to 5 tons gross axle load :—

State highways	..	235 miles
Main roads	..	358 ,,
Tourists' and Forest roads	..	254 ,,
Total	..	847 ,,

This is a reduction of 434 miles (34 per cent.) on the previous year. As a consequence of the above action no permits were issued in respect of limited roads from December, 1957.

The number of permits issued for the year was 6,256, an increase of 775 or 14 per cent. Due to the change over from 6 tons gross limits to 5 tons axle limits, the number of annual weight permits issued dropped from 631 to 47 whilst the number of permits issued from Head Office for single trips rose from 4,264 to 4,715.

In October, 1957, the Board established on the Calder Highway at Carlsruhe a weighbridge for the checking of heavily-loaded trucks. (Plate 31.)

Two additional traffic officers and one additional assistant traffic officer have been appointed. The increase in staff and records has made more office accommodation necessary and in November the Board's Traffic Section transferred to leased premises at 62 Queensberry Street where sufficient area was available for immediate needs.

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

LEGISLATION AFFECTING THE BOARD.

The *Railways* (*Level Crossings*) *Act* 1957 (No. 6118) provides, *inter alia*, that before any level crossing is closed notice by the Railway Commissioners of their intention to do so shall be given to the Country Roads Board.

The *Motor Car* (*Registration Fees*) *Act* 1957 (No. 6149) provides that, as from 1st February, 1958, registration fees in respect of diesel-powered vehicles shall be reduced by one-half to a fee equivalent to that paid in respect of petrol-powered vehicles.

The *Local Government* (*Amendment*) *Act* 1957 (No. 6151) provides (Section 4) that where a municipality is requested by the Country Roads Board to declare a road to be a road of limited access, the Governor-in-Council may, after consultation by the Minister with the Council, make the required regulation, if the Board's request is not complied with within six months.

The *Motor Car* (*Amendment*) *Act* 1957 (No. 6154) includes amendments for increased limits in respect of height, length and width of motor vehicles and increased penalties in cases of overloading.

The *Tourist Act* 1957 (No. 6155) provides for the Chairman of the Country Roads Board, or his nominee, to act as a member of the Tourist Development Authority.

The *King Street Bridge Act* 1957 (No. 6156) provides that the King Street Bridge shall be constructed on behalf of the Government of Victoria by the Country Roads Board. The cost of the construction of the bridge shall be borne—65 per cent. Government of Victoria, 30 per cent. City of Melbourne and 5 per cent. City of South Melbourne.

The *Commonwealth Aid Roads* (*Special Assistance*) *Act* 1957 provides for financial assistance to the States in respect of financial years 1957–58 and 1958–59. Victoria is to receive £700,000 in each of these years to be expended under the terms of the Act on construction, reconstruction, maintenance and repair of roads or on the purchase of roadmaking plant or in making payments to local authorities for similar purposes.

SEGREGATION OF TRAFFIC

Plate 32.—Dandenong Shire. Stud Road (main road) provides for only two traffic lanes.

Plate 33.—Heidelberg City. Heidelberg–Eltham Road. Narrow median strip separating dual carriageways.

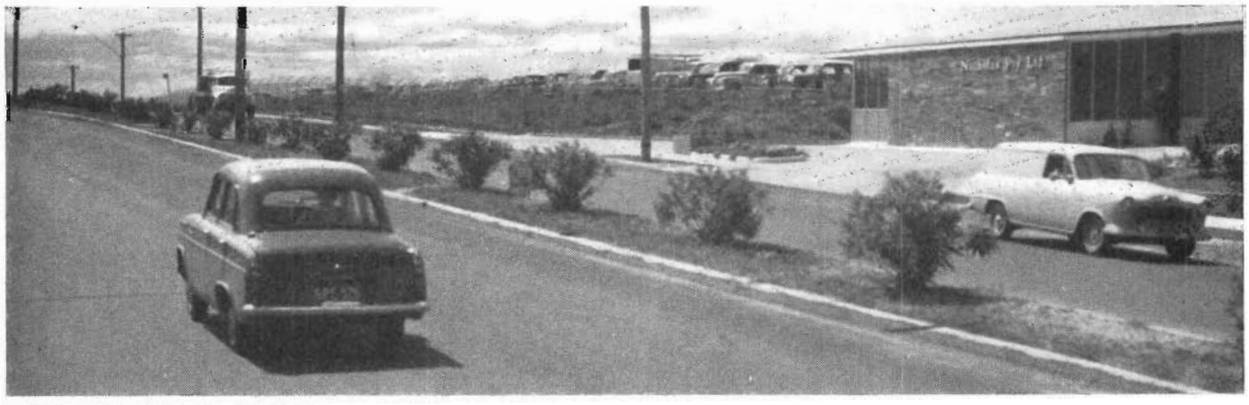


Plate 34.—Warrigal Road, showing median strip with shrubs.

Plate 35.—Footscray City. Junction of Millers Road and Princes Highway West, showing shrub plantation in median strip with indentation of median for turning lane. Service road at left.

LIMITATION OF ACCESS.

The community is becoming increasingly aware of the necessity so to design roads as to separate opposing streams of traffic and wherever possible to segregate local from through traffic. There is increasing realization that on many of the more important roads the reserve width should allow for considerably more than merely two traffic lanes separated only by a centre line marking. (Plate No. 32.) On a few sections of the road and street network of the State it has been possible to provide dual carriageways with a narrow median strip in the centre between them (Plate 33) or in some cases a dividing strip wide enough to accommodate extra turning lanes at intersections, and generally between intersections to allow for beautification by a screen of trees or shrubs. (Plates 34 and 35.) These somewhat isolated examples together with observations of travellers of extensive use of the same principles in overseas countries have assisted the general public to appreciate the benefits of roads in which safety and convenience are an elementary factor of design and layout and the wastefulness of congestion is eliminated. In built-up areas many local government councils are providing separate service roads along frontages where sufficient reserve widths are available, thus affording safe access to properties without recourse to random manoeuvring and turning movements in and out of the " through " traffic lanes. (Plate 35.)

Where general development and improved road facilities enhance property values along a route subdividers are generally co-operating with the councils and the Board by initial construction of subdivisional roads along the frontages either within the subdivision or on the existing road reserve if the latter is already of sufficient width to accommodate a service road. Such provision avoids the general financial embarrassments which still arise in the case of old subdivisions made prior to a recent amendment of the statute. This amendment enables councils to declare a road to be a road of " limited access ", i.e., to prohibit or control the creation of fresh accesses additional to those existing along unsubdivided paddocks. The statute also provides that the Board may request a council to declare a main road or State highway to be a road of limited access and many councils are co-operating with the Board in this very necessary step in forward planning. The statutory procedure is somewhat cumbersome and it would be simpler if the Board itself were enabled by by-law to classify sections of its declared roads as limited access roads. This would expedite application of vital controls in cases where locally there may be undue hesitancy in handling a problem of speculative subdivision and ribbon development.

BITUMINOUS SURFACING.

Because of the great economies resulting to road operators and road authorities there is probably no class of road improvement more sought after throughout the State than the extension of bitumen sealing. Moreover a large part of the road-maintenance programme consists of resealing, whilst reconstruction of old sections sealed 25 or 30 years ago involves restoration of the seal coat on the improved pavements. During the financial year 1957–58, a large allocation of funds was therefore provided for bituminous surfacing, and because of the unusually long season of good weather experienced, a record length of work was carried out. The total length of all types of work amounted to 2,353 miles, which represents 37·5 per cent. more than the length of work carried out in the year 1956–57 and included extension of the sealing of the declared road system by a length of 511 miles, thus bringing the total length treated to 9,314 miles, or 64·5 per cent. of the declared system of 14,430 miles. This extension of the sealed system added a further 58 miles to the sealed length of State highways, 439 miles to the sealed length of main roads, and 14 miles to the sealed length of tourist and forest roads.

A length of 464 miles of initial sealing was carried out on unclassified roads, which represents an increase of 88·6 per cent. on the length of similar work carried out in 1956–57.

Retreatment and initial treatment of reconstructed sections of previously sealed pavement on the declared system amounted to 1,123 miles, or 12·8 per cent. of the treated system, this including retreatment by resealing of 9·4 per cent. of the sealed system. Local conditions and materials used vary considerably throughout the State, but probably on the average not less than about 13 per cent. of the treated system should be retreated annually in order to satisfactorily maintain it.

SEALING ROADS

Plate 36.—Sealing work being carried out on the Rokewood Road at Shelford between Geelong and Rokewood. Shire of Leigh.

Plate 37.—Bitumen Spraying Camp alongside Traralgon–Maffra Road near Tinamba. Shire of Maffra.

Plate 38.—8,000 gallon bitumen storage tanker.

Each year the Board makes available, whenever practicable, its mobile spraying units to undertake sealing work for municipalities who may not be in a position to have work done in any other way, and for other State or Commonwealth authorities. A total length of 86 miles of work has been carried out this year for other authorities.

Full details of the lengths of various types of treatment carried out on the various road categories are set out in Tables A, B and C in the Chief Engineer's section of this Report. Plate 36 shows a typical item of sealing work in progress and Plate 37 a portion of a typical roadside depot, the average period of occupation of such depots being only thirteen days.

Bituminous Plant, Equipment and Materials.—During the year six 400-gallon and seventeen 800-gallon spraying units, manned by approximately 650 men, were engaged on the work. The strength of the Board's bituminous plant was severely taxed to cope with the large programme of work. Some of the items of plant are becoming obsolete or past their economic life, and it was only intensive plant maintenance, coupled with the long spell of fine weather, which allowed such a large mileage of work to be accomplished.

A small amount of assistance was obtained by utilizing the services of a contractor who was able to carry out a length of approximately 30 miles of work in an area close to Melbourne. While the work carried out in this way was generally satisfactory, the method does not provide the necessary flexibility of operation evidenced in the Board's own sealing units, which are completely self-contained with their own specialized and manoeuvrable equipment. Steps are now being taken by the Board to acquire additional plant and equipment, not only to replace worn-out units but also to cope with the ever-increasing demand for bituminous surfacing.

An additional oil refinery commenced the production of bitumen in Victoria this year, so that the Board had two sources of supply from two Victorian refineries. The total quantity of bitumen obtained from these two refineries and used in the work amounted to the record annual quantity of 22,704 tons, or 46 per cent. more than the quantity used in 1956–57. Approximately 1 per cent. only of this material was supplied in drums, the balance being delivered in bulk in either rail tank cars or road tankers.

For the handling, storage and heating of bulk bitumen in the field, nineteen 2,000-gallon road tankers, eighteen 2,000-gallon and one 8,000-gallon mobile storage tankers of the trailer type were utilized (Plate 38), together with seventy-nine 400 and 600-gallon heavy-duty bitumen heaters.

During the year, a quantity of 260,110 cubic yards of covering aggregate was used by the Board's surfacing units in the sprayed work programme, which is 35·6 per cent. more than the quantity handled in 1956–57. The availability of covering aggregate for bituminous work is always one of the prime factors limiting the amount of work which can be done. The production by the Board's own crushing plant of a very large quantity of material in one area where the supply has always been short hitherto has helped materially this year. The availability of covering aggregate for bituminous work is always one of the prime factors limiting the amount of work which can be done. Further, costly delays and uneconomical planning are inevitable when adequate supplies are not in sight for the proposed programme of work. This year, production by the Board's own crushing plant of a large quantity of material in one area where supplies have always been short hitherto, has proved the economy of providing supplies well in advance of requirements, and has focused attention on the advantages to be gained by endeavouring to arrange for supplies on a similar large scale, in other parts of the State. Table E in the Chief Engineer's section of this Report sets out details of the costs of material over the past five years. It will be noted that the general upward trend in the costs was halted at the end of 1956–57, the average costs of material being slightly less in 1957–58 than in the previous year.

Throughout the State the Board's engineers and municipal engineers are constantly endeavouring to discover materials and adopt variations and procedures which may effect economies or improvements in bituminous surfacing. Particulars are given in the Chief Engineer's section of this Report regarding experimental work performed during the year.

TRAFFIC LINE MARKING.

During 1957–58, 2,821 miles of roads were maintained in a "striped" condition. On State highways, approximately 700 miles are striped twice per year. The standard white striped line, 3-in. wide, consists of 10-ft. dashes and 30-ft. gaps.

The total expenditure on this type of work during the financial year was £29,391, representing an average of £6 8s. 6d. per mile of standard stripe. An average of 15 miles of line was striped per day, i.e., 5,000 square feet of painted area. A total quantity of lacquer used was 16,038 gallons with an average rate of application per standard mile of stripe of 3·50 gallons per mile.

STAFF.

Since the 1st July, 1957, the total number of officers on the Board's staff has increased from 582 to 662, made up of:—

Permanent Staff—355 males, 52 females	407
Temporary Staff—168 males, 87 females	255
	662

Of these officers 332 are located at the Head Office, Exhibition Building, 62 at the Central Depot and Workshops at Montague, 92 at the offices at Drummond Street and Queensberry Street, Carlton, and 176 in rural divisions.

Thirty-one male officers, and 25 female officers resigned during the year, and new appointment totalling 141, comprising 105 males and 36 females were made. There is still a need for additional qualified engineers to cope with the increased works programme for the current year.

Mr. H. P. Wood, A.M.I.E. (Aust.), C.E., Highways Engineer, retired on 18th March, 1958, after 44 years service with the Board.

It is greatly regretted that a number of highly-valued officers passed away during the year. The names of these officers whose loss is greatly felt by the Board and staff, are as follows:—

Mr. I. Quarrell.

Mr. R. M. Dempster.

Mr. A. B. Miles.

During the year the following functional changes took place in the Chief Engineer's Branch:—

Mr. F. West, B.C.E., M.I.E. (Aust.), C.E., was appointed Highways Engineer on 19th March, 1958, following the retirement of Mr. H. P. Wood.

