COUNTRY ROADS BOARD

VICTORIA

FIFTY-FIFTH ANNUAL REPORT

FOR YEAR ENDED 30TH JUNE, 1968.

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

COUNTRY ROADS BOARD

Chairman	**I. J. O'Donnell**
Deputy Chairman	**R. E. V. Donaldson**
Member	**J. D. Thorpe**

PRINCIPAL OFFICERS

Head Office

Chief Engineer	**H. S. Gibbs**
Secretary	**N. L. Allanson**
Accountant	**R. G. Cooper**
Deputy Chief Engineer	**H. P. George**
Deputy Secretary	**C. C. Liddell**
Deputy Accountant	**R. J. C. Bulman**

DEPUTY CHIEF ENGINEERS

Works	*Road Design*	*Bridges*	*Mechanical*
C. C. Perrin	**J. H. Townley**	**B. R. Abery**	**G. M. Langham**

DIVISIONAL OFFICES

Division	*Divisional Engineer*
Bairnsdale	**W. H. Dolamore**
Ballarat	**F. F. O'Brien**
Benalla	**R. C. Handley**
Bendigo	**L. Upton**
Dandenong	**F. W. Docking**
Geelong	**W. F. Neville**
Horsham	**A. J. Pryor**
Metropolitan	**H. W. P. Hobbs**
Traralgon	**A. Jacka**
Warrnambool	**F. G. Lodge**

60 Denmark Street,
Kew
6th January, 1969

The Honourable M. V. Porter, M.L.A.,

Minister of Public Works

State Public Offices

Melbourne 3000

Sir,

In accordance with the requirements of Section 128 of the Country Roads Act 1958, No. 6229, the Board has the honour to submit to you for presentation to Parliament the report of its proceedings for the year ended 30th June, 1968.

The Board thanks you, Sir, for your continued support and interest in its activities and wishes to place on record its appreciation of the continued co-operation and assistance of other State Ministers, Government Departments, State instrumentalities and municipal councils.

The Board also pays tribute to the continued loyal co-operation and work done by its staff and employees throughout the year.

We have the honour to be,

Sir,

your obedient servants

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

R. E. V. DONALDSON, A.A.S.A. (Senior),
J.P., Deputy Chairman.

J. D. THORPE, F.I.E.Aust., M.S.E.,
M.I.T.E.(U.S.)., Member.

N. L. ALLANSON, A.A.S.A. (Senior), J.P.,
Secretary

COUNTRY ROADS BOARD

FIFTY-FIFTH ANNUAL REPORT, 1967-68

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During 1967-68 the Board

- **Constructed 30 miles of additional dual carriageways.**
- **Commenced construction of 154 new bridges.**
- **Sealed or resealed with bitumen 3,078 miles of road.**
- **Eliminated in conjunction with the Victorian Railways Department 4 railway level crossings by the construction of road overpasses and deviations.**

ANNUAL REPORT 1967/68

REVIEW

The financial year 1967/68 was the fifty-fifth year of the Board's existence. While the Board's basic role has remained much the same over the years the importance of roads has increased.

The magnitude of the Board's work has also increased greatly over the years both in the number of projects carried out simultaneously throughout the State and in the size of individual projects undertaken. This has involved the use of advanced road and bridge design practices, modern construction techniques, scientifically tested materials and sound management concepts. Until the late 1930's earth was moved mainly by horse-drawn scoops and drays which were loaded manually by laborers, each shovelling up to 20 cubic yards per day. On the current Strathmore By-pass Road project approximately 10,000 cubic yards of earth are being moved each day by modern scrapers which can carry up to 30 cubic yards of loose fill in a single load.

Years ago the growth of the Board's activities could be measured by the increase in the mileage of roads declared under the Country Roads Act. This has not been so over the last twenty years as indicated in the following table:—

Year ending 30th June	Motor Vehicles Registration	Miles of Main Roads	Miles of State Highways	Miles of Tourists' Roads	Miles of Forest Roads	Miles of By-pass Roads	Miles of Declared Roads Total
1913							
1918	14,121	2,950					2,950
1923	36,673	6,300					6,300
1928	126,328	6,300	1,474				7,774
1933	156,163	6,376	2,296				8,672
1938	223,122	6,685	2,308	350			9,343
1943	216,051	8,490	2,804	392			11,686
1948	290,153	9,806	3,846	402	241		14,295
1953	503,028	9,792	3,849	414	375		14,430
1958	720,030	9,754	3,845	415	378		14,392
1963	957,494	9,111	4,474	444	461	29	14,519
1968	1,222,563	9,097	4,460	483	461	40	14,541

The great increase in traffic has caused the Board to devote most of its finance towards maintaining and developing the existing road system together with the construction of some completely new routes.

The type of development required to meet the needs of today's traffic includes dual carriageways, wider pavements on undivided roads, wider and stronger bridges and the elimination of railway level crossings. Where very high traffic volumes are generated it has become necessary to develop completely new freeway type roads to provide direct, safe travel.

The Board's increased expenditure on declared and unclassified roads in five year periods since 1913 is shown in the following table:—

	Declared Roads	Unclassified Roads	Total Road Expenditure from Board's Funds
	£'000s	£'000s	£'000s
1913-1918	1,750	—	1,750
1919-1923	4,102	542	4,644
1924-1928	7,866	380	8,246
1929-1933	7,024	1,455	8,479
1934-1938	6,752	1,684	8,436
1939-1943	5,509	1,542	7,051
1944-1948	6,149	1,299	7,448
1949-1953	19,477	3,512	22,989
1954-1958	39,737	10,550	50,287
1959-1963	69,232	21,895	91,127
1964-1968	$205,869	$59,874	$265,743

MAJOR WORKS COMPLETED

Some of the major works which were completed during the year and which were financed from the Board's funds or the Roads (Special Projects) Fund during the year included:—

NEW ROUTE

Tullamarine Freeway — 4½ miles of the Tullamarine Freeway By-pass Road between Lancefield Road at the north-west of Essendon Airport to the Melbourne (Tullamarine) Airport entrance.

Aerial View of Tullamarine Freeway with Airport Terminal in the foreground.

Tullamarine Freeway — View under Carrick Drive Overpass.

Tullamarine Freeway — Approaching Mickleham Road.

Tullamarine Freeway — Interchange bridge at Airport entrance.

DUAL CARRIAGEWAYS ON STATE HIGHWAYS AND BY-PASS ROADS

Hume Highway — Construction of 4.1 miles between Kal Kallo and Beveridge as part of Special Project No. 2.

Nepean Highway — Construction of 2.0 miles between Old Mornington Rd., Frankston City and Wooralla Drive, Mornington Shire, as part of Special Project No. 13.

Burwood Highway — Construction of 2.1 miles from east of Blackburn Road to Morack Road, Nunawading City.

Maroondah Highway — Construction of 2.3 miles between Mt. Dandenong Road and Stirling Road, North Croydon.

Western Highway — Construction of 3.0 miles from Rockbank to Melton East as part of Special Project No. 5.

Burwood Highway — Dual carriageways between Springvale Road and Dandenong Creek.

Maroondah Highway — Mt. Dandenong Road to Stirling Road.

BRIDGES

South Gippsland Highway — Tarwin River Bridge. A thirteen span bridge 632 feet long by 28 feet wide between kerbs over the Tarwin River west of Meeniyan.

Princes By-pass Road (Moe Section) — Coalville Road Bridge — a four span bridge 322 feet long by 28 feet wide between kerbs.

Midland Highway — Goulburn River Bridge — Underpinning the existing 14 span bridge 491 feet long by 50 feet wide to take a deeper channel carrying the main river flow about one mile west of Shepparton.

Princes By-pass Road (Moe Section) — Coalville Road Bridge.

ELIMINATION OF RAILWAY LEVEL CROSSINGS

Princes Highway East — Construction of a road over rail overpass at Kilmany 123 miles from Melbourne.

Ovens Highway — Construction of Bluebell Deviation to eliminate two railway level crossings.

Warrigal Road — Construction of a road over rail overpass at the level crossing in Oakleigh City. Bridge works constructed by Victorian Railways Department and road works supervised by Oakleigh City Council.

Warrigal Road — Road over rail overpass at Oakleigh.

LOWER YARRA CROSSING APPROACH ROADS

Preliminary work was carried out during the year for the 4.1 miles Lower Yarra Freeway between its junction with the Princes Highway West and Williamstown Road and for the eastern approaches to the crossing in Port Melbourne City and South Melbourne City. The work consisted of preliminary design, the purchase of residential and commercial property and the removal of services to provide right of way for the roadworks. A model of the freeway section was prepared for public exhibition.

ROAD NEEDS SURVEY

The Road Needs Survey for the decade 1969/79 which was reported in the last Annual Report was substantially completed during the year. The survey is being conducted by each of the State Road Authorities in Australia in conjunction with the Commonwealth Bureau of Roads.

It is expected that this fundamental study of road needs leading to an estimate of the cost of constructing roads of a reasonable standard to meet traffic needs will result in a more equitable distribution of road funds by the Commonwealth following the expiry of the present Commonwealth Aid Roads Act on 30th June, 1969.

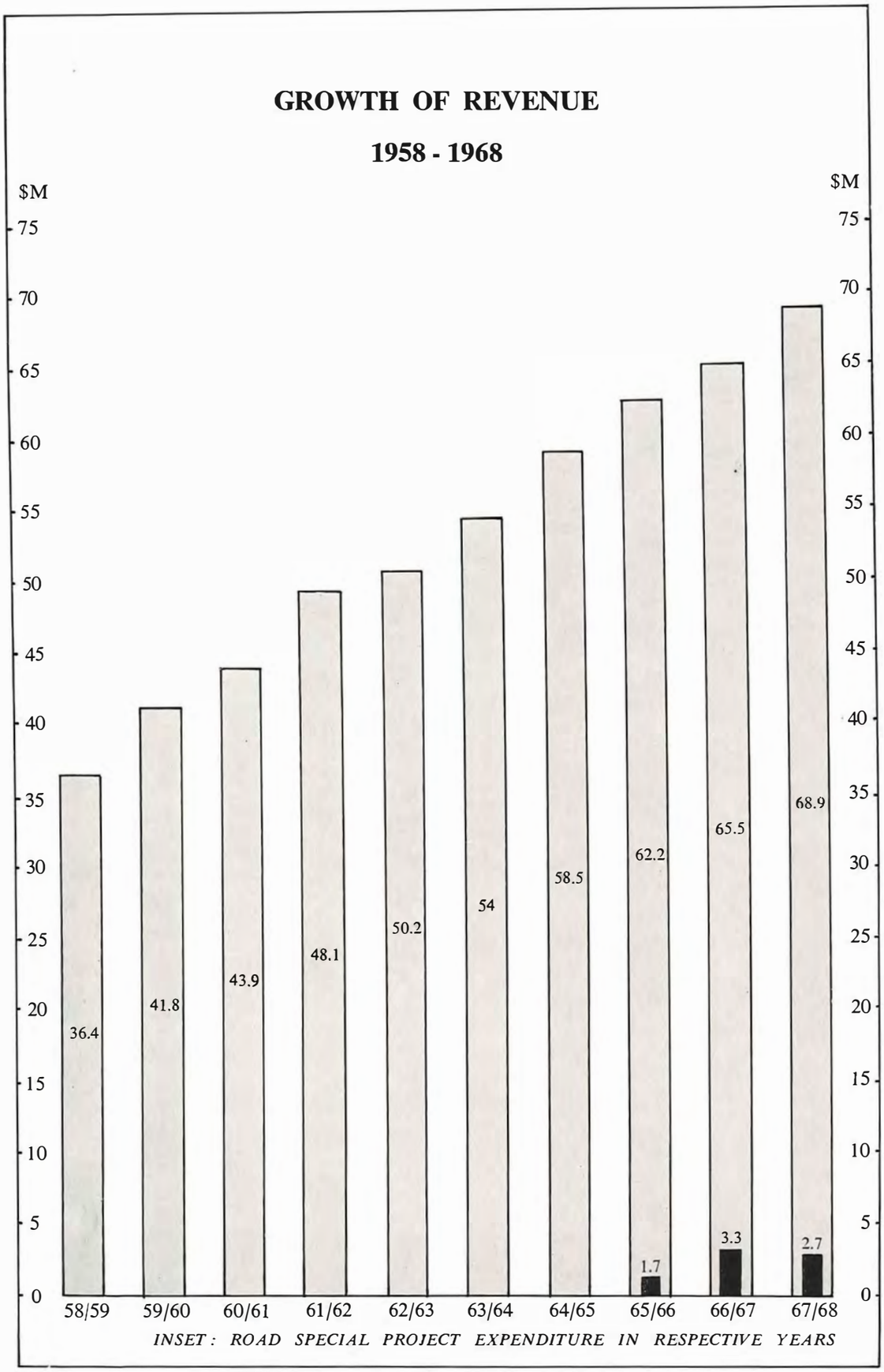
DROUGHT RELIEF

During the year funds were allocated to the Board by the Government for the alleviation of unemployment in drought affected areas in the western half of the State. A total of $260,859 was expended by the Board and up to 129 men were employed on a variety of construction and maintenance works. Approximately one half of the men engaged were employed in the Board's Warrnambool Division.

Drought Relief — Workers on Mt. Difficult Road, Wimmera Shire.

FINANCE

The total amount available to the Board for expenditure on its normal road programme during the year was $71,160,300 including a balance of $2,299,798 carried forward from financial year 1966/67. In addition $3,145,000 was provided from the Roads (Special Projects) Fund for the Board to expend on behalf of the Government.



RECEIPTS

Total receipts for the financial year 1967/68 compared with those of financial year 1966/67 are shown below:—

STATE SOURCES	1966/67	1967/68
Motor Car Act	$25,871,489	$26,805,336
Commercial Goods Vehicles Act (ton/mile tax)	6,732,313	7,247,586
Municipalities' repayments	1,823,958	1,845,339
Loan Funds	833,520	987,000
Special Grant from State Treasury	714,920	700,000
General Receipts	458,693	380,118
	$36,434,893	$37,965,382

COMMONWEALTH AID ROADS ACT	1966/67	1967/68
General Purposes	$17,273,026	$18,380,641
Rural Roads	11,777,063	12,514,479
	29,050,089	30,895,120
Grand Total	$65,484,982	$68,860,502

EXPENDITURE

Expenditure in the form of cash payments during the financial year 1967/68 amounted to $69,791,024 leaving a cash balance of $1,369,276 to be carried forward into financial year 1968/69. The receipts under the Commonwealth Aid Roads Act were fully expended leaving the balance of funds in the Country Roads Board Fund.
The following table compares expenditure from the Board's funds in 1967/68 with 1966/67:—

Item	1966/67	1967/68
Construction and maintenance of roads and bridges	$54,443,968	$58,665,569
Capital expenditure, e.g. plant, workshops, offices etc.	1,553,520	1,980,170
Salaries, operating accounts and other administration expenditure	5,074,487	5,816,225
Statutory payments to Tourist Fund, Transport Regulation Fund and contribution to Australian Road Research Board etc.	1,052,280	1,139,282
Interest and Sinking Fund payments	2,140,461	2,189,778
	$64,264,716	$69,791,024

SHARING COSTS:

The Country Roads Act provides that no more than one-half of the amount expended on permanent works and one-third of the amount expended from the Country Roads Board Fund on main roads during the preceding financial year shall be apportioned between the various municipalities benefited thereby. The Act also provides that the amount apportioned to a council in respect of expenditure charged to the Country Roads Board Fund may be reduced where the cost of maintenance is excessive due to motor traffic not of local origin or to timber traffic. The revenue, valuation and rating of the municipality and its financial obligations for loan expenditure on permanent works are taken into account in deciding the level of contribution by a council.