Mr. G. J. Dempster, B.C.E., A.M.I.E. (Aust.), C.E., M.A.P.I., was appointed Engineer for Road Design to supervise and co-ordinate all aspects of road design involving traffic engineering, road location, engineering survey, title survey and plans and survey.

Mr. R. C. Handley, A.M.I.E. (Aust.), C.E., was appointed to the position of Construction and Maintenance Engineer under the direction of the Highways Engineer to investigate current road construction practices and techniques with a view to improving and developing new ones.

Mr. H. W. P. Hobbs, B.C.E., A.M.I.E. (Aust.), C.E., was appointed to the position of Programme Engineer under the direction of the Highways Engineer to prepare and assist in the general supervision of the programme of works on roads under the Board's direct supervision.

Mr. H. P. George, A.M.I.E. (Aust.), C.E., F.A.P.I., C.H.T. (Yale), A.M.I.T. (London), was appointed Divisional Engineer, Dandenong, on 13th January, 1958.

Mr. L. Upton, C.E., A.M.I.E. (Aust.), was appointed Divisional Engineer, Bendigo, on 13th January, 1958.

STAFF CHARITIES FUND.

This fund again received substantial support from a number of members of the Board's staff mainly by contributions deducted from each fortnightly pay. The total sum contributed during the year, including special donations, was £352 15s. 3d., a slight increase over the contributions for the previous year.

A total amount of £339 15s. was contributed to 22 charities throughout the State, including various metropolitan and country hospitals, the Junior Legacy Club, the Institute for the Blind, and various appeals by, or on behalf of the Returned Sailors, Soldiers, and Airmen's Imperial League of Australia. The usual donations on a "bulk" basis were also made to several special button-day appeals by purchasing buttons or badges for each contributor to the Fund. The balance of £131 13s. 1d. on hand at the 30th June, 1958, will be used to meet commitments which will arise later in the calendar year.

EMPLOYMENT.

The number of employees for the year averaged 2,915. The peak of employment was reached in April, 1958, when 3,132 employees were working for the Board and the lowest number was 2,616 in August, 1957.

The total number employed on works being carried out for other authorities reached its peak during July, 1957, when 168 men were working for :—

State Rivers and Water Supply Commission	144	employees
Housing Commission	16	,,
Public Works Department	8	,,

During the year 1957–58 no difficulty has been experienced in recruiting employees.

THE CANCER CAMPAIGN APPEAL.

The total amount contributed by Board's personnel by means of payroll deductions was £1,491 10s. and from sale of raffle tickets, £208 10s., making a total of £1,700.

The Board desires to express its thanks and appreciation to all its employees and staff, who have contributed to the Cancer Campaign Appeal, for their splendid response which has resulted in the raising of such a large sum of money.

DISPLAYS AND EXHIBITIONS.

A working model of vehicles running along a divided highway was displayed at the Royal Agricultural Society's Show and at the Motor Show. (Plates 39 and 40.)

A model of a divided highway with restricted access and with a clover-leaf interchange was exhibited at the Geelong Show, at Swinburne Technical College during Education Week and at the R.A.C.V. Club-rooms at Geelong. Another model of the King Street Bridge was also displayed at Swinburne College and at the Motor Show. The models have attracted great attention at the Royal Agricultural and Motor Shows and the Board's officers answered many questions.

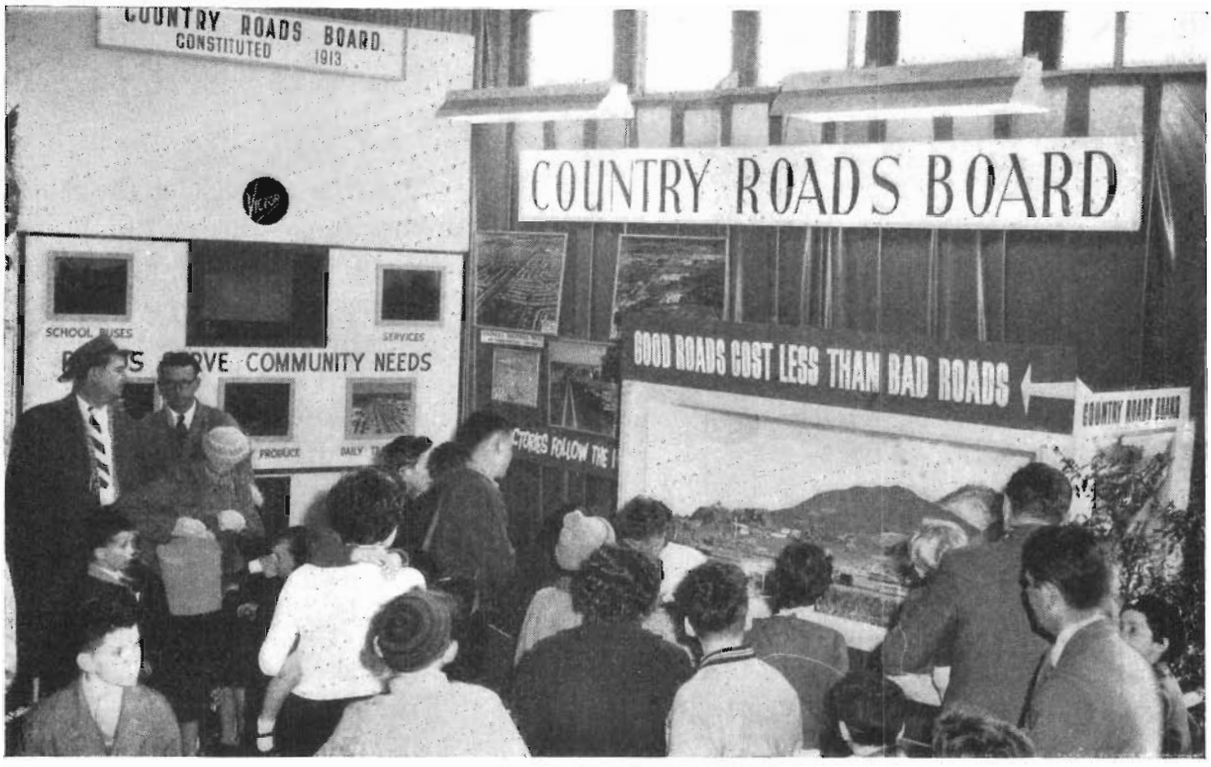


Plate 39.—Exhibit at Royal Agricultural Show, September, 1957.

Plate 40.—Exhibit at Motor Show, Exhibition Buildings, March, 1958.

ACKNOWLEDGMENTS.

The sincere thanks of the Board are tendered to the Minister of Public Works, the Hon. Sir Thomas Maltby, E.D., M.L.A., for his help and interest in its work.

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

We have the honour to be,

Sir,

Your obedient servants,

D. V. DARWIN, M.M., M.C.E., M.I.C.E., M.I.E. (Aust.), C.E., F.A.P.I., Chairman.

C. G. ROBERTS, M.C., B.Sc. (Eng.), A.M.I.C.E., M.I.E. (Aust.), C.E., F.A.P.I., Deputy Chairman.

W. H. NEVILLE, A.A.S.A., J.P., Member.

R. E. V. DONALDSON,
A.A.S.A., A.C.A.A., J.P.,
Secretary.

COUNTRY ROADS BOARD.

Statement of Receipts and Payments for Year ended 30th June, 1958.

(Adjusted to nearest pound.)

		Country Roads Board Fund.		Commonwealth Aid Roads.			Loan Funds.			
				Act 1954–56.		Act 1957.			Commonwealth/ State Flood Restoration.	Total.
		Act 3662.	Act 5931 Road Maintenance Account.	Sec. 9 (2).	Sec. 9 (3).	Special Assistance.	Permanent Works.	Restoration of Flood and Bush Fire Damage.		
Receipts.	£	£	£	£	£	£	£	£	£	£
Balance at 1st July, 1957		418,204	..	..	..	..	..	..	..	418,204
Motor Car Registration Fees	7,953,462									
Additional Registration Fees	511,998									
Drivers Licence Fees	219,342									
Fines	155,027									
	8,839,829									
Less Cost of Collection	607,219									
		8,232,610	..	..	..	..	..	..	..	8,232,610
Municipalities Repayments—										
Permanent Works—Main Roads	17,440									
Maintenance—Main Roads	428,407									
		445,847	114,245	..	..	..	..	..	..	560,092
Moneys provided by Commonwealth Aid Roads Acts		..	..	3,148,567	2,310,340	700,000	..	..	..	6,158,907
Proceeds from Commercial Goods Vehicles Act 5931		..	1,529,236	..	..	..	..	..	..	1,529,236
Receipts from State Loan Funds—										
Act 3662		..	..	..	..	..	400,000	..	..	400,000
Act 6066—Flood and Bush Fire Damage		..	..	..	..	..	..	2,822	..	2,822
Moneys provided under Commonwealth/State Agreement for Flood Restoration		..	..	..	..	..	..	..	460,452	460,452
Fees and Fines under Country Roads Acts		1,065	..	..	..	..	..	..	..	1,065
General Receipts		36,049	..	..	..	..	..	..	..	36,049
		9,133,775	1,643,481	3,148,567	2,310,340	700,000	400,000	2,822	460,452	17,799,437

PAYMENTS.										
Main Roads—										
Construction and Reconstruction	2,844,040	..	1,129,944	..	..	183,334	..	85,658	4,242,976
Maintenance	1,141,009	..	44,694	..	..	..	..	..	1,185,703
State Highways—									
Construction and Reconstruction	1,043,517	..	966,366	..	700,000	216,666	..	56,953	2,983,502
Maintenance	361,760	1,643,446	..	..	..	..	..	..	2,005,206
Tourists Roads—									
Construction and Reconstruction	301,695	..	..	..	..	..	..	..	301,695
Maintenance	156,040	..	..	..	..	..	..	..	156,040
Forest Roads—									
Construction and Reconstruction	59,078	..	..	..	..	..	..	58	59,136
Maintenance	68,639	..	..	..	..	..	..	..	68,639
Unclassified Roads—									
Construction and Reconstruction	..	..	1,007,563	1,726,965	..	..	2,822	317,199	3,054,549
Maintenance	..	..	..	560,829	..	..	..	..	560,829
Murray River Bridges and Punts	84,339	..	..	22,546	..	..	..	584	107,469
Traffic Line Marking	30,492	..	..	..	..	..	..	..	30,492
Plant Purchases	1,053,254	..	..	..	..	..	..	..	1,053,254
Traffic Lights	6,460	..	..	..	..	..	..	..	6,460
Interest and Sinking Fund Payments	831,077	..	..	..	..	..	..	..	831,077
Payment to Tourist Fund	108,780	..	..	..	..	..	..	..	108,780
General and Administrative Expenditure	823,808	..	..	..	..	..	..	..	823,808
	8,913,988	1,643,446	3,148,567	2,310,340	700,000	400,000	2,822	460,452	17,579,615
Balance at 30th June, 1958	219,787	35	..	..	..	..	..	..	219,822

NOTE.—Relief to Municipalities granted under Acts 4140 and 4415 amounted in 1957–58 to £111,242.

AUDITOR GENERAL'S CERTIFICATE.

The accounts of the Country Roads Board for the year ended 30th June, 1958, have been audited. In my opinion the above statement of Receipts and Payments fairly presents in summary form the transactions during that period.

R. W. GILLARD,
Auditor-General.
11th February, 1959.

R. G. COOPER,
Acting Accountant.
22nd January, 1959.

COUNTRY ROADS BOARD.

Loan Liability at 30th June, 1958.

—	£ s. d.	Main Roads, &c. £ s. d.	Developmental Roads. £ s. d.	Total. £ s. d.
Permanent Works—				
Main Roads	.. 6,810,971 15 11			
State Highways	.. 5,590,147 1 9			
Tourists' Roads	.. 55,292 10 3			
Forests Roads	.. 1,083 18 11			
		12,457,495 6 10	..	12,457,495 6 10
Developmental Roads	.. .. ..	..	6,425,757 10 11	6,425,757 10 11
Discount and Expenses	.. .. ..	247,723 2 8	262,831 1 4	510,554 4 0
Total Amount Borrowed	..	12,705,218 9 6	6,688,588 12 3	19,393,807 1 9
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 ..	.. .. ..	1,065,916 4 4	..	1,065,916 4 4
National Debt Sinking Fund ..	.. .. ..	1,227,365 15 7	1,617,558 5 11	2,844,924 1 6
		2,664,189 8 7	2,319,027 13 5	4,983,217 2 0
Loan Liability at 30th June, 1958 ..	.. .. ..	10,041,029 0 11	4,369,560 18 10	14,410,589 19 9

CHIEF ENGINEER'S REPORT

Country Roads Board,
Melbourne
19th November, 1958.

THE CHAIRMAN,

SIR,

I have the honour to submit a report on matters of technical interest carried out during the year 1957–58.

Staff Organization.

During the year an important change was made in the organization of the Chief Engineer's branch with a view to centralizing control in fewer sections.

Mr. G. J. Dempster was appointed Engineer for Road Design, and under him were placed the Traffic and Location Engineer, the Engineer for Plans and Surveys, and the Principal Title Survey Officer, with the Senior Engineering Surveyor immediately under the Engineer for Plans and Surveys. This re-organization has streamlined operations considerably, and avoids the co-ordination previously necessary because the Engineer for Road Design is now responsible to the Chief Engineer for all initial investigations involving traffic requirements of any proposal, the location, design and title survey of the boundaries if there be any new reservation, and finally for the actual road design.

Following the retirement of the Highways Engineer in March, 1958, Mr. F. West was appointed to this position in charge of State highways, with, in addition, oversight of all direct works carried out by the Board on main roads, forest roads, and tourists' roads.