In September, 1967, expenditure on main roads in financial year 1966/67 was apportioned in accordance with the Country Roads Act resulting in the following distribution of expenditure: —

Expenditure from Country Roads Board Fund	$10,520,216
Expenditure from Commonwealth Aid Road moneys	$ 3,485,962
Expenditure from proceeds of ton/mile tax (Commercial Goods Vehicles Act)	$ 2,171,731
TOTAL	$16,177,909
Amount apportioned to councils	$ 1,781,024

Municipal councils were therefore required to bear only 11% of the total expenditure on main roads. The previous year's contribution by municipal councils amounted to 10.8% of total expenditure on main roads.

Within the limits of funds available the Board made allocations to municipal councils for works on unclassified roads. The expenditure incurred from the allocations made by the Board in financial year 1967/68 compared with 1966/67 was as follows:—

	1966/67		1967/68	
	C.R.B.	Council Contribution	C.R.B.	Council Contribution
Construction etc.	$10,956,264	$2,854,840	$11,802,554	$3,188,851
Patrol maintenance	1,520,781	693,282	1,633,275	726,076
TOTALS	$12,477,045	$3,548,122	$13,435,829	$3,914,927

ROAD CONSTRUCTION AND MAINTENANCE

DECLARED ROAD SYSTEM

The mileage of roads declared under the Country Roads Act as at 30th June, 1968 totalled 14541 miles consisting of:—

32 State highways having a total length of 4460 miles.

7 By-pass roads having a total length of 40 miles.

21 Tourists' roads having a total length of 483 miles.

24 Forest roads having a total length of 461 miles.

665 Main roads having a total length of 9097 miles.

In addition to the major works of constructing dual carriageways, elimination of railway level crossings and constructing completely new roads, many improvements were effected to the State's road system during the year. Some of the more significant works are listed in the appendices to this report.

STATE HIGHWAYS:

The Board's expenditure on State highways during the year was $19,735,874 including $2,652,122 from the Roads (Special Projects) Fund. $5,349,009 was expended on the maintenance of State highways.

The mileage of dual carriageways on State highways was extended by twelve miles during the year.

Details of the more significant works on State highways are listed in Appendix 1.

BY-PASS ROADS

Major construction expenditure on by-pass roads during the year was on the Tullamarine By-pass Road, Princes By-pass Road (Moe Section), the Princes By-pass Road (Laverton Section), the Hume By-pass Road (Tullarook Section) and the Strathmore By-pass Road which is referred to in more detail on page 14 of this report.

Total expenditure on by-pass roads during the year was $7,506,863 including $2,860,499 expended on land acquisition for current and future projects.

TOURISTS' ROADS:

Expenditure on proclaimed tourists' roads during the year was $2,857,203. The mileage of tourists' roads increased from 445 miles to 483 miles. The mileage of some roads was reassessed and the Bogong High Plains Road was proclaimed a tourists' road during the year.

Cairn commemorating the opening of the Bogong High Plains Road.

On 27th June, 1968, the Upper Kiewa Valley Road and its extension to the Omeo Highway over the Bogong High Plains were together proclaimed by the Governor-in-Council to be a tourists' road and transferred to the care and management of the Board. The new tourists' road runs a distance of 43 miles from the termination of the Kiewa Valley Highway at Mt. Beauty to the Omeo Highway near Shannonvale, 28 miles north of Omeo, via Falls Creek and the Rocky Valley Reservoir.

The Upper Kiewa Valley Road was constructed to give access to the State Electricity Commission's hydro-electric installations in the area but it has also for many years been used by tourists and winter sports enthusiasts. The link road over the Bogong High Plains was built by the Country Roads Board in collaboration with the Tourist Development Authority, the State Electricity Commission and the Forests Commission. It was opened to traffic in 1966. Details of the more significant works carried out on tourists' roads are listed in Appendix 2.

FOREST ROADS:

The Board expended $658,398 on forest roads during the year. Details of the more significant works carried out on forest roads are listed in Appendix 3.

MAIN ROADS:

The Country Roads Act provides that permanent works, permanent improvements and the maintenance of declared main roads shall be carried out by the municipal councils concerned to the satisfaction of the Board.

In some cases to assist the municipal council the Board obtains the approval of the Governor-in-Council to carry out works on main roads under the supervision of its own staff.

Each year the amount of the applications for funds received by the Board from municipal councils greatly exceeds the amount the Board is able to allocate, having regard to the needs of other roads throughout the State. The following table shows the applications, allocations and expenditure on main roads in financial year 1966/67 and 1967/68.

Item		1966/67	1967/68
		$'000s	$'000s
A	Applications	31,664	31,204
B	Allocations	22,243	22,628
C	Expenditure	16,765	16,769
		%	%
B	as percentage of A	70.2	72.5
C	as percentage of B	75.4	74.1

A summary of the more important works completed on main roads during the year is contained in Appendix 3.

UNCLASSIFIED ROADS:

The Board assists municipal councils financially to carry out construction and maintenance works on approximately 20,000 miles of unclassified roads each year. A total of $13,468,289 was expended from the Board's funds during the year.

It is impossible for the Board to provide allocations to satisfy all the applications for funds received from municipal councils for works on unclassified roads.

The applications for funds, together with allocations made and expenditure incurred, are shown below:—

Item		1966/67	1967/68
		$'000s	$'000s
A	Applications	39,943	43,266
B	Allocations	16,871	17,793
C	Expenditure	12,477	13,468
		%	%
B	as percentage of A	42.2	41.1
C	as percentage of B	74.0	75.7

A list of the more significant unclassified works carried out with the Board's allocations is contained in Appendix 4.

LINE MARKING

The Board maintained traffic line marking on 6,129 miles of road consisting of 3,994 miles of State highways, 1,778 miles of other declared roads and 357 miles of unclassified roads. 50 per cent of the total mileage was reflectorised with glass beads.

The total mileage of equivalent standard 3 inch line painted during the year was 15,901 compared with 15,036 miles last year. The cost of this work was $239,682 or an average of $12.95 per mile excluding miscellaneous markings.

Line Marking — New machine designed and constructed at the Central Depot, Syndal.

BITUMINOUS SURFACING

The total mileage of bituminous surfacing work completed during the year including both sprayed work and plant mix work amounted to 3,078 miles at an approximate cost of $9,592,484. Of this length the Board's 23 mobile bituminous surfacing units together with plant owned by municipal councils and contractors completed 2,975 miles of sprayed work at a cost of approximately $6,808,656.

The work included:—

343 miles of widening existing pavements
30 miles of dual carriageways
472 miles of restoration of seal costs on reconstructed sections
1,292 miles of maintenance retreatments
120 miles sealed on behalf of other State, Commonwealth and municipal authorities

The mileage of bituminous sealed public roads throughout the State was extended by 821 miles as follows:—

State highways and by-pass roads	14
Tourists' roads and forest roads	4
Main roads	137
Unclassified roads	666
	821 miles

The total length of sealed roads in the Board's declared road network is 12,868 miles or 88.5 per cent of the total length of declared roads.

214,481 tons of bituminous concrete was used on 103 miles of the more densely trafficked roads. This work was undertaken by contractors operating fixed asphalt plants using 180,000 cubic yards of aggregate.

The Board purchased 29,885 tons of bitumen of which approximately 70 per cent was carried by rail. Contractors used a further 12,500 tons of bitumen in the manufacture of bituminous concrete used on Board's works.