A new position, Road Construction and Maintenance Engineer, was also created. This engineer is responsible directly to the Highways Engineer, with the duty of investigating construction practices and techniques, and the methods employed in construction and maintenance work, also, in conjunction with the Mechanical Engineer, to carry out research, investigation, and experimental work with new types of plant.

MECHANICAL DIVISION.

There has been a steady increase in the volume of work carried out by the Division over the past successive years, and this trend was maintained during 1957–58. In addition to the routine plant maintenance and major overhauls carried out, considerable work of an experimental nature and on the design and construction of new plant and equipment was performed.

Experimental Work.

The design and testing of spark arrestors which has been in progress for three years has resulted in the development of new arrestors, which are now being made in quantities for the Board for general use on larger engines. They are now being used on the majority of the Board's larger internal combustion engines.

Maintenance.

All engines overhauled at the South Melbourne workshops are now tested by dynamometer before being released for use. This test has enabled the workshops to bring overhauled engines back to almost new condition, both as regards output and fuel consumption, and has resulted in substantial economy in subsequent operation.

Design and Construction of New Plant and Equipment.

Bitumen Road and Storage Tankers.—A design was prepared for replacing the worn out Ford V8 engines of the pumping units of bitumen road and storage tankers with Holden engines. This change, with some other simplifications, reduced the cost of these pumping units substantially, and it is proposed to use these engines for replacements in the future.

Roadmen's Cabins.—New designs, utilizing modern caravan construction methods, were used in the development of the latest type roadmen's cabins, which are now being constructed, and similar methods are used in the design of a new cookhouse which will be available shortly.

Steps have been taken to abandon the use of kerosene for heating, cooking, and refrigeration in the new cookhouses and to replace it with bottled propane gas for these purposes. The use of this non-toxic, non-explosive, and odourless gas will eliminate at no additional expense the smell and danger associated with kerosene.

Aggregate Loader.—A prototype of a new aggregate loader was built and has now completed over 100 hours of test running. The new loader was developed in order to obtain improved screening ability, reduced and easier maintenance, simplified operation and lower initial cost compared with the present loaders. The general performance of the prototype with a loading rate of 1·8 c.yds. per minute at a conservative engine speed was so promising that it is proposed to build four machines (for full scale field use) from drawings now being completed (plate 1). The present type of aggregate loader was designed by the Board's staff in 1940 and although capable of being improved as indicated has given very valuable service.

Purchase of New Plant and Equipment.

The Board purchased the following new types of plant during the year:—

(i) Le-Tourneau-Westinghouse Model L.W. 16 pneumatic tyred dozer. This unit has a 4-cylinder 111 B.H.P. engine, and has proved to be very satisfactory on those jobs where it is necessary to move the machine from place to place and where a float would have to be used to move a crawler type machine.

(ii) "Scheid" automotive tandem vibrating roller powered by a 10-H.P. Deutz diesel engine. The roller has been used for consolidating fine crushed rock and dusty toppings on the Princes Highway West at Belmont. It was found to be very useful, particularly in the restricted area in which it had to work.

(iii) McDonald trench roller powered by a 50-H.P. International diesel engine complete with fluid coupling, outrigger pneumatic wheel, and hydraulic coupling.

Front roll 12 inches wide. Rear roll 16 inches wide.
Front roll 120–140 lb. per inch.

Rear roll—
330–365 lb. per inch unballasted.
380–400 lb. per inch ballasted.
Overall weight 4 tons.

The unit has been used on road widening jobs on the Hume Highway at Kilmore and Benalla, and on the Henty Highway at Hamilton.

(iv) McDonald A.N.P., a narrow power roller powered by a 4-cylinder 50·9 b.h.p. International diesel engine complete with fluid coupling.

Plate 1.—C.R.B. aggregate loader, new type—test model.

Length 16 ft. 6 in., width 3 ft. 6 in., height 9 ft. 2 in.
Front roll 350 lb. ballasted.
Rear roll 370 lb. ballasted.

This unit has been used on widening jobs on the Princes Highway West at Panmure.

(v) Two makes, "Pacific" and "McDonald", automotive 11-wheeled pneumatic tyred rollers, which are at present under test. They are basically designed for use on B.S.T. work. (See also page 53.)

(vi) "Domor" road widener for attaching to a Caterpillar-12 power grader. This unit consists of a blade attachable to the main grader blade by means of chains, and permits the width of the cut being varied from 1 ft. to 6 ft. and the depth from 9 in. to 15 in. The unit weighs 3,140 lb.

The Domor attachment was used with mechanical and economical advantages in excavating widening trenches 3 feet in width and 10 inches in depth on a pavement widening project 3½ miles in length on the Goulburn Valley Highway between Shepparton and Tallygaroopna.

More accurate control of the dimensions of the trench can be obtained with the Domor than by using the normal blade on a power grader alone. Loosening the material to be excavated is done with the grader tynes, and the top portion of this material is then cut out with the normal grader blade. The Domor attachment is used to complete the excavation and final trimming.

(vii) Two makes of front-end loaders, "Conquip" and "Cranvel", mounted on Chamberlain pneumatic tyred tractors. Their capacity is ¾ cubic yard.

(viii) Two Michigan Model 75A front-end loaders with 1½ cubic yard buckets, 4-wheel drive and torque converters. These units were purchased for heavy loading jobs and are at present in use in the Bendigo and Benalla divisions.

New Workshops.

Considerable progress has been made with the erection of the new workshops at Syndal, and it is proposed that small scale workshop operations will start very shortly using a portable compressor and an electric generating set and temporary wiring until permanent supply can be provided.

Staff.

There is still a need for more technical staff though the position has improved slightly in the last year. In order to keep in touch with modern trends in workshop management, some members of the staff have attended lectures on work study and other management problems.

BITUMINOUS SURFACING.

Extent of Work.

Table 1 sets out the mileages of work carried out on declared roads, unclassified roads, and for other authorities, the total length being 2,353 miles, or 37·5 per cent. more than the length carried out in 1956–57. Table 2 shows the lengths of different types of treatments carried out on the declared road system, and Table 3 sets out similar information in respect of unclassified roads. Fig. 1 represents graphically the general increase in the bituminous surfacing work over the past ten years, the gradual rate at which the sealing of the declared system is being extended, and the annual rate of retreatment of the sealed system.

Table 4 sets out the average costs of sprayed work carried out this year, subdivided into the four major categories—materials, labour, plant hire, and stores. Fig. 2 demonstrates the trend in costs of initial treatment, and average retreatment work over the past ten years, together with the costs of basic materials and the increasing total expenditure on bituminous surfacing.

TABLE 1.—LENGTH OF WORK CARRIED OUT IN 1956–57 AND 1957–58.

Type of Road and Plant Used.	Miles. 1956–57.		1957–58.	
(*a*) Work on C.R.B. declared roads—				
(i) Board's plant ..	1,267		1,654	
(ii) Municipal plant ..	34		55	
(iii) Contractor's plant ..	..		24	
		1,301		1,733
(*b*) Work on undeclared roads to which the Board contributes—				
(i) Board's plant ..	260		458	
(ii) Municipal plant ..	31		54	
(iii) Contractor's plant ..	..		22	
		291		534
(*c*) Work for other Authorities done by Board's plant—				
(i) Municipalities ..	114		73	
(ii) State instrumentalities..	2		5	
(iii) Commonwealth of Australia	4		5	
		120		83
(*d*) Work done for municipalities by C.R.B. contractor's plant ..	..			3
		1,712		2,353

TABLE 3.—MILEAGE OF WORK CARRIED OUT ON UNDECLARED ROADS DURING SEASON 1957–58.

Work.	Miles.	
Initial Treatments—		
Extensions	432	
Reconstructed lengths of previously sealed pavements	28	
Widening	4	
		464
Retreatments		70
Total		534

Bituminous Plant.

Approximately 99 per cent. of the bitumen required for work carried out by the Board is now handled in bulk, and delivery is undertaken by 10-ton road tankers direct to works within reasonably close proximity to the sources of supply, by 40-ton refinery owned rail tank cars to various centres elsewhere in Victoria, and by road tankers again, from the rail tank cars to the site of the works being served primarily by rail. In the past, consideration was given to the desirability of establishing fixed storages for bitumen in certain country areas, in order to reduce the demand for rail tank cars in the periods of peak usage, but with the entry into the field of a second supplier of bitumen, who is also building up a fleet of rail tank cars, the need for fixed bitumen storages in the country has receded. As long as the demand for supplies by rail can be met, as it has been during the past year, it is more economical to maintain or add to the number of mobile 2,000-gal. storages, and road tankers owned by the Board so as to enable rail tank cars to be rapidly emptied and " turned around ".

One 8,000 gallon mobile bitumen storage was used to great advantage this year in the Bairnsdale division, where it is frequently necessary to transport bulk bitumen long distances from the rail head over tortuous and, therefore, " slow " roads. The ability to transfer the whole of the contents of a rail tank car into such a storage in short time not only avoids the demurrage charges, but also puts the rail tank car back into service for other deliveries with a minimum of delay.

Contracts have been let during the year for the supply of further bitumen sprayers, road tankers, mobile storage tankers, aggregate spreaders and other minor items in order not only to replace obsolete equipment but also to increase the number of bituminous surfacing " units " available. Designs are in hand for an improved type of mobile kitchen and rotary road broom. Pneumatic tyred rollers have been used in sprayed work for some years because of the better kneading action when pressing the covering aggregate into the sprayed seal, and also because less damage and breakdown of the aggregate are caused than by steel wheeled rollers. Pneumatic tyred rollers are usually tractor drawn, but the self-propelled roller has advantages because of its manoeuvreability and fast travel speed between jobs. The " Pacific " roller has an unballasted weight of approximately 4 tons, with wide, flat tread tyres, and has a fluid coupling in the drive. The roller can be ballasted to approximately 10 tons with wet sand and water in two separate compartments. The " McDonald " roller has an unballasted weight of approximately 7 tons and can be ballasted with water only to a total weight of approximately 12 tons.

Bituminous Materials.

(*a*) *Priming Material.*—Two types of priming material have been available to the Board hitherto, namely, crude vertical retort or crude horizontal retort tars, and bituminous cutback primers. The production of gas from brown coal, by the Lurgi process at Morwell has now made available materials which, when blended, can be used under certain conditions as a satisfactory primer.

Two materials are available in heated storage tanks at the Gas and Fuel Corporations' Lurgi Gas Plant Works :—

(1) A heavy tarry residue, of semi-solid consistency at normal temperatures, melting rather sharply at about 50° C. to a mobile liquid.

(2) A mixture of various types of Hydro Carbon oils, which boils at approximately 140° C. and has a Flash Point of approximately 130° C. This material is termed " Heavy Benzol ", but is Benzol in name only, having an extremely low concentration of actual benzene. The " Heavy benzol " is a very effective cutter for the heavy tar.

Initial experimental work with various mixtures of the two materials of known viscosities has made it possible to predetermine the proper proportions of the mixture in order to meet certain requirements in the field. Close co-operation with the Corporation's chemical laboratory is necessary, as the viscosity of the heavy tar residue can vary from time to time as it is produced.

The following summarises the present position regarding the handling of the material and its use :—

(i) The heavy residue is stored at between 180° F. and 190° F.

(ii) The " heavy benzol " is available in tanks between 100° F. and 110° F.

(iii) Both materials can be pumped into the sprayers or road tankers, and mixed by circulating.

(iv) Three mixtures have been used :—

50 per cent. tar 50 per cent. heavy benzol
60 ,, ,, 40 ,, ,, ,,
65 ,, ,, 35 ,, ,, ,,

(v) Temperature of mixture approximately 140° F. to 160° F. is satisfactory for spraying.

TABLE 2.—MILEAGE OF EACH TYPE OF WORK CARRIED OUT ON DECLARED ROADS DURING 1957–58.

Type of Road and Control of Work.		Length in Miles.																		Summary of Work.	
		Nature of the Work.																			
		Initial Treatments.										Retreatments.									
												Reseals.									
Road.	Control.											Nominal Size of the Aggregate.					Two Application Reseal.	R.M.S.	P.M.S.	State Highways.	Other Declared Roads.
		Duplication and Widening.		One Application Seal Only.		Two Application Seal Only.		I.T. Prime and Two Application Seal.		I.T. Prime and Seal.											
		Widen.	Duplication.	E.	R.	E.	R.	E.	R.	E.	R.	¾-in.	⅝-in.	½-in.	⅜-in.	¼-in.					
State Highways	Direct	64·51	7·14	17·50	47·71	6·49	..	1·20	0·64	33·13	116·91	16·33	56·98	89·20	103·54	56·66	1·14	..	6·78	625·86	..
	Municipal	..	..	..	..	..	..	..	..	..	0·65	1·23	..	29·34	0·40	..	..	..	1·57	33·19	..
Main, Tourist's, and Forest Roads	Direct	2·69	..	8·94	5·36	..	..	..	..	11·59	13·74	0·12	5·20	25·38	2·84	..	..	..	..	..	75·86
	Municipal	22·42	1·25	172·71	53·12	4·74	0·38	9·17	2·07	245·80	53·39	24·52	73·29	150·85	107·11	58·67	0·86	7·08	10·35	..	997·78
	Totals ..	89·62	8·39	199·15	106·19	11·23	0·38	10·37	2·71	290·52	184·69	42·20	135·47	294·77	213·89	115·33	2·00	7·08	18·70	659·05	1,073·64
		98·01		305·34		11·61		13·08		475·21		803·66						25·78			
		903·25										829·44								1,732·69	
		1,732·69																			

Abbreviations.—E, Extension to the bituminous surfaced system. R, Initial treatment on reconstructed length of previously sealed pavement. P.M.S., Treatment with plant mix. R.M.S., Treatment with roadmix.