The Board also purchased approximately 14,000 tons of bituminous materials such as cutback bitumen, tars and bitumen emulsions and 301,000 cubic yards of aggregate for sprayed work.

ROADSIDE DEVELOPMENT

During the year the Board continued to develop roadside stopping places, rest areas and other facilities for travellers. At Garfield on the Princes Highway East the first of a number of toilet blocks was constructed in conjunction with the Tourist Development Authority. This facility, which has proved very popular, is maintained by the Board's road patrol.

The long standing practice of establishing and maintaining roadside plantations on highways throughout the State will be continued. Some 45,000 trees and shrubs are planted annually within the general standard that large shrubs and small trees are planted at least 20 feet from the pavement edge and larger trees at least 30 feet.

Rest Area at Garfield — Princes Highway East.

Wayside stop near the South Australian border — Western Highway.

CONTRACTS

Contracts under Board's Direct Supervision

Details of the type of contracts entered into by the Board and their respective values are shown in the following table:—

Type of Contract	Number of Contracts	Value $
Road construction (Major works, i.e. over $60,000)	14	4,949,505
Road construction (Minor works, i.e. under $60,000)	9	208,097
Supply of roadmaking materials	89	1,302,219
Bituminous treatment and supply of materials	94	3,936,597
Bridge construction	26	1,953,733
Manufacture of bridge components and fabricated steel	20	600,882
Supply of reinforced concrete pipes and box culverts	20	680,000
Supply of road and bridge construction equipment	33	973,058
Divisional facilities	5	338,477
Miscellaneous services and stores	15	1,230,427
	325	$16,172,995

The above details include 22 contracts having a total value of $2,719,355, which are being financed from the Roads (Special Projects) Fund.
Prices rose slightly during the year but in most cases the Board was able to obtain competitive tenders at realistic prices.

Contracts under Councils' Supervision

During the year the Board approved the acceptance by municipal councils of 455 tenders having a total value of $6,960,771 for road and bridge works for which the Board allocated funds in whole or in part.

The Board also approved the use of 98 municipal period contracts for the supply of materials for works partly financed from funds provided by the Board.

STRATHMORE BY-PASS ROAD

The Strathmore By-pass Road was the largest single project under construction by the Board during the year. When completed late in 1969 it will provide an important link in the Tullamarine Freeway which will extend from Flemington Bridge to the new Melbourne Airport at Tullamarine and also open up a much needed crossing over the Moonee Ponds Creek between the north-eastern and north-western suburbs of Melbourne. An interchange with the M.M.B.W. Route 14 (Tullamarine Freeway) will be constructed at the Bell Street end.

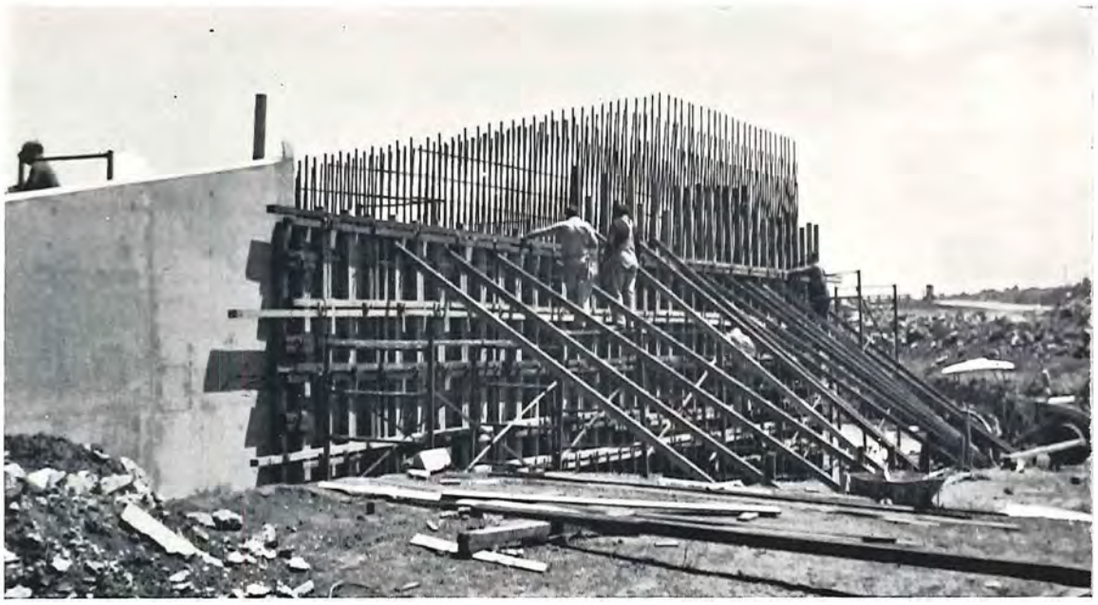
The road was envisaged in the early 1950's as a simple proposal to link the north-eastern suburbs with the Calder Highway by constructing a connection between Bell Street, Coburg and Bulla Road, North Essendon. In 1961 the proposal was increased in importance and standards to that of a limited access road under the by-pass road provisions of the Country Roads Act. The design was later amended to meet the requirements of the Tullamarine Freeway.

Construction of the road commenced early in 1968. The massive earthworks in progress indicate the magnitude of the task of constructing the road which extends for two miles in an east-west direction.

The four-lane dual carriageways of the road are designed to meet the most up-to-date standards of the National Association of Australian State Road Authorities. High standard horizontal and vertical alignments and a maximum grade of 1 in 30 will be provided. Ramps and connections with the existing street system will have gradients up to a maximum of 1 in 15. Two 12 ft. wide traffic lanes will be provided in each direction together with sealed shoulders and an emergency 10 ft. wide lane on the left side. There will be two levels of roadway at the interchange at Bell Street.

The project contains eight bridges, the longest of which will be the top level bridge of 650 ft. for west bound traffic from Bell Street to the freeway. In addition to the eight permanent structures two temporary structures are required, one at Napier Street to allow road traffic to continue using Napier Street during construction of the permanent bridge and the other over the railway to carry earthmoving plant.

The cost of the project will be approximately $10M including land acquisition and the diversion of the Moonee Ponds Creek to a new alignment alongside the railway line.



Strathmore By-pass Road — Retaining wall under construction.

Ten ton Vibrating Tamping Roller in use at Strathmore.

Strathmore By-pass Road — Work in progress — View from Bell Street end.

ROADS (SPECIAL PROJECTS) FUND

The Roads (Special Projects) Fund was established as from 1st July, 1965 following the enactment of the Roads (Special Projects) Act 1965. Additional revenue received from increased motor registration fees imposed as from 1st July, 1965 are paid into the Fund. The Fund is administered by the State Treasurer for the purpose of providing finance for special road projects. Approximately one third of the moneys paid into the Fund are allocated to the Board to carry out large projects on behalf of the Government.

The first project to be undertaken by the Board was the extension of dual carriageways on the Hume Highway from Craigieburn to Wallan. The first to be completed was Special Project No. 10 — the deviation of the Princes Highway East and construction of a new bridge at Hospital Creek near Orbost. In the three years that the Fund has been in existence the Board has expended $7,617,000 on behalf of the Government; $2,652,000 being spent in 1967/68.

Progress on projects the Board has been authorised to commence is as follows:—

Special Project No.	Description	Length Miles	Progress at 30th June, 1968
2	**Hume Highway**—Extension of the four lane divided highway from Craigieburn to Wallan.	11.0	Duplication has been completed from Craigieburn to the foot of Beveridge Hill a distance of approximately 8.5 miles. Work is in progress on the deviation at Beveridge.
5	**Western Highway**—Extension of the four lane divided highway from Deer Park to west of Bacchus Marsh (including a by-pass of Bacchus Marsh).	23.3	Dual carriageways have now been provided for a distance of 12.6 miles between Deer Park and Melton and from the Djerriwarrh Hill to Coimadai Creek east of Bacchus Marsh.
6	**Princes Highway East**—Extension of the four lane divided highway from Doveton to east of Narre Warren.	4.6	The first 2½ miles of dual facility is now under traffic and the remaining 2 miles to east of Narre Warren is under construction.
7	**Western Highway**—Construction of a four lane divided highway from west of Myrniong to east of Ballan (including a new deviation at Pykes Creek Reservoir) and a second bridge over the reservoir.	4.0	The new four lane divided eastern approach to Pykes Creek reservoir some 2 miles in length has been completed and work is in progress on the balance of 2 miles on the western side.
8	**Hume Highway**—Extension of the four lane highway north and south of Tallarook including a by-pass of Tallarook.	4.5	Two miles of dual carriageway have been constructed north and south of Tallarook and a start is about to be made on the by-pass of Tallarook.
9	**Princes Highway East**—Construction of the Princes By-pass Road (Moe Section).	3.6	Work is nearing completion on this 3.6 miles of new road by-passing the Town of Moe.
10	**Princes Highway East**—Construction of a two lane deviation and a bridge at Hospital Creek near Orbost.	5.5	Work completed.
11	**Maroondah Highway**—Extension of the six lane divided highway from North Croydon to Brushy Creek.	2.0	Work is proceeding as programmed, to be completed in 1969.
12	**Taylor Bay Road**—Construction of a new road from Taylors Lane to Maintongoon Road to link Eildon township with Bonnie Doon.	9.7	This project has been completed providing a new road 9.7 miles in length from Taylors Lane to Maintongoon Road.

Special Project No.	Description	Length Miles	Progress at 30th June, 1968
13	**Nepean Highway**—Extension of the divided highway from beyond old Mornington Road to south of the turn off to Manyung including a four lane by-pass of Mt. Eliza.	2.0	This four lane divided facility has been completed for 2.3 miles to Wooralla Drive including the Mt. Eliza Deviation and work is in progress on a further length of 1 mile to Tower Road.
14	**Marlo-Cape Conran Road**—Construction of a new road for tourists to Cape Conran.	11.0	A length of 7 miles of this new tourist road has been constructed and is under traffic. The widening and reconstruction of an additional 3 miles and extension of approximately 1 mile is in progress.
15	**Jamieson-Licola Road**—Construction of a new road to link Licola in Maffra Shire with Jamieson in Mansfield Shire.		Construction of a length of approximately four miles of this new road has almost been completed. Work will continue on the balance of the project when weather conditions are suitable.

BRIDGES

NEW BRIDGES COMMENCED

Work was commenced during the year on the construction of 154 new bridges throughout the State estimated to cost $7,470,000. Sixty-five bridges estimated to cost $5,540,000 proceeded under the direct supervision of the Board's staff, and 89 bridges estimated to cost $1,930,000 proceeded under municipal supervision.
Even though construction commenced on 179 new bridges in financial year 1966/67, i.e. 25 more than in 1967/68, the estimated cost of the 154 new bridges commenced in 1967/68 amounted to $2,230,000 more than in 1966/67. This is a result of the commencement of work on some of the larger and more complicated bridges, such as the Strathmore By-pass Road bridges and the Hopetoun bridge over the Yarra River.

LARGE BRIDGES COMPLETED IN RURAL AREAS

Some of the larger bridges completed under the supervision of the Board's staff in the rural areas of Victoria during the financial year included:

(a) **Tarwin River Bridge — South Gippsland Highway—Shire of Worrayl;** A thirteen span prestressed concrete beam and reinforced concrete bridge 632 feet long by 28 feet between kerbs over the Tarwin River on the South Gippsland Highway at 90.5 miles.

(b) **Coalville Road bridge over the Princes By-pass Road — Moe Section;** A four span continuous composite steel girder and reinforced concrete bridge 322 feet long by 28 feet between kerbs at the crossing of Coalville Road over the Princes By-pass Road in the City of Moe.

(c) **Goulburn River Bridge — Midland Highway — City of Shepparton;** Underpinning the existing 14 span reinforced concrete bridge 491 feet long by 50 feet wide, crossing a flood channel of the Goulburn River on the Midland Highway approximately 1 mile from Shepparton. The channel will later be deepened by 25 feet to carry the main flow of the Goulburn River.

(d) **Anglesea River Bridge — Ocean Road — Shire of Barrabool;** A three span prestressed concrete beam and reinforced concrete bridge 137 feet long by 28 feet between kerbs together with 2 footways each 5 feet wide over the Anglesea River in Anglesea at 68.2 miles on the Ocean Road.

(e) **Bunyip River Bridge — South Gippsland Highway — Shire of Cranbourne;** A reinforced concrete bridge 212 feet long by 28 feet between kerbs constructed on a curve and superelevated, over the Bunyip River at 42.7 miles on the South Gippsland Highway.

Midland Highway — Underpinning the bridge over the Goulburn River at Shepparton.

South Gippsland Highway — New bridge over the Bunyip River in Cranbourne Shire.

Anglesea River Bridge — Ocean Road, Barrabool.

Some of the larger bridges constructed throughout the year under municipal supervision included:

(a) **Heath Hill Bridge over the Lang Lang River — Westernport Road — Shire of Cranbourne;** A three span prestressed concrete beam and reinforced concrete bridge, 181 feet long by 24 feet between kerbs, over the deeply scoured channel of the Lang Lang River on the Westernport Road in the Shire of Cranbourne.

(b) **Ellerslie Bridge over the Hopkins River — Mortlake–Warrnambool Road — Shire of Mortlake;** A five span prestressed concrete beam and reinforced concrete bridge, 271 feet long by 28 feet between kerbs over the Hopkins River at Ellerslie on the Mortlake-Warrnambool Road in the Shire of Mortlake. The bridge replaced a timber bridge over 100 years old and originally opened on 30th May, 1867.

(c) **Barwon River Bridge — Currier Street — City of Geelong;** A fifteen span prestressed concrete slab low level bridge, 196 feet long by 20 feet 6 inches between kerbs over the Barwon River and passing under the railway bridge at Currier Street in the City of Geelong. The bridge is constructed along the top of a causeway built by Captain Fyans in 1840 and reconstructed by David Lennox in 1845.

(d) **White Horse Bridge over Yarrowee Creek — Mt. Clear Road — Borough of Sebastopol;** A three span prestressed concrete beam and reinforced concrete bridge 120 feet long by 28 feet between kerbs at the crossing of the Sebastopol—Mt. Clear Road over Yarrowee Creek in the Borough of Sebastopol.

(e) **Diamond Creek Bridge — Heidelberg - Kinglake Road — Shire of Diamond Valley;** A three span precast concrete slab and reinforced concrete bridge, 106 feet long by 26 feet between kerbs together with a footway 5 feet wide, providing a duplicate crossing of the Heidelberg-Kinglake Road over Diamond Creek in the Shire of Diamond Valley.

Heath Hill bridge over the Lang Lang River, Westernport Road, Cranbourne Shire.

METROPOLITAN BRIDGES AND OVERPASSES

Major activity in the metropolitan area under the direct supervision of the Board's staff included:

(a) the commencement of a further three bridges of the eight road bridges associated with the Strathmore By-pass Road;

(b) the completion of a road over road overpass, 260 feet long with a 40 feet roadway and 7 feet wide footway at La Trobe University.

(c) the commencement of the Hopetoun Bridge over the Maribyrnong River in the Cities of Melbourne and Footscray. The bridge will be 483 feet long with two roadways each 26 feet wide and two footways each 7 feet wide.

Two prestressed concrete slab and reinforced concrete bridges each 67 feet by 31 feet between kerbs plus footways each 7 feet 6 inches wide over the Elwood Canal on Marine Parade were completed under the supervision of the St. Kilda City Council.