NOTE.—The Table does not include 534 miles of work done on Undeclared roads to which the Board contributes funds. (See Table 3).

TABLE 4.—AVERAGE COST OF B.S.T. WORK CARRIED OUT BY C.R.B. PLANT ON ROADS TO WHICH THE BOARD CONTRIBUTED FUNDS DURING 1957–58.
(Cost in pence per Square Yard.)

Item.	Nature of the Work.																			
	Initial Treatments.								Retreatments.											
									Reseals.											
									Nominal Size or Gauge of Aggregate Used.										Two Application Re-Seal.	
	I.T. Seal Only.		I.T. Two Application Seal Only.		I.T. Prime and Two Application Seal.		I.T. Prime and Seal.		¾-in. "E".		⅝-in. "F".		½-in. "G".		⅜-in. "H".		¼-in. "I" and Sand.			
Square yards costed ..	3,750,103		109,298		113,890		6,544,633		456,511		1,344,206		2,721,855		2,125,480		1,084,734		29,610	
	d.	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%	*d.*	%
Material	16·3	70·3	32·3	76·7	34·9	69·8	23·2	62·2	18·6	61·2	16·9	66·0	14·7	64·8	12·6	65·6	9·8	70·0	23·7	72·0
Labour	3·5	15·1	4·8	11·4	7·8	15·6	7·3	19·6	6·3	20·7	4·7	18·4	4·2	18·5	3·6	18·8	2·0	14·3	4·8	14·6
Stores	0·7	3·0	1·2	2·9	1·1	2·2	1·2	3·2	0·9	3·0	0·7	2·7	0·6	2·6	0·5	2·6	0·5	3·6	0·7	2·1
Plant Hire	2·7	11·6	3·8	9·0	6·2	12·4	5·6	15·0	4·6	15·1	3·3	12·9	3·2	14·1	2·5	13·0	1·7	12·1	3·7	11·3
Totals ..	23·2	100	42·1	100	50·0	100	37·3	100	30·4	100	25·6	100	22·7	100	19·2	100	14·0	100	32·9	100

— BITUMINOUS SURFACING — ANNUAL UNIT COSTS OF MATERIALS —
— TYPES OF WORK AND EXPENDITURE —

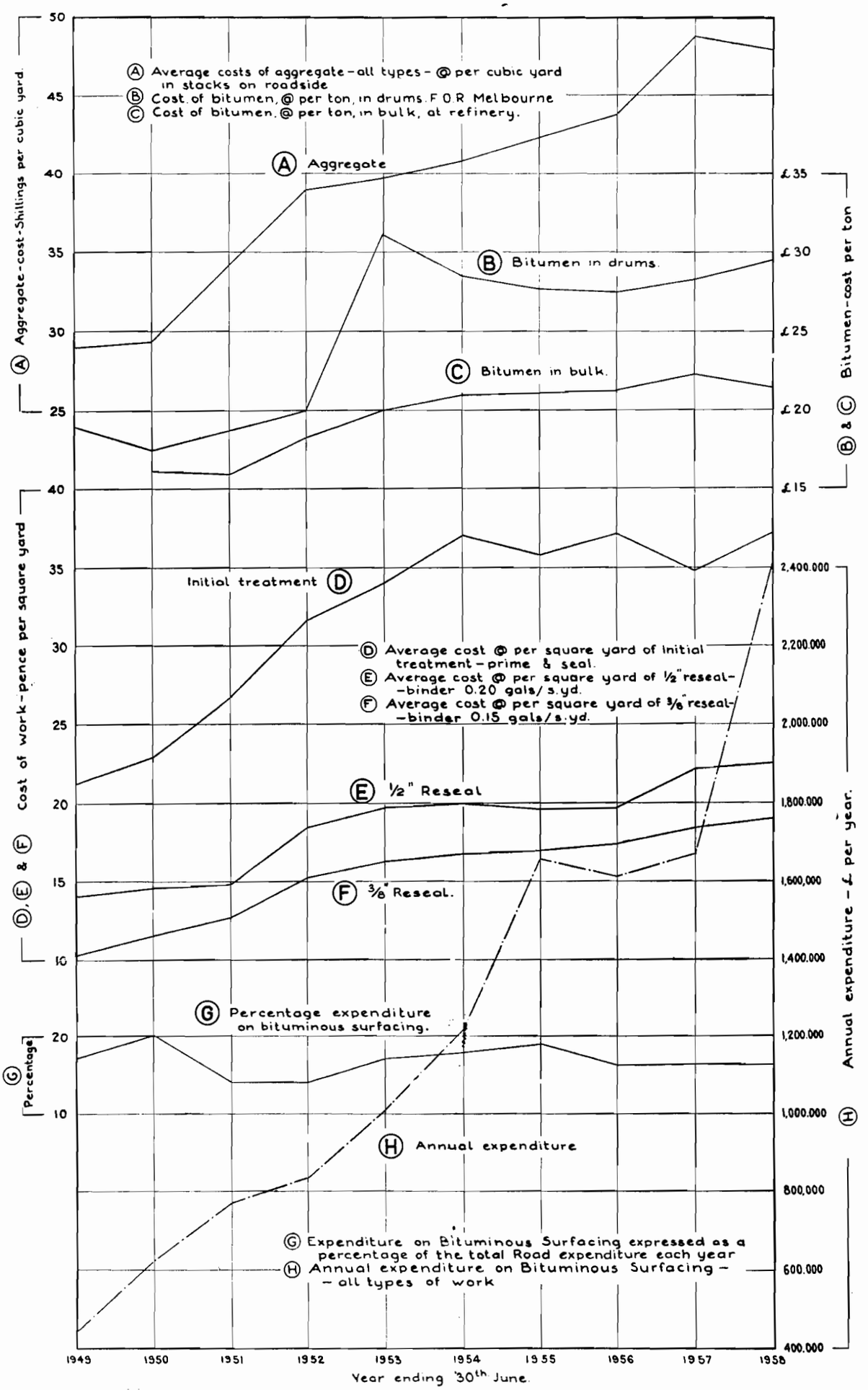


Fig. 1.

— MILEAGE OF DECLARED AND BITUMINOUS SURFACED SYSTEM —
— ANNUAL MILEAGE OF WORK CARRIED OUT —
— RATES OF EXTENSION & RETREATMENT PER YEAR —

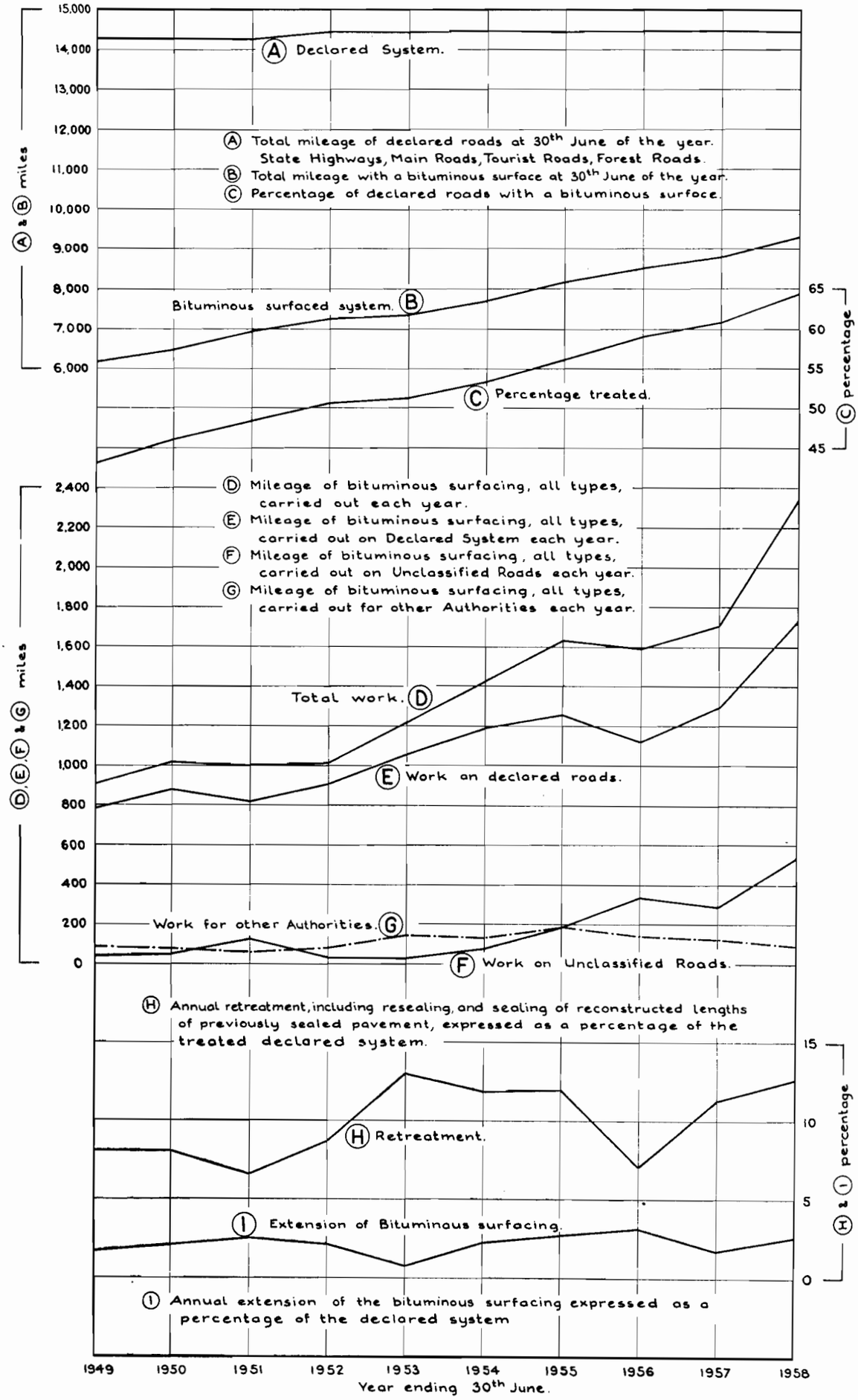


Fig. 2.

(vi) The mixture remains a stable solution above 70° F. Below that temperature settlement takes place, so that facilities to keep the temperature above 70° F. in the sprayer or tanker must be available.

(vii) The various mixtures have been used satisfactorily with rates of application varying between 0·15 and 0·20 gallons per square yard, dependent upon the nature of the pavements to be primed or the traffic conditions.

(*b*) *Bitumen.*—Some few years ago the Board, in an endeavour to control, principally, the temperature-susceptibility characteristics of the bitumen being produced by local oil refineries, included certain supplementary requirements in its quality specification in addition to the existing Australian Standard Specification. After some minor modification, this resulted in the specification, Table 5, on which bitumen was supplied to the Board by two oil refinery companies during the year. The bitumen is produced in one case from a Kuwait crude oil, and in the other from a blend of Aramco and Qatar crudes. In the latter case the proportions of the blend were, generally, 60 per cent. Aramco, 40 per cent. Qatar, but blends containing higher percentages of Aramco meet the specification.

TABLE 5.—SPECIFICATION FOR 80–100 RESIDUAL ASPHALTIC BITUMEN (1957–58).

1. Specific Gravity 25° C./25° C. (Min.)	0·98
2. Flash point, Pensky-Martens Open Cup. (Min.)	250° C.
3. Softening Point. (deg. C.)	45–60
4. Penetration (100 gms. 5 secs.) at 25° C.	80/100
5. Ductility at 25° C. (Min.)	100 cm.
6. Solubility of bitumen in carbon tetrachloride (Min.)	99%
7. Penetration (200 gms. 60 secs.) at 0° C.	Not less than 16
8. Ductility at 4° C.	Not less than 5 cm.
9. Viscosity in stokes at 70° C.	Not less than 450
10. Viscosity—Saybolt Furol. Secs. at 135° C.	150–270
11. Penetration of residue after loss on heating—Thin Film test, as percentage of original penetration (100 gms. 5 secs.) at 25° C.	Not less than 55%
12. Penetration 0° C. 200 gms. 60 secs.	Not less than 18
Penetration 25° C. 100 gms. 5 secs.	80–100
13. Product of penetration (100 gms. 5 secs.) at 25° C. and viscosity in stokes at 70° C.	Not less than 45,000

The product referred to in item 13 was designed to prevent a supplier endeavouring to meet the viscosity requirement at 70° C. by producing material always at the bottom of the 80–100 penetration range. With the object of still further controlling the penetration of the material being supplied, and thus permitting a standard procedure for fluxing and cutting back a basic bitumen to meet the conditions prevailing at each particular job in the field, the supplier was permitted a range of five points only on either side of a mid-point within the 80–100 penetration range nominated by him, subject to change by him upon due notice being given, and provided that all material supplied was within the 80–100 penetration range.

During the year, consideration was given to a specification proposed for Commonwealth-wide use by the Conference of State Road Authorities, Table 6. As a result contracts for the supply of bitumen for the year 1958–59 have been arranged on the basis of the following specification, which, it will be noted, relaxes slightly, amongst others, the requirement for viscosity at 70° F., and omits the test for penetration at 0° C., but introduces requirements additional to those in the specification used for supplies for 1957–58, Table 5.

TABLE 6.—SPECIFICATION FOR 80–100 RESIDUAL ASPHALTIC BITUMEN (1958–59).

1. Specific Gravity 25° C./25° C. (Min.)	0·98
2. Flash Point, Pensky-Martens Open Cup (Min.)	220° C.
3. Softening Point. (deg. C.)	44–51
4. Penetration (100 gms. 5 secs.) at 25° C.	80–100
5. Penetration (100 gms. 5 secs.) at 15° C. as percentage of penetration at 25° C. (Min.)	28%
6. Ductility—	
(*a*) at 25° C. (Min.)	75 cm.
(*b*) at 4° C. (Min.)	5 cm.
7. Solubility in carbon tetrachloride (Min.)	99%
8. Viscosity—	
(*a*) at 70° C.—Stokes (Min.)	400
(*b*) at 130° C.—Stokes	3·0–6·5
9. Thin film oven test—	
(*a*) Loss on heating 5 hours, 163° C. (Max.)	1%
(*b*) Penetration of residue at 25° C. as percentage of original penetration at 25° C. (Min.)	50%
(*c*) Ductility at 25° C. (Min.)	60 cm.
10. Product of penetration (100 gms. 5 secs.) at 25° C. and viscosity in stokes at 70° C. (Min.)	40,000

(*c*) *Cutback Bitumen.*—Apart from its use as a binder in sprayed work, the Board uses cutback bitumen in the following ways:—

(i) Priming.

(ii) Maintenance work—small areas of surface sealing, premix patching, &c.

The types used are Medium Curing Cutbacks, and have been of the oil, kerosene type, the usual mixtures being given in Table 7.

TABLE 7.

Grade.	Composition. Parts by vol. at 60 F.		
	80/100 Bit.	A.O.	P.K.
MC. 0 (Priming)	100	60	50
MC. 1 (Priming)	100	30	25
MC. 2 Surface	100	2½	30
MC. 3 Patching or	100	2½	17½
MC. 4 Premixing	100	2½	12½

Most of the material used for priming is prepared in the field, but commercially produced material has been supplied for years and is used for surface patching or premixing in normal maintenance work.

As the result of work carried out by the Board in investigating the possibilities of obtaining a commercially produced cutback which would display curing characteristics slightly more rapid than the medium curing grades generally used, the following specification, Table 8, for cutbacks was produced. Material complying with it was supplied by an oil refining company this year.

It will be noted that the specification provided for an additional grade MC.OO which, it was believed, may be of use in priming very dense, tight pavements.

These materials were produced by blending 80–100 penetration bitumen with one cutter (a type of jet fuel), and although very little of the priming grades have been called for, the grades MC.2, 3, and 4 have been extensively used. Some conflicting opinions have been expressed but generally, the material appears to have an advantage over the oil-kerosene types in the direction desired, that is slightly quicker set up, and a harder residue. Further research on this matter is being undertaken.

TABLE 8.—TECHNICAL SPECIFICATION FOR MEDIUM CURING CUTBACK BITUMEN.

Use.	Priming Grades.						Surface Sealing and Premixing Grades.					
Grade	0·16		0·5		1·6		5		16		50	
Number	00		0		1		2		3		4	
——	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Kinematic Viscosity Stokes at 122° F.	0·11	0·22	0·36	0·71	1·1	2·2	3·6	7·1	11	22	36	71
Flash Point ° F.	100	..	100	..	100	..	120	..	120	..	120	..
Distillation Test.												
Distillate percentage by volume of total distillate to 680° F.—												
to 374° F.	0	15	0	15	0	10	0	10	0	10	0	5
to 437° F.	20	65	15	60	10	50	0	40	0	35	0	30
to 500° F.	55	90	50	85	40	80	30	70	20	60	10	50
to 600° F.	80	100	80	100	80	95	70	95	65	90	50	85
Residue from distillation to 680° F. percentage volume by difference	40	..	50	..	58	..	66	..	73	..	79	..
Tests on residue from distillation—												
Penetration, 100 gms. 5 secs. 77° F.	100	250	100	250	100	250	100	250	100	250	100	250
Ductility, cms. 77° F.*	100	..	100	..	100	..	100	..	100	..	100	..
Solubility in Carbon Tetrachloride	99·5	..	99·5	..	99·5	..	99·5	..	99·5	..	99·5	..

* If the ductility of the distillation residue is less than 100 cm. at 77° F., the material will be acceptable if it has a ductility of 100 cm. at 60° F.
All material shall be free from water.

(*d*) *Aggregate.*—The supply of the large quantity of aggregate used this year (260,110 cubic yards), mainly by contractors throughout the State, was augmented considerably by the continued operation of the Board's own crushing and screening plant at Stawell, and a gravel washing, crushing and screening plant at St. Arnaud. Details of this plant are given on page 33.

Table 9 sets out the average price per cubic yard of various types of aggregate used for the last two years; Fig. 1 shows the trend of increasing average costs of aggregate over the past ten years, and indicates that some stabilization was reached in 1957–58.

TABLE 9.—AVERAGE PRICE OF AGGREGATE FOR BITUMINOUS SURFACING AT PER CUBIC YARD IN STACKS BY THE ROADSIDE 1957–58.

Material.	Price per cubic yard.											
	1952–53.		1953–54.		1954–55.		1955–56.		1956–57.		1957–58.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Screenings ..	40	3	41	11	44	5	44	10	51	5	49	4
Gravel ..	42	4	40	10	40	4	44	1	39	11	46	1
Sand ..	21	0	17	7	23	4	20	6	29	3	26	3
Scoria ..	17	3	15	7	12	1	18	4	26	2	18	9
Average price all aggregates	39	10	40	11	42	4	43	8	48	8	47	11

Rates of Application of Binder in Sprayed Work.

In designing the rates of application of the residual binder in sprayed seal coats, the Board has used for some years the F. M. Hanson method of filling a predetermined percentage of voids in the traffic compacted layer of one sized stones which form the covering aggregate, the average height of the one stone thick layer being regarded as the average least dimension of the aggregate used. This procedure has been modified from time to time to meet the varying demands of different types of aggregates, and differing traffic conditions.

The table used up to the present year 1957–58 (slightly condensed) was as follows:—

PERCENTAGE OF VOIDS IN THE TRAFFIC COMPACTED WORK TO BE FILLED WITH RESIDUAL BINDER (PRIOR TO 1957–58).

Aggregate.	Surface Condition, Primed, or Smooth, or Black. Traffic—Vehicles per Day.		
	Under 250.	250–1,000.	Over 1,000.
Normal Materials.			
Quartz gravel—			
Rounded or partly crushed	75	70	70
Wholly crushed	70	65	65
Screenings	70	65	60
Certain other specific aggregates with which stripping troubles had been experienced	75–80	70–75	65–70
Limestone aggregate ..	Two application procedure		

An additional 0·025 gallons per square yard was added if for any reason the primer was omitted, or when resealing a surface which might be regarded as "hungry". A rate of application of binder less than provided by the 250–1,000 v.p.d. column in the table, was never given in the case of an initial treatment.

For some time there has been a general feeling amongst engineers carrying out sealing work, that the above table, which was designed to give a reasonable compromise between the two somewhat conflicting objects—ample binder to hold the stone and long, skid-resistant life, provided little margin for taking care of variations in aggregate grading and shape, nature of surface, &c., as well as variations in the effect of traffic compaction. This was evidenced in many reports of stripping where the only obvious reason was an apparent insufficiency of binder.

The most frequent cases of stripping occurred in resealing work, where the aggregate used was crushed, or partly crushed and screened quartz, or where inadequate

provision was made to allow for the quantity of binder absorbed by a surface on which there was still a large proportion of aggregate projecting above the level of the original binder.

In the latter case, it would appear that the best procedure is to apply a light reseal, using a fine covering aggregate of grit or sand, which will not only arrest any stripping which may be taking place, but also provide a uniform, smooth (but still skid resistant) surface on which, if necessary, a normal reseal may be applied at a later date.

The difficulty of ensuring complete success when using quartz aggregate in sprayed work has always been apparent, the usual poor surface characteristics and inherent poor affinity for bitumen being recognized as the main reason for the stripping of stone from the seal coat. It has been the practice to increase the normal rates of application of binder when using quartz aggregate and to use an adhesion agent, either in the binder or applied to the stone surface in a dilutent.

Experience shows that even this action may not ensure complete success, and although the process has not yet been adopted as standard practice, experimental work appears to indicate that best results may be obtained by using the two application procedure, that is a normal application of binder and aggregate followed by a light application of binder and fine covering material.

For the year 1957–58 the table was modified, as shown hereunder, in order to provide, generally, a slightly heavier rate of application of binder.

PERCENTAGE OF VOIDS IN THE TRAFFIC COMPACTED WORK TO BE FILLED WITH RESIDUAL BINDER—1957–58.

Aggregate.	Surface Condition, Primed, or Smooth, or Black.		
	Traffic—Vehicles per Day.		
	Under 250.	250–1,000.	Over 1,000.
Screenings—Basalt Porphyry, Diabase	75	70	65
All quartz gravels, crushed, partly crushed or screened	80	75	75
All other aggregates (other than limestone)	80	75	70
Limestone aggregate ..	Two application procedure		

The usual allowances were made for initial treatments and for resealing on a surface other than smooth or black, except that stress was placed on a more careful assessment of the degree of " hungriness " of the surface to be treated, so that instead of a general increase of 0·025 gallons per square yard for a so-called " hungry surface ", the rate of application might be increased by any quantity between 0·025 and 0·075 gallons per square yard.

It is believed that a general improvement in the work has resulted from this slight increase in the rates of application.

Rubber in Bitumen.

The following are details of a short experimental section of work carried out on the Mt. Buffalo plateau (elevation 4,400 feet) with the object of observing the effect of incorporating rubber in a bituminous sprayed seal coat subject to snow conditions.

Date of treatment: 3rd March, 1958.

Road: Mt. Buffalo Road.

Length and width—

(i) rubberised sections—2 sections—150 feet x 16 feet and 203 feet x 16 feet;

(ii) unrubberised sections—1 section—150 feet x 16 feet.

Type of work: prime and two application bituminous emulsion seal.

Primer: crude vertical retort tar applied at 0·20 gallon per square yard.

Binder—

1. Control section, no rubber, bituminous emulsion type A.
   First application—half width 0·125 gallon per square yard; half width 0·188 gallon per square yard.
   Second application—0·20 gallon per square yard.
2. Rubberised section, 150 feet x 16 feet, bituminous emulsion type A, in which was incorporated approximately 3½ per cent. by volume of a 60 per cent. rubber latex.
   First application—0·20 gallon per square yard.
   Second application—0·20 gallon per square yard.
3. Rubberised section 203 feet x 16 feet, bituminous emulsion type A, in which was incorporated approximately 7 per cent. by volume of a 60 per cent. rubber latex.
   First application—0·15 gallon per square yard.
   Second application—0·215 gallon per square yard.

Aggregate: In all cases—

First application—⅜ inch type H, one sized partly crushed river gravel, applied at the approximate rate of 1 cubic yard to 100 square yards.

Second application—coarse sand applied at the approximate rate of 1 cubic yard to 140 square yards.

Adhesion in Sprayed Work.

As referred to earlier in this report, work has continued, both in the laboratory and the field, with the use of various types of adhesion agents, either incorporated in the binder or sprayed onto the aggregate in a dilution of light petroleum oil or power kerosene. Four different types of imported adhesion agents have been used during the year incorporating them in the binder when the aggregate was free from dust, or when damp or wet conditions prevailed, and using them in a dilution for precoating the aggregate when conditions were dry but the aggregate was either dusty or known to be hydrophillic.

Various concentrations of additive have been used in the binder ranging from ¼ per cent. to 1 per cent. by weight, depending on the nature of the aggregate and the relative weather conditions. While it can be said that the work has generally been successful, it has been proved that it is not safe to rely on the use of such materials in the binder in order to reduce the risk of failure when the aggregate is in a dusty condition. In such cases, pretreatment of the aggregate appears to be essential for success.

The concentration of adhesion agent diluted in a 50–50 mixture of diesel fuel oil and power kerosene for precoating the aggregate is normally about half a gallon or 5 lb. of the agent, diluted in a 44–gallon drum of the mixture. This is sprayed onto the aggregate as it is being loaded

into the trucks at the approximate rate of ¾ to 1 gallon per cubic yard, reasonable coating of the stones being achieved as they cascade down the chute of the aggregate loader, and as they are being spread through the rotating belt spreader.

Table 10 sets out the general instruction given to field supervisors as a guide to the action to be taken, the table being modified from time to time, to meet certain particular circumstances.

This table is based on the following general assumptions :—

(i) Adhesion between binder and most aggregates is improved by using an adhesion agent.

(ii) Adhesion between binder and most basalt aggregates is usually good, and adhesion agents need be used with this type of aggregate only when wet conditions prevail. If the aggregate is dusty, spraying it with a mixture of diesel fuel oil and power kerosene appears to be all that is necessary.

(iii) When using any other type of aggregate, an adhesion agent should be used either by adding it to the binder, or spraying a dilution of it onto the aggregate.

TABLE 10.—TREATMENT OF BINDER AND/OR AGGREGATE TO AID ADHESION.

Aggregate.	Conditions.	Action to be Taken.
Basalt ..	Clean dry aggregate—good weather	No action
	Aggregate wet, or pavement damp, or weather unsettled	½ per cent. adhesion agent in binder
	Aggregate dusty, weather good	Spray aggregate with oil and power kerosene mixture
	Aggregate dusty, pavement dry, but weather unsettled	Spray aggregate with oil and power kerosene mixture to which has been added adhesion agent (approx. 1 per cent.)
	Aggregate dusty, weather either good or unsettled, but pavement damp	(*a*) Spray aggregate with oil and power kerosene mixture (*b*) ½ per cent. adhesion agent in binder
All other types of aggregate	Clean, dry aggregate—good weather	½ per cent. adhesion agent in binder
	Aggregate wet, or pavement damp or weather unsettled	½ per cent. adhesion agent in binder
	Aggregate dusty, weather either good or unsettled, but pavement dry	Spray aggregate with oil and power kerosene mixture to which has been added adhesion agent (approx. 1 per cent.)
	Aggregate dusty, weather either good or unsettled, but pavement damp	(*a*) Spray aggregate with oil and power kerosene mixture (*b*) ½ per cent. adhesion agent in binder

MATERIALS RESEARCH DIVISION.