PEDESTRIAN OVERPASSES

In financial year 1966/67 the construction of the pedestrian overpass over the Western Highway adjacent to the Braybrook State School was completed. This year the Board completed the pedestrian overpass over the Western Highway near the Braybrook High School and almost completed the overpass over the Princes Highway West of Ormond Road, Kingsville near the Kingsville State School and the Footscray Corpus Christi Denominational School.

Work also commenced on the construction of the overpass over the Maroondah Highway near the Blackburn State School.

Planning and design work proceeded during the year for the construction of pedestrian overpasses at the following locations:—

Nepean Highway in Moorabbin City, near the Moorabbin State School.

Nepean Highway in Parkdale near the Parkdale State School.

Maroondah Highway in Blackburn near the Blackburn State School.

Maroondah Highway in Mitcham near the St. John's Roman Catholic School.

Buckley Street, Essendon near the St. Columba's Girls School, Lowther Hall Girls School and Penleigh Girls School.

Johnston Street, Collingwood near the St. Euphrasia Roman Catholic School.

Lower Plenty Road, Heidelberg near the Rosanna Golf Links State School and Roman Catholic School.

Pedestrian Overpass at Braybrook State School — Western Highway.

BRIDGE AND CULVERT MATERIALS

Reinforced concrete pipes for bridgeworks throughout the State for which the Board provided funds in whole or in part amounted to approximately 150,000 lineal feet at an estimated cost of $314,000.

The supply of precast reinforced concrete box culverts for Board and municipal works included many large culverts with spans of 72 inches and over. A total length of 17,600 feet was used at an estimated cost of $138,000.

Production of precast concrete bridging units in the Board's precasting yards consisted of 6,030 tons of reinforced concrete piles valued at $156,000 and 5,400 tons of High Strength U slabs valued at $186,000.

Prestressed concrete bridge components valued at $177,000 were supplied under contract. This was approximately $100,000 less than last year because some of the larger bridge contracts let during the year required the contractor to supply the major prestressed concrete units.

Approximately 3,500 tons of reinforcing steel valued at $502,000 and 930 tons of rolled steel girders were used in bridges constructed from Board funds during the year.

Corrugated steel guardrail used during the year amounted to 86,000 lineal feet at an estimated cost of $66,900. Corrugated steel pipes and culverts valued at $52,000 were also used.

TOURIST DEVELOPMENT AUTHORITY

For the 8th successive financial year the Government provided $200,000 for expenditure by the Board in conjunction with the Tourist Development Authority on roads of tourist interest other than proclaimed tourists' roads.

The funds were expended on roads giving access to places which offer attractions to tourists including:—

The access road to Mt. Baw Baw via Mt. Gwinear.
The Mt. Pinniger access road in Alexandra Shire.
The Mt. Difficult Lookout access road in the Grampians Tourist Area.
The Dargo High Plains Road.

In addition, funds were provided to municipal councils for work on the Wannon-Nigretta Falls Road, in the Shire of Dundas, the access road to the Turrumberry Lock in the Shire of Rochester, and the Cape Nelson Lighthouse Road in the Shire of Portland.

The Board is required to make an annual payment into the Tourist Fund amounting to 2 per cent of the amount credited to the Country Roads Board Fund from receipts under the Motor Car Act. An amount of $517,430 was paid by the Board during the year. The Tourist Fund is administered by the Tourist Development Authority.

At 30th June, 1968 $1,530,078 had been expended from the total provision of $1,600,000 made available by the Government since 1960/61.

Timber transport on the Dargo High Plains Road.

NATIONAL PARKS AUTHORITY

For the 5th successive financial year the Government made available $100,000 for work on roads in or adjacent to National Parks. The amount of $100,000 made available was allocated in conjunction with the National Parks Authority for work on roads and associated purposes in or near

The Mt. Buffalo National Park
The Fraser National Park
The Glenaladale National Park
The Port Campbell National Park
The Wyperfeld National Park

At 30th June, 1968 $472,478 had been expended from the total provision of $500,000 made available by the Government since 1st July, 1963.

BUSHFIRES

In spite of the exceptionally dry season, the Board was not required to make any grants during the year for the repair of damage due to bushfires.

The Board did however take part, to a significant degree, in fighting fires which broke out in the Dandenong Ranges and at Lurg in north-eastern Victoria.

Co-operation in emergency is provided under the State Disaster Plan. The Board is responsible within the plan for the provision of plant and equipment. Within its role the Board provided a headquarters, plant, personnel and radio control for the Dandenong fires. At Lurg, graders and water tankers were provided while an engineer helped operations by spotting from the air.

CONTROL OF HEAVY TRAFFIC

In the interests of safety of road users and the protection of the road itself it is necessary for the Government to impose statutory limits on the weight, width, height and length of vehicles and their loads. The Board is responsible for controlling the movement of vehicles and loads which exceed the statutory limits and ensuring as far as possible that vehicles in excess of such limits do not travel on roads unless a permit has been issued.

Offence reports during the year totalled 7,547 resulting in $294,618 in fines and costs. Permits for loads in excess of weights and dimensions prescribed under the Motor Car Act increased by 1,703 to 22,533 during the year. There were 299 loads over 70 tons of which 63 exceeded 90 tons. The heaviest single load was 256 tons carried between Geelong and Anglesea.

An interesting permit issued during the year was for the first heavy over-dimensional load travelling from Melbourne to the natural gas installation at Dutson. Special arrangements necessary to permit the 150 ft. long, 140 tons overall weight vehicle to proceed included raising State Electricity Commission cables, modification of traffic signals and signs, strengthening shoulders on some sections of road and flaring awkward corners. The vehicle was escorted by police and the Board's traffic officers.

163 ton Stator en route to Anglesea Power Station.

A significant event during the year occurred in December 1967 when the Board was able to lift the prohibition of the use on the Beech Forest — Lavers Hill Road between Ferguson and Lavers Hill in the Shire of Otway of vehicles loaded or unloaded which exceeded 5 tons on any one axle. This action marked the passing of a long period during which the Board in collaboration with municipal councils was forced to limit the weight of vehicles permitted to travel on certain roads of light construction. The situation ten years ago was that load limits of six tons gross were in existence on 511 miles of State highways, 551 miles of main roads, 207 miles of tourists' roads and 12 miles of forest roads. The

sub-grades and pavements of these 1,281 miles of roads at that time would not permit heavier loads to be carried without causing extreme damage to road surfaces. Since then reconstruction and strengthening works over the years have enabled all restrictions on loads of less than the legal limits provided in the Motor Car Act to be lifted from the 14,541 miles of roads which constitute the Board's declared road system.

DEVELOPMENT OF THE MATERIALS RESEARCH DIVISION

When the Country Roads Board was established in 1913, it inherited a worn out system of roads and bridges suitable for horse drawn transport. It was therefore essential that improved economical methods of construction should be evolved. At first this technological aspect of the Board's work was carried out as part of the general engineering function but in the early 1920's a laboratory was set up in conjunction with the University of Melbourne to carry out tests on stone and bitumen by what were, at the time, standard methods.

This laboratory did not prove entirely satisfactory and in 1928 the Board set up its own laboratory in the Exhibition Buildings with an initial staff of two. For the next 10 years the activity in the laboratory was confined to the elementary control testing of gravel and bitumen while some research was carried out on the application to local conditions of the methods of soil and gravel testing being developed during the period by the Bureau of Public Roads in the United States of America.

During the same period the Board's engineers were developing methods of low cost road construction appropriate to the traffic of the day, together with efficient plant and techniques for bituminous surface treatment of roads.