New Laboratory.

A new materials research laboratory has been built in a reconditioned factory building in Carlton and work commenced there during the year.

The building provides more space with better lighting and more convenient rooms, although the possibilities of further expansion of the accommodation are limited, the general layout having been controlled by the existing structure.

It has been found that, in spite of the loss of time incurred in actually moving into the new laboratory, the output of work has increased and the better surroundings have had beneficial effect on the morale of the staff.

Asphalt Paving.

In consequence of a number of failures of hot rolled asphalt designed in accordance with British Standard No. 594, but using 80–100 penetration bitumen in place of the harder bitumen required by the specification, a laboratory investigation of the factors influencing the stability of asphalt mixtures has been commenced. The Marshall stability test is being used and the effect of variations in stone, bitumen and filler content are being studied. It appears that mixing plant and mixing operations have not been controlled closely enough to supply satisfactory material.

Adhesion of Bitumen.

Materials used to promote the adhesion of bitumen to stone continue to be studied and the apparatus for the modified " plate test " of the Department of Main Roads New South Wales has been installed. Work continues with the " immersion tray " test and an Immersion Wheel Tracking machine as developed by the Road Research Laboratory is on order.

Extraction of Bitumen.

The pressure filtration method of bitumen extraction described in the previous Annual Report has been continued and it has been found possible for two operators to perform up to fourteen extractions, including sieve analyses of the extracted aggregate, in one day.

Owing to the extremely toxic properties of benzol which was formerly used as a solvent, mineral turpentine has been substituted and is found to be satisfactory.

Control of Bitumen.

An officer of the laboratory has been employed throughout the year in sampling and testing bitumen at the Oil Refineries supplying the Board. Not only did this ensure that material supplied conformed to the specification, but it also ensured that the material supplied to most of the municipalities in Victoria was satisfactory material.

Sand Equivalent Test.

The California " Sand Equivalent " test is being examined as a possible test for such materials as gravel, crushed rock and sands and the results indicate that it should be applicable to local materials when the appropriate specification limits have been established. It is rapid and requires very little equipment.

Approximately 110 grammes of $\frac{3}{16}$-inch material is put into a calibrated cylinder containing 4 inches of a solution of calcium chloride, glycerine and formaldehyde and water and shaken for 30 seconds. The cylinder is then filled with the solution and allowed to stand for 20 minutes. The levels of the sand and clay are read off, and the reading of the top of the sand divided by the reading of the top of the clay multiplied by 100 is the " sand equivalent ".

It is hoped that this test will prove a useful quantity control test covering both the Plastisty index and grading of the material. It will not serve as an acceptance test for samples submitted with tenders.

New Equipment.

(i) An automatic pneumatically operated compactor has been constructed and used in preparing Marshall stability specimens.

(ii) Two jaw crushers have been installed to enable material supplied as 4-inch or 6-inch spalls to be crushed to suitable size for the Los Angeles test.

(iii) A mobile laboratory has been obtained and is at present being used by the Geelong Division.

(iv) A cone penetrometer on which the load is measured by strain gauges has been constructed and used successfully to depths of over 100 feet.

(v) A small trailer mounted auger has been developed. This enables test holes in pavements to be opened in a minimum of time and with little disturbance of the pavement.

(vi) An all metal pressure filter for bitumen extraction has been developed.

(vii) The 10,000 lb. capacity testing machine which was constructed during wartime for use in the California Bearing Ratio test has been reconstructed and by the use of a variable speed hydraulic gear box is now available and convenient for all speeds for testing including that required for the Marshall test. Speeds from 0 inch per minute to 3 inches per minute can be used.

The laboratory at the Exhibition buildings did not have a room controlled at constant temperature where concrete test specimens may be cured under the standard conditions required in specifications. One has been provided in the new laboratory and has been found very convenient.

Divisional Laboratories.

Typical of the work undertaken in country divisional laboratories the following statistics for Horsham Division are cited.

Five hundred and two samples were tested during the year as follows :—

Bitumen aggregates	262
Concrete aggregates	5
Pavement materials	122
Subgrade material	113
Total	502

A total length of 14·4 miles of highways in the division was dipped and soil samples taken to enable pavement depths to be computed.

Considerable testing of subgrade and pavement materials from the various shires in the division was carried out. Some control work on the Sheep Hills by-pass was done whilst the Shire was winning and placing the pavement material.

Aggregates from the Board's crushing plants at St. Arnaud and Stawell were checked for sizing at various periods, and samples were forwarded to Head Office for Abrasion Loss test.

Concrete mixers for both the Board and Shires were designed during the year.

Monthly readings on the moisture apparatus situated at 178 mile post on Western Highway were carried out (see Annual Report 1955–56), and some investigation work on footings for proposed bridge sites was carried out.

Road Design.

Location and Design Developments.

As an experiment in the further development of photogrammetric procedures for road location and design, large scale topographical plans with very small contour interval have recently been used in the preparation of an important by-pass project, the Moe–Morwell by-pass.

Using a map scale of 200 feet to 1 inch and a 2 feet contour interval, it is now possible to design, from the topographical plan alone, the geometry of the whole long range development of this by-pass, including traffic interchanges at each end, as well as to determine all property access, calculate approximate earthwork quantities and fix the desirable road boundaries within very close limits.

This method which has been termed design mapping rather than reconnaisance mapping, effects very considerable savings in field survey and design time, as well as giving greatly improved confidence that all aspects of design have been covered, because of the wealth of information available from the topographical plans.

This method also allows of modifications to be considered from time to time, consequent upon co-ordination with other authorities or for other reasons. It also avoids delays waiting for piecemeal extensions of ground survey by conventional methods.

It is expected that it will be possible in this case to determine earthwork quantities from the topographical information to within about 10 per cent. of the quantities to be physically moved on the ground.

Other Minor Improvements in Survey Methods.

Investigation into possible road widening proposals, which involve the accurate measurement of the distances of buildings from the road boundary will be simplified by the use of a new and relatively inexpensive range finder which has been tested and found reliable over the restricted range usually needed in built up areas. The use of this instrument avoids the need for entrance into private property to make measurements with consequent disturbance of owners, and waste of time of the surveyors.

Recently fibre glass measuring tapes, which are quite cheap have become available and their use should avoid difficulties due to liability to fracture of steel tapes and the excessive stretching of metallic linen tapes.

Highways Record Surveys.

During the 1957–58 financial year, 125 miles of highway record surveys were completed and printed.

These consisted of—

(*a*) Pyrenees Highway—final 40 miles completed October, 1957.

(*b*) Northern Highway—85 miles, completed May, 1958.

As well as the compilation of record surveys, strip mosaics of the Goulburn Valley Highway (85 M), and portion of the Princes Highway East (45 M), were assembled for the Benalla and Dandenong divisions respectively. Total mileage mapped in this form was 130 miles. For the present financial year, compilation of a highway record survey of the North-Western Highway (139 M) and mile post identification on the photographs of the Glenelg and the Borung Highways is contemplated.

Title Surveys.

Title surveys have been completed for both the widening of the Princes Highway and the by-pass of Werribee, between Melbourne and Geelong, a total distance of approximately 34 miles. The land involved has in most cases been acquired. In addition to these projects, about 250 other title surveys have been carried out during the year.

TRAFFIC ENGINEERING.

Traffic Counts.

During the year, continuous counts extending for twelve months were completed on the Calder Highway at Diggers Rest, Hume Highway at Campbellfield, and the Western Highway at Bungaree. Automatic traffic counters recorded hourly volumes at each of these stations for the whole period.

Table 11 sets out certain results obtained from these counts and compares them with results from other continuous count stations in previous years.

Automatic counts for seven consecutive days each month at ten locations spread over the State have continued this year in the same manner as last year. Daily volumes only are obtained in these counts.

Results obtained in the year 1957–58 are compared in Table 12 with those obtained in the year 1956–57.

Traffic Index.

For many years the Board has conducted traffic counts annually to ascertain the numbers and types of vehicles using the roads constructed and maintained by the Board. On State highways records extend over a period of 25 years and a number of stations outside urban areas, where unbroken series of counts are available, have been selected for use in computing this index.

The average of traffic in years 1933 and 1934 has been taken as the basic figure for each station and subsequent counts expressed as a percentage of the basic figure.

An index for each highway has then been taken to be the arithmetical mean of the percentages at each station on that highway. An examination of the figures indicates that the traffic on some highways is growing at a faster rate than on other routes, and emphasizes the necessity for detailed consideration to be given to projects on different routes when planning of new facilities is under consideration. The figures for several highways and an overall index are shown in Table 13.

TABLE 11.—TRAFFIC AT VARIOUS "CONTINUOUS" STATIONS.

Traffic Volumes.	Highway—Location—Period.									
	Hume.	Western.	Calder.	Princes West.	Hume.	Maroondah.	Princes West.	Nepean.	Princes East.	Princes East.
	Campbellfield.	Bungaree.	Diggers Rest.	Pirron Yallock.	Glenrowan.	Box Hill.	Corio.	Mordialloc.	Oakleigh.	Oakleigh.
	Mar. '57–Mar. '58.	April '57–April '58.	Jan. '57–Jan. '58.	Dec. '55–Dec. '56.	July '55–July '56.	April '55–April '56.	Dec. '54–Dec. '55.	Mar. '54–Mar. '55.	Feb. '54–Feb. '55.	Feb. '53–Feb. '54.
Average Daily Traffic ..	3,432	2,268	2,316	1,392	1,807	15,561	5,309	9,421	10,837	8,926
Percentage of A.D.T. in—										
Maximum day	215·4	221·8	354·2	236·0	250·7	137·2	251·8	274·0	157·8	142·3
Minimum day	58·7	66·6	47·1	67·9	60·6	65·9	59·8	63·7	77·4	78·9
Maximum hour	26·1	25·1	45·3	26·6	28·8	13·5	30·2	23·2	13·8	15·1
10th highest ,,	19·6	19·2	30·3	18·7	22·7	11·2	22·8	19·8	12·0	13·5
20th highest ,,	18·1	17·2	27·5	16·2	18·0	10·5	21·2	18·9	11·1	13·0
30th highest ,,	16·6	15·9	26·6	14·8	16·8	10·2	20·0	17·9	10·8	12·5
50th highest ,,	15·1	14·6	23·5	13·4	15·5	9·9	17·8	16·8	10·3	11·9

TABLE 12.—INCREASE OF TRAFFIC AT VARIOUS "SEVEN-DAY" STATIONS.

Traffic Volumes.	Highway Location.									
	Midland.	Loddon Valley.	Western.	Henty.	South Gippsland.	Princes East.	Calder.	Ovens.	Maroondah.	Ocean Road.
	Mt. Clear.	South of Serpentine.	West of Goroke Road.	South of Cavendish.	East of Welshpool.	Nowa Nowa.	South of Ouyen.	Wangaratta.	Alexandra.	North of Lorne.
Average Daily Traffic—										
1956–57 ..	1,390	356	610	339	409	457	427	543	..	419
1957–58 ..	1,473	440	645	359	..	501	461	745	517	650
Annual Average Week Day—										
1956–57 ..	1,233	357	597	331	389	443	426	506	..	355
1957–58 ..	1,324	448	651	357	..	481	456	690	539	608

Traffic Counters.

The addition of a seven-day time switch to the standard non-recording traffic counter used by the Board has further increased the usefullness of this instrument. Previously, it was necessary for a person to be in attendance both at the beginning and end of a period over which a count was desired. This became impracticable if a count was required, say, from midnight to midnight.

However, by setting the time switch, the traffic counter will automatically switch on at the required time, and switch off again at the end of the period. It can then be read at the convenience of the operator.

Traffic Line Marking.

The total mileage of roads maintained in a "striped" condition during the year 1957–58 was 2,821 miles, an increase of 451 miles over the previous year's figure. This total comprised 2,136 miles of State highways, 569 miles of other declared roads, and 116 miles of roads not under the Board's jurisdiction.

TABLE 13.—COUNTRY ROADS BOARD HIGHWAY TRAFFIC INDEX—VICTORIA.

Year.	Average of Two Years: 1933 and 1934.	1935.	1936.	1937.	1938.	1939.	1941.	1944.	1946.	1947.	1948.	1949.	1950.	1952.	1953.	1954.	1955.	1956.	1957.	1958.
Princes Highway East ..	100	120	163	143	167	185	140	86	141	215	204	255	329	431	420	461	554	582	695	687
Hume Highway	100	112	151	154	150	183	137	60	134	188	178	227	301	383	374	443	523	526	540	567
Princes Highway West ..	100	124	136	129	166	180	150	59	116	167	161	187	246	333	362	393	459	474	468	517
Western Highway ..	100	121	137	155	178	188	144	73	121	145	215	195	265	385	367	396	453	504	508	502
Calder Highway	100	122	142	151	162	152	104	44	84	124	130	145	212	230	237	275	315	316	371	366
Average of several minor highways ..	100	115	146	154	158	185	150	73	137	175	225	240	288	354	380	442	426	470	530	544
All highways' index ..	100	119	146	148	164	179	138	66	122	169	185	208	273	353	357	402	455	479	519	530

In order to maintain a line on this length of road it was necessary to paint 4,576 miles of " standard stripe ", i.e., a line consisting of 10 feet dashes and 30 feet gaps. The length of " standard stripe " painted exceeds the length of road maintained because :—

(*a*) approximately 700 miles of road are striped twice per year;

(*b*) some roads are three and four lane roads;

(*c*) there are many double lines and single continuous lines;

(*d*) striping is necessary after resealing.

The total expenditure on this work during the financial year was £29,391, and the average cost per mile of " standard stripe " was £6 8s. 6d. as compared with £6 10s. for the previous year. The total quantity of lacquer used was 16,038 gallons, being at an average rate of application of 3·50 gallons per mile of standard stripe.