During the war years of 1939-45 the Board's laboratory staff gained experience of pavement design in connection with airfield construction and in 1948 the California Bearing Ratio method of pavement design was developed to suit the Board's normal construction work. This method with modifications introduced from time to time remains in use today.

In 1955, the laboratory, now titled the Materials Research Division, was transferred to a building of its own in Carlton and remained there until 1963 when it was moved to a modern laboratory building adjacent to the new Head Office at Kew. The greater space and improved facilities not only permitted a substantial increase in control testing but also enabled original research to be undertaken.

The location of deposits of road making material has long been an important function of the laboratory and since 1961 considerable use has been made of seismic methods. In 1965, electrical resistivity techniques were introduced and both these methods are used in checking the depth and hardness of rock in road cuttings and bridge foundations. Modern sampling and testing equipment is used in foundation engineering studies on undisturbed soil samples to ascertain the possible amount of settlement of embankments.

Metallurgical Laboratory Established

While facilities for routine strength tests on steel have been available for many years, the metallurgical laboratory established in 1965 now provides for the complete metallurgical investigation of steel used in bridges or in failed parts of mechanical plant. Research is also carried out on welding characteristics of new types of steel.

The pavement is the part in direct contact with vehicles using the road and it has become necessary to provide objective methods for measuring roughness, slipperiness and strength. In the first case, an instrument of overseas design which measures unevenness in a road surface has been modified and fitted with electronic recording eqiupment. This machine, known as a roughometer, is being used on comprehensive surveys of State highways. Slipperiness or the tendency of certain stones to polish can be measured according to British Standard Methods while the strength of pavements is assessed by measuring the deflection of the surface when it is loaded by a wheel carrying the maximum legal load.

Officers of the Board's Materials Research Division have also taken part in the activities of the Standards Association of Australia and have carried out developmental work in the preparation of specifications and test methods for traffic line paints, materials for reflective signs and markings, bituminous products, cement concrete and related materials.

Workshop at the Central Depot, Syndal.

CENTRAL DEPOT SYNDAL

The Board's direct labour force, including its road and bridge construction, maintenance and bituminous surfacing personnel require the use of mechanical plant and equipment. The major maintenance and repair of this plant and equipment is performed mainly at the Board's Syndal Depot and, to a lesser extent, at the various divisional workshops situated at Bairnsdale, Ballarat, Benalla, Bendigo, Geelong, Horsham, Traralgon and Warrnambool.

The Syndal Depot covers an area of just over 30 acres on which is situated offices, workshops, stores, testing facilities and plant parking areas. The grounds are landscaped and many trees, shrubs and lawns have been planted to merge in with the general residential nature of the area. The depot is under the control of the Deputy Chief Engineer-Mechanical.

The design and development of specialised equipment necessary for the Board's work is an important part of the duties of the officers of the Mechanical Sub-branch. During the current year an entirely new traffic line marking machine was designed and manufactured at the depot. Other recent developments include the design and construction of a sprayer test pit for testing bitumen sprayers up to a spray bar width of 24 feet and the design of a hydraulic drive for the bitumen sprayer pump in place of the mechanical drive.

During the financial year over $4,000,000 was expended on the purchase and maintenance of plant and mechanical equipment. Materials, stores and spare parts purchased for Board's works throughout the State by the Controller of Stores, who is stationed at the Depot, amounted to over $2,000,000.

Most of the direction signs and warning boards used by the Board are manufactured by private industry but the very large signs currently used on freeways and by-pass roads and any unusual signs are manufactured at the Syndal Depot.

The Apprentice Centre at the depot is equipped to provide essential trade training for twelve plant mechanical apprentices.

THE COMPUTER INSTALLATION

In June 1964 the Board purchased an I.B.M. 1620 computer. The I.B.M. 1620 is fundamentally designed to perform engineering computations and immense benefit has been obtained from its use on engineering work as referred to in the Chief Engineer's annual reports.

The computer is also being used to advantage in processing certain commercial work including:—

(a) Land acquisition statistics. Information concerning negotiations for the purchase of land, analysis of compensation paid, and details of outstanding valuations and instructions to solicitors are being produced.

(b) Unclassified road allocations. Most of the recording work concerned with the applications for funds and the allocation of funds for unclassified roads including the production of the allocation advices to municipal councils for financial year 1968/69 were processed on the computer.

(c) Building services expenditure. Details of the many categories of expenditure incurred in connection with the Head Office buildings are being produced.

The necessary systems analysis and systems design work for the computer applications is being performed by officers of the Methods Section in conjunction with officers of the sections concerned. The computer programmes have been prepared by officers of the Methods Section in consultation with the Senior Engineer Programmer. The systems analysis, systems design, programming and time scheduling is necessarily more extensive for commercial applications on the I.B.M. 1620 than would be required for a computer especially designed to process commercial work.

Preliminary investigations have been conducted into the advantages of producing personnel records and statistics on the computer and also into processing control accounts for divisional expenditure. Progress is also being made with systems analysis and design of a system to record applications for funds and allocations made by the Board for expenditure on main roads. Provision will also be made to record the variations which occur during the year.

The Head Office telephone directory is produced on the computer.

In addition to the above commercial computer applications, a system involving the installation, at the Central Stores Office, Syndal, of two accounting machines specially programmed to produce an accurate punched paper tape record of transactions posted to stock ledger cards has been in operation for approximately two years. The punched paper tape is processed on a Burroughs computer installed at a Computer Service Bureau to assist in the financial control and management of stores.

LEGISLATION AFFECTING THE BOARD

Legislation enacted during the year which affected the Board included the following:—

Country Roads (Borrowing Powers) Act 1968 No. 7658

This Act amended Section 31(1) of the Country Roads Act 1958 by increasing from $12,000,000 to $32,000,000 the Treasurer's authority to make advances to the Country Roads Board to finance permanent works.

The authority was increased by $20,000,000 because the old loan authorisation of $12,000,000 is almost fully expended and because major projects such as the approaches to the Lower Yarra Crossing, the Phillip Island bridge, the Strathmore By-pass Road and the Calder By-pass Road (Keilor City) could be charged wholly or partly to loan funds if made available to the Board.

Country Roads (Amendment) Act 1968 No. 7697

This Act enables the Board to:—

(a) contribute up to $5,000 towards the establishment of a Chair of Town Planning and Urban Studies at the University of Melbourne;

(b) expend its funds on the installation, maintenance and operating costs of lighting by-pass roads declared under the provisions of the Country Roads Act.

Motor Car Act 1967 No. 7593

This Act provided inter alia for:—

(a) increased motor registration fees to be paid as from 1st March, 1968;

(b) a certain percentage of various fees paid upon registration or re-registration of certain vehicles to be paid into the Roads (Special Projects) Fund. The distribution of motor registration fees between the Roads (Special Projects) Fund and the Country Roads Board Fund is in the ratio of approximately one to two;

(c) the maximum height of a vehicle which may be used on a public highway without a permit, being increased from 12′6″ to 13′0″.

Town and Country Planning (Amendment) Act 1968 No. 7676

This Act provided for the establishment of a State Planning Council consisting of 12 members of whom one shall be the Chairman of the Board or some person nominated by him in writing to act in his stead.

The functions of the Council are:—

(a) to co-ordinate planning by State instrumentalities and semi-government authorities of future works and developments for which they are responsible;

(b) to act as consultant and adviser to the Town and Country Planning Board with respect to the preparation and adoption of any statement of planning policy prepared by that Board with respect to any other matter necessary to be provided for in the interests of the State in the preparation of regional or other planning schemes.

The Act also provided for the extension of the Melbourne Metropolitan Planning Area from approximately 688 square miles to approximately 1942 square miles.

FILMS AND DISPLAYS

During the year the Board's film unit was engaged in the production of films on the Phillip Island Bridge project and the construction of a new road across the Dividing Range to link Licola in Maffra Shire with Jamieson in Mansfield Shire.