The slightly lower cost per mile of standard stripe this year is attributed to the greater efficiency and fewer hours lost due to wet weather. Dissection of the expenditure for two years is as follows :—

Cost Dissection.

—	1596–57.		1957–58.	
	Total. £	%	Total. £	%
Labour	4,767	17·2	5,355	18·2
Accommodation charges ..	2,000	7·2	1,987	6·8
Plant hire	1,622	5·9	1,470	5·0
Materials	18,710	67·6	19,960	67·9
Stores and tools ..	593	2·1	619	2·1
Totals ..	27,692	100·0	29,391	100·0

Traffic Studies.

A number of studies on several aspects of Traffic Engineering was made at the request of the Conference of State Road Authorities of Australia.

(*a*) *Analysis of Highway Accidents.*

This study was made to investigate the technique of statistical quality control as applied to highway accidents. Accident data was obtained from Police records for five highways leading from Melbourne for the years 1954, 1955, and 1956. The vehicle mileage for each highway was determined. The technique of quality control was then used to determine what sections of highway had an accident rate higher or lower than might be expected purely due to chance. The conclusions reached were that the method is useful in determining accident-prone sections, but the sections of highway compared must be of a similar character, e.g., rural or urban, no intersection or the same type of intersections, &c. Again, the lack of basic accident data which is both accurate and uniformly reported, makes the use of this method more academic than practical at present.

(*b*) *Vehicle Operating Costs.*

The operating costs of motor vehicles were investigated. The comparative figures are shown in Table 14.

TABLE 14.

—	Mileage Element Costs.	Non-mileage Element Costs.	Total.
	d.	*d.*	*d./mile.*
Passenger car ..	6·28	2·28	8·56
Light trucks ..	6·68	12·28	18·96
Medium truck ..	11·06	14·80	25·86
Semi-trailer	17·01	10·31	27·32

Tables were also prepared which enable operating costs of vehicles on grades to be calculated.

(*c*) *Length Limitation on Omnibuses.*

This report was prepared following requests to the Conference of State Roads Authority of Australia from bus operators that omnibuses 37 feet long be permitted instead of the existing limit of 33 feet. Submission from the Australian Road Transport Federation and the Australian and New Zealand Tramways Conference purported to show that the swept width on curves occupied by a 37 feet long omnibus was not greater than that of existing articulated vehicles. Conclusions reached were as follows :—

(*a*) On the basis of swept width no clear case existed for increasing allowable length of omnibuses from 33 feet to 37 feet.

(*b*) On basis of axle loading, a strong case exists against permitting 37 feet buses as existing 33 feet buses are frequently overloaded.

(*c*) Overtaking a 37 feet bus may not be less hazardous, as claimed, than overtaking a 45 feet semi-trailer. Buses habitually travel faster and hence may make overtaking more difficult.

(*d*) Stopping areas would have to be increased in length for longer buses.

(*e*) Legislation overseas did not in general permit 37 feet buses, particularly 2-axle buses.

It was concluded that an increase from 33 feet to 37 feet should not be permitted.

(*d*) *Turning Paths of Semi-trailers and Omnibuses.*

In conjunction with the study of turning characteristics of buses compared with semi-trailers, made for C.O.S.R.A.A., a detailed study was made of the paths occupied by large vehicles describing short radius turns.

Frequently in the design of channelized intersections, it is necessary to check whether sufficient width has been allowed in turning lanes to allow large vehicles to use them without exceeding the allowable lane width.

General conclusions reached were :—

(i) The outside path of all vehicles when making small radius turns at slow speeds is for all practical purposes circular and tangential to the approach and leaving tangents.

(ii) The worst type bus has a minimum outside turning radius of 43 feet (legal limit 40 feet maximum). Semi-trailers can, in general, describe much smaller radius curves down to about 20 feet for small wheelbase prime movers.

(iii) On curves of the same outside radius, semi-trailers occupy a wider path than other vehicles.

(iv) The track followed by the rear wheels of all vehicles is only circular if the angle turned through is very large (more than 180° for some semi-trailers). The track followed by the rear wheels in entering and leaving a curve is transitioned.

For convenience in designing, the paths occupied by semi-trailers were plotted for outside radii of 40 feet, 50 feet, 75 feet, and 100 feet at scales of 20 feet, 40 feet, and 50 feet to 1 inch. These were then photographed and printed on celluloid, to be used as an overlay on plans. Fig. 3 shows 40 feet and 50 feet radius curves at scale of 40 feet to 1 inch.

Adoption of New Type Signs.

During the year changes were made in the design of certain road signs in order to conform with the proposed revised S.A.A. Code, the main alterations being :—

(*a*) All permanent warning signs are now diamond-shaped, black on yellow, in place of some circular ones.

(*b*) Regulatory or mandatory signs are now rectangular, black on white, in place of the circular black on yellow design.

(*c*) Parking signs are now rectangular red and/or green on white, in place of the circular design.

Speed limit and " walking legs " pedestrian crossing signs remain circular to comply with Road Traffic Regulations.

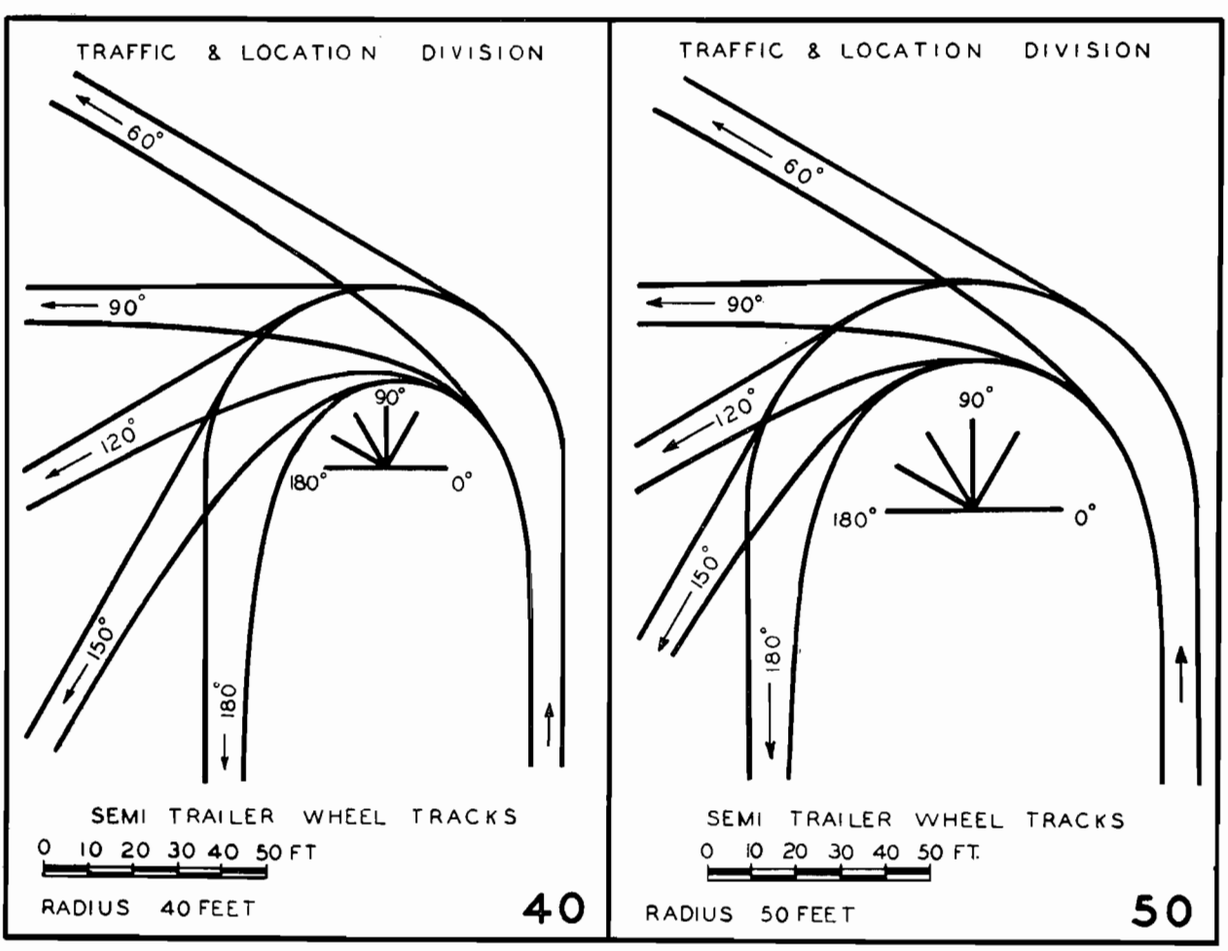


Fig. 3.

ROADMAKING MATERIALS.

Restoration of Shallow Gravel Stripped Areas.

With the exception of bitumen and cement all materials used in road construction come from the earth and their extraction so as to leave a minimum of permanent damage is a problem of considerable moment.

In 1947, the Soil Conservation and Land Utilization Authority was established by Act of Parliament and charged with, in general terms, the prevention and investigation of soil erosion and the promotion of soil conservation. It was also given the duty of advising Government Departments as to the manner in which, *inter alia*, gravel deposits should be worked.

In pursuance of the Board's policy of co-operation with this Authority, several areas were treated during 1957–58 following gravel stripping operations in order to prevent scour and make the land productive again in the shortest possible time. Where possible, grass and top soil to a depth of approximately 1½ inch. is removed with a power grader. After the gravel is removed, smoothing, ripping, and resurfacing of the area with the top soil is carried out by bulldozer and power grader. If the area is on a slope sufficiently steep to encourage scouring, contour banks are erected.

In some cases the foregoing method has resulted in the seed in the replaced topsoil providing a very good cover without the need of sowing new grasses. It has generally been necessary to fence the treated area off from stock to assist in establishing the new pasture. Costs of restoration vary, but where the top soil is saved and respread, the cost of pit restoration is in the order of £10 to £12 per acre including approximately £2 per acre for seeding and manuring.

BRIDGE DIVISION.

Prestressed Concrete.

Further progress has been made in the development of prestressed precast concrete beams and slabs referred to in the 44th Annual Report, and completion of several bridges using these units has enabled field loading tests to be carried out to check their performance.

A test load was applied to the 20-ft. prestressed precast concrete slab spans used in the bridge over Mt. William Creek, on the Halls Gap Road, at Mokepilly, and measurements of deflection and strain were obtained. The tests showed that the slabs are very satisfactory and they will permit construction of flat slab bridges more rapidly and at reduced cost, compared with the older cast in place reinforced concrete slab bridges. Details are given in Plate 2 and Fig. 4.

Work was also continued on the development of a hollow 30-ft. prestressed precast concrete slab which it is noted will be used shortly and also a 40-ft. span prestressed precast concrete beam to replace the 40-ft. precast reinforced concrete beam used in the past.

Approximately twenty prestressed precast beams were made under contract and used in some of the spans of the bridge over Kororoit Creek, on the Kororoit Creek-road, with precast concrete beams in neighbouring spans. On completion of the bridge a load test was arranged to compare the performances of the new prestressed concrete beams with the older reinforced concrete ones. Measurements of deflection and strain showed that the new type beams were stiffer than the older reinforced concrete ones and gave a better transverse distribution of load.

The new prestressed beam weighs 4 tons while the old one weighed 5·7 tons and a contract has recently been let for the supply of 48 of the prestressed concrete beams at approximately one-half of the price of the earlier reinforced concrete ones. (See Plate 3).

Pile Driving at Gellibrand River.

Difficult foundation conditions were encountered in the construction of the bridge over Gellibrand River on the Ocean-road near Lavers Hill. The foundation material did not give the required driving resistance to the first pile driven and tests by the Materials Research Division with a cone penetrometer indicated that the material was uniformly poor to depths varying from 80 feet to 100 feet.

Since it was out of the question to handle and drive reinforced concrete piles of that length with the equipment available it was decided to drive steel pipes, 18 inches

Plate 2.—Placing of 20-ft. prestressed concrete slab deck on bridge over Mt. William Creek at Mokepilly on Grampians tourists' road.

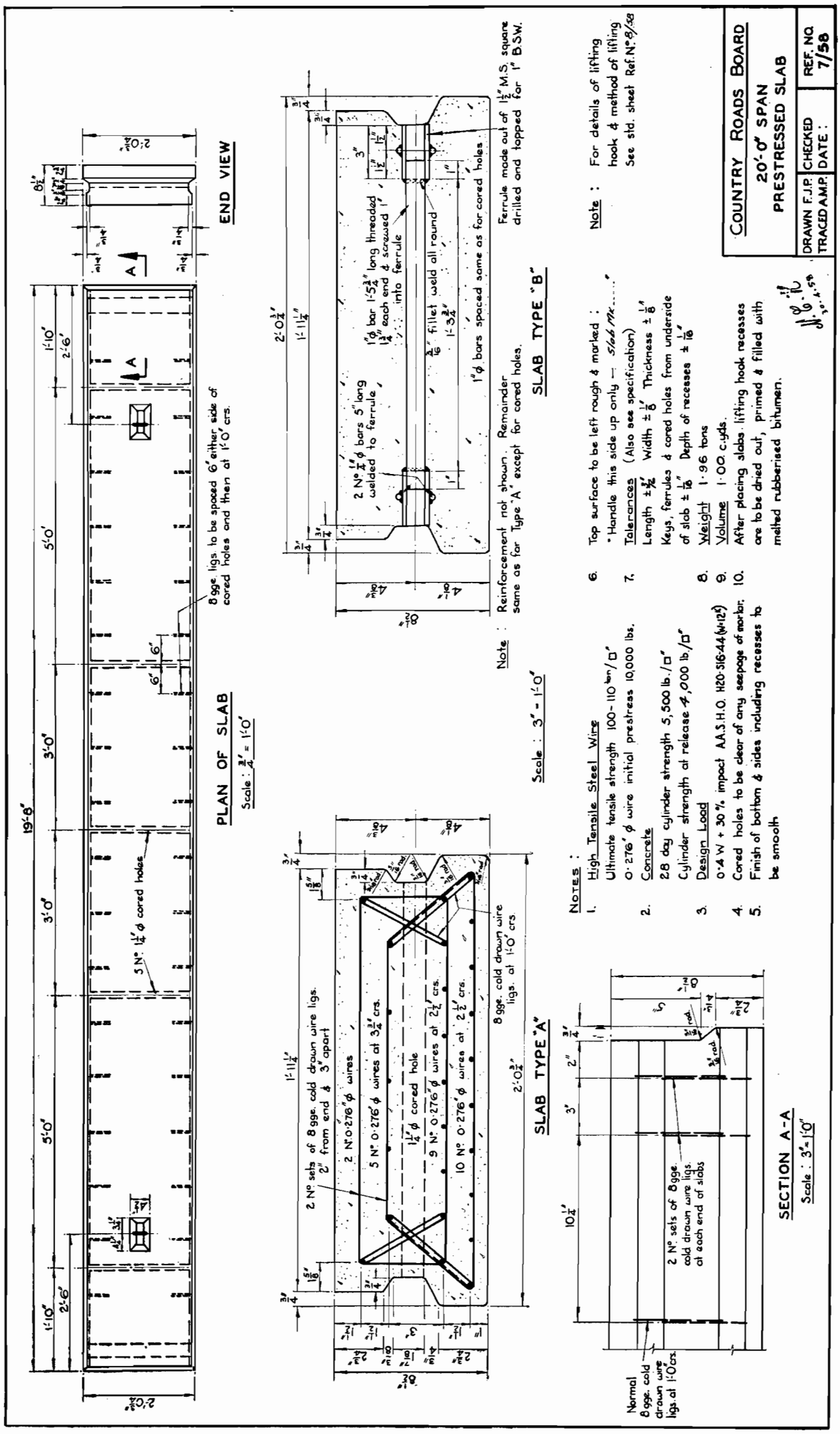


Fig. 4. Details of 20ft. span pre-stressed reinforced concrete slab.

Plate 3.—Loading 40-ft. span prestressed, precast concrete beam for transport to bridge over Kororoit Creek on Kororoit Creek main road.

diameter, in 30-ft. lengths, welding on additional lengths until the pipes were driven into bedrock. In this way, pile loadings of 30 tons were achieved, the reduction in the number of piles required partly offsetting the increased length of pile. (Plate 4 and Fig. 5.)

The driving end of the pipe was closed with a concrete plug and filled with a cast steel pile shoe. After driving, the empty pipe was filled with concrete through a tremie, fitted with two pulsators, and a 12-volt electric light. Because of the possibility of corrosion of the pipes near the surface, a steel reinforcing grid was placed in the last 20 feet to form a reinforced concrete column inside each pipe pile.

Bridge Inspection 1957–58.

During the year 24 bridges having a total of 74 spans were the subjects of extensive site examination and report by the Bridge Inspecting Engineer. This included 8 bridges on the State highways, 15 bridges on main roads, and 1 on an unclassified road.

Widening of Masonry Arch Bridges.

A bridge on the Hume Highway, Section 2 at record mileage 83·48 was widened during the past year. The old structure was a single 28-ft. span masonry arch with filled spandrels, the arch being constructed in granite 2 feet in thickness. As the stone work

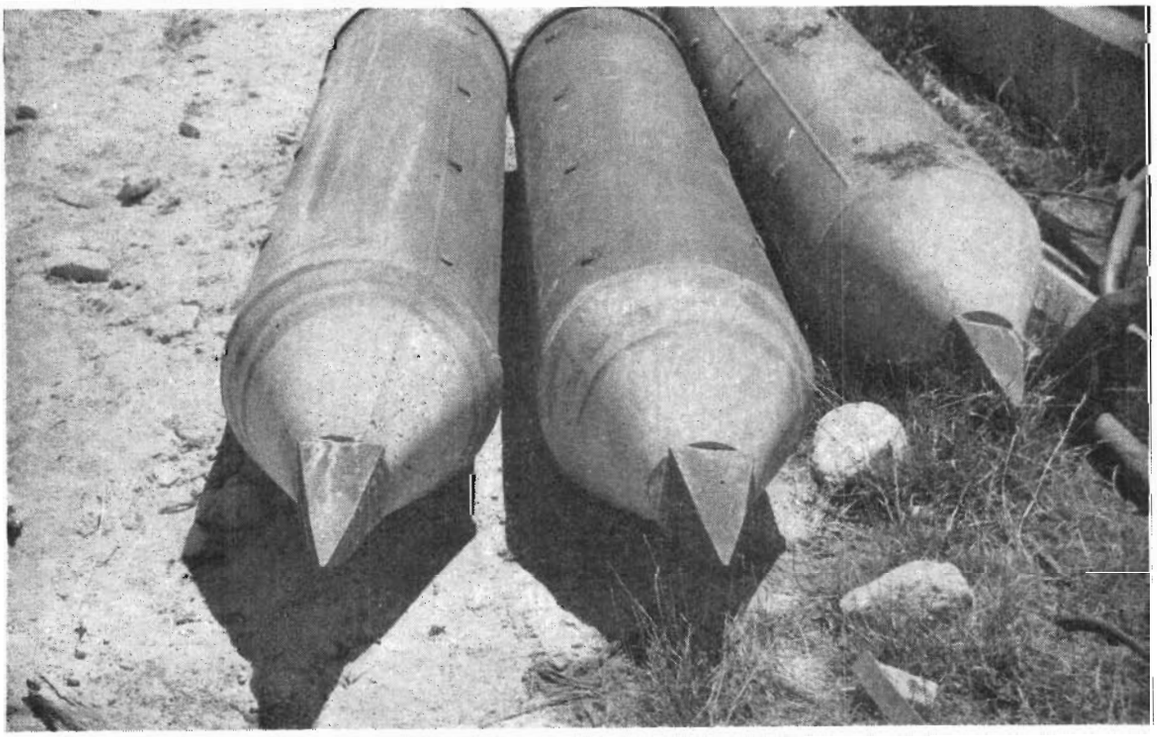


Plate 4.—Bottom section of steel tubular piles fitted with cast steel point.

possesses considerable aesthetic value, it was decided to preserve the original appearance of the structure as far as possible. Widening was carried out on one side only in reinforced concrete in the form of an arch of 12-in. thickness. The widened section was refaced with the masonry in the same relative position it had occupied on the original bridge and held in place against the reinforced concrete with steel dowels.

Similar treatment was accorded the bridge on the Calder Highway at Woodend. (See plate 21 page 25.)

King-street Bridge.

The tender of Utah Australia Ltd. for the construction of the King-street bridge, consisting of the main bridge over the Yarra, the elevated carriageway along Hanna-street and the Flinders-street overpass, was accepted on the 18th July, 1957, the total of the items in the schedule being £2,374,360.

The contractors are proceeding with the design and working drawings and it is anticipated that these will be completed by December, 1958, and the checking of the design should be finished during the first quarter of 1959.

While the tenders were under consideration, and subsequently, additional bores were put down to determine the level of the Silurean silt stone and also its quality as regards load bearing capacity. A special attachment for the diamond drill was evolved by C.S.I.R.O. and is used to obtain lengths of undisturbed material, and again with the assistance of the C.S.I.R.O., tests have been made which related the bearing strength, consolidation, and moisture content of the silt stone. As drilling proceeds at the site of the various cylinders, samples are taken from the undisturbed cores and tested for moisture content. From graphs, the levels for founding the cylinders are estimated.

Preliminary work commenced on the site in November, 1957, and a temporary bridge across the Yarra with two "fingers" pointing downstream between the lines of cylinders carrying the two river piers was first constructed. By the end of June, sinking the cylinders for the pier on the north bank, pier A, had commenced. (See Plate 22 page 26.)

One of the biggest ancillary jobs necessitated by the project is the diversion of a large stormwater drain which runs along Hanna-street. This work has been carried out by the M.M.B.W. and is substantially complete.

Details of the structures which comprise the project are shown in Table 15.

TABLE 15.—PARTICULARS OF KING-STREET BRIDGE PROJECT.

Structure.	Width Between Kerbs.	Number of Traffic Lanes.	Total Length Including Approaches.	Span Lengths.	Superstructure.			Substructure.		
					Deck.	Girders.	Type.	Pier Above Ground or Water Level.	Foundation.	Type.
River Bridge ..	123′ with two 12′ footways	4 high level and 4 low level	440′	109′ 160′ 105′	Reinforced concrete	Welded high tensile steel (BS968)	Cantilever and suspended spans	R.C. cross-heads with tiebeams near water level	5′ diameter reinforced concrete cylinders	Reinforced concrete frame
Elevated carriageway	Two 26′ 6″ roadways with 4′ median	4	2,040′	13 spans varying from 90′ to 242′	ditto	ditto	ditto	3′ diameter R.C. with tiebeams at ground level R.C. crosshead	ditto	ditto
Flinders-street over-pass	62′	4 and double tramtrack	920′	40′–101′–40′	ditto	ditto	Continuous spans	2′ 6″ diameter precast R.C. columns and pre-cast R.C. crossheads	ditto	ditto
				40′	Precast prestressed concrete tee-beams		Simply supported spans			

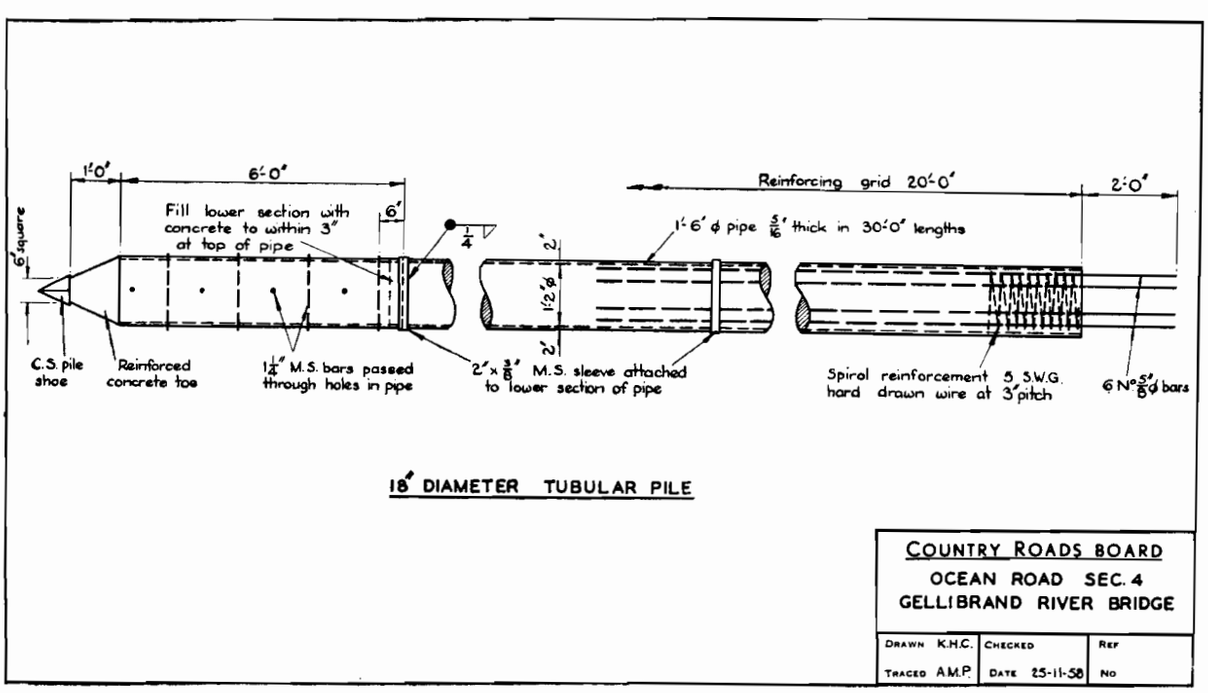


Fig. 5. Detail of steel tubular pile.

PUBLICATIONS.

Engineering Papers.

During the year, the following paper was presented by a member of the staff :—

Paper.	Author.
Operational Aspects of Highway Engineering in U.S.A. and Europe. (Paper read at the joint meeting of Melbourne Division and Civil Engineering Branch of Institute of Engineers Aust., on 16th July, 1957)	H. P. George, A.M.I.E. (Aust.), M.S.E., F.A.P.I., A.M.I.T. (Lond.), Cert. H.T. (Yale)

The following Engineering Notes were issued during the year :—

No.	Title.	Date of Issue.
61	Conditions governing erection of service stations abutting C.R.B. roads	9th April, 1958
62	New Plant	25th June, 1958

STAFF.

On the 18th March, 1958, Mr. H. P. Wood retired after 44 years' service with the Board. Mr. Wood was a particularly good draughtsman and was responsible for the preparation of many of the earlier bridge standards used by the Board. In 1928, he was appointed district engineer, Benalla, where he remained until he was appointed Highways Engineer in 1945. At Benalla he was instrumental in carrying out many works on State highways, (he completed the bituminous surfacing of the Hume Highway) and main roads. In particular, he trained a number of young engineers. This training was thoroughly carried out, and those fortunate in serving under him received extremely good grounding in construction work, administration, and in supervising contracts. The staff wishes Mr. Wood many years of happy retirement.

During the year, very good work was done by the staff, despite the fact that every section was under-staffed to a greater or less extent. The work of all is greatly appreciated.

J. MATHIESON,
Chief Engineer.

By Authority: A. C. Brooks, Government Printer, Melbourne.