An 18 feet long model of the Lower Yarra Freeway was constructed during the year. It will be displayed in the Altona Shire Offices for the benefit of organizations and individuals affected by the project. It will also be used as part of the Board's 1968 Royal Agricultural Show exhibit.

Once again the Board entered an exhibit at the Royal Agricultural Show and at the International Motor Show. At the Royal Agricultural Show the exhibit had an overall theme of road safety and featured a model of the Bell Street interchange of the Strathmore By-pass Road, elimination of railway level crossings, the problem of litter on roadsides, the Board's activities in providing rest areas, wayside stops and scenic viewpoints and also a display of large colour photographs of the Board's works. At the Motor Show where greater space was available the whole Strathmore By-pass Road model was the central item in a similar display. Both these displays attracted great public interest.

MUNICIPAL INSPECTIONS

During the year Members of the Board, accompanied by the respective Divisional Engineers, made official visits to twenty-eight municipalities.

The Board is most appreciative of the co-operation and hospitality extended by the Councils of the Shires of Bet Bet, Buln Buln, Bungaree, Buninyong, Charlton, Cobram, Dimboola, Eltham, Hastings, Kowree, Kyneton, Maffra, Maldon, Marong, Nathalia, Newham & Woodend, Numurkah, Rodney, Strathfieldsaye, Tambo, Tungamah and Werribee; the Borough of Kyabram and the Cities of Bendigo, Frankston, Oakleigh, Sandringham and Williamstown.

The visits enable the Board Members personally to obtain an up to date knowledge of road conditions throughout the State. The inspections during the year disclosed the additional problems which confronted Municipal Engineers due to the excessively dry conditions.

MUNICIPAL ASSOCIATION CONFERENCES

The Board continued the practice of being represented at Municipal Association Conferences throughout the State. The following conferences were attended:—

1. Municipal Association of Victoria Conference held at Melbourne on 11th and 12th October, 1967 — opening session attended by the Chairman and Board Members.

2. Goulburn North-East Municipalities Association conference held at Wodonga on 28th March, 1968 — attended by Mr. R. C. Handley, Divisional Engineer, Benalla.

3. Western District Municipal Association conference held at Mortlake on 1st April, 1968 — attended by Mr. A. N. Jephcott, Assistant Divisional Engineer, Warrnambool.

4. Northern District Municipal Association conference held at Rochester on 23rd April, 1968 — attended by Mr. F. West, Member.

5. Gippsland Municipalities Association conference held at Orbost on 26th April, 1968 — attended by Mr. R. E. V. Donaldson, Deputy Chairman.

6. North Western Municipalities Association conference held at Swan Hill on 24th May, 1968 — attended by Mr. L. Upton, Divisional Engineer, Bendigo and Mr. A. J. Pryor, Divisional Engineer, Horsham.

The Board thanks the Associations for the opportunity of being represented at these conferences, attendance at which strengthens the close ties between the Board and Municipal Councils.

DEPUTATIONS

Representatives of municipal councils and local organisations were received by the Board on fourteen occasions during the year.

The Board is always prepared to discuss problems of mutual concern with representatives of local interests. Such discussions enable an expedient exchange of information and points of view and assist in the ultimate solution of matters which are often of a complex nature.

NATIONAL ASSOCIATION OF AUSTRALIAN STATE ROAD AUTHORITIES

Under the chairmanship of Mr. R. C. Sharp, Director of Public Works, Tasmania, the National Association of Australian State Road Authorities held its thirty-fifth meeting at Hobart from 13th to 17th November, 1967. Representatives of each State Road Authority and the Commonwealth Department of Works attended. The Chairman of the Commonwealth Bureau of Roads was present at some of the sessions. The Board was represented by Mr. I. J. O'Donnell, Chairman.

Included in the fifty-seven agenda items were reports on matters referred to the Standards Association of Australia, reports submitted by various technical committees, a review of NAASRA technical publications, the introduction of container transport and vehicle standards, the Road Needs Survey 1969-79, road signs, national routes, and road construction planning and programming.

Following the NAASRA meeting the first conference of State Government Ministers concerned with the construction of highways was held. The Hon. M. V. Porter, MLA, Minister of Public Works, attended the conference accompanied by Mr. I. J. O'Donnell. The main purpose of this meeting was an exchange of information on State highway legislation and practice with a view to providing a valuable means of further co-ordinating Australia-wide activities in the sphere of road construction and transportation planning.

The thirty-sixth meeting of NAASRA was held in Melbourne on 14th and 16th May, 1968. The three Members of the Board were present. Progress was reported on many of the matters considered at the previous meeting, including the Road Needs Survey 1969-79. The formation of additional technical committees, and a possible study course in Australia for African and Asian engineers were amongst other items discussed.

AUSTRALIAN ROAD RESEARCH BOARD

The Ninth Meeting of the Board of Directors was held in Hobart on 16th November, 1967. The Country Roads Board was represented by Mr. I. J. O'Donnell, who is Deputy Chairman of the Australian Road Research Board. The meeting approved the invitation of applications for the new position of Assistant Director. Staff superannuation, salaries, and internal control procedures were discussed and progress reports of research projects were noted.

The Tenth Meeting of Directors was held in Melbourne from 14th to 16th May, 1968 in conjunction with the Fourth Annual General Meeting. The Commissioner of Main Roads, Queensland, Mr. C. N. Barton, was elected Chairman for the ensuing year, and Mr. I. J. O'Donnell was re-appointed Deputy Chairman. Arrangements for the Fourth Biennial Conference to be held in Melbourne during August 1968 were reviewed. The progress of continuing research projects was noted and an offer by the Australian Automobile Association of a $5,000 grant to carry out research into uncontrolled intersections was accepted when approval was given to commence ten new research projects. An operating budget of $1,000,000 for the 1968/69 year was adopted.

OVERSEAS VISITS

Mr. R. E. V. Donaldson, Deputy Chairman and Mr. H. W. P. Hobbs, Divisional Engineer, Metropolitan Division, left Melbourne on 3rd June, 1967, on a sixteen weeks study tour of parts of the United States of America, Canada, United Kingdom and some European countries.

The latest developments in road construction and design were observed. The Deputy Chairman made a special study of certain aspects of organisation and administration including the application of electronic data processing, financial planning and budgetary control. He also discussed matters relating to the co-ordination of road and public transport in urban situations together with the development of roads to serve tourists and national parks. Mr. Hobbs studied many technical matters.

Mr. J. H. Townley, Deputy Chief Engineer—Road Design and Mr. D. Pritchard, Engineer (Location) represented the Board at the New Zealand Roading Symposium in August/ September, 1967. In addition they examined various aspects of roads in New Zealand.

Mr. W. S. Brake, Assistant Deputy Chief Engineer—Road Design and Mr. W. F. Neville, Divisional Engineer, Geelong Division represented the Board at the 13th World Road Congress held in Tokyo during November, 1967, where they undertook study tours and attended discussions arranged by the Permanent International Association of Road Congresses. In addition road problems were examined in Hong Kong, Thailand, Malaya and Singapore in conjunction with the authorities in these countries.

Mr. F. West

RETIREMENT OF MR. F. WEST

Mr. F. West, Board Member, retired on 28th June, 1968 after almost 40 years' service with the Board. He joined the staff in August, 1928 and became Assistant Highways Engineer in 1934 progressing through the positions of Divisional Engineer at Stawell and Bendigo, Highways Engineer, Deputy Chief Engineer—Works, and Chief Engineer. Finally in July 1963 he was appointed Board Member.

During his career Mr. West was twice sent overseas to study road development. He visited the United States of America and the United Kingdom in 1953 to study overseas practices in road construction and maintenance including road tunnels and in 1964 he visited the United States of America to investigate advanced design of freeways and works programming techniques.

Mr. West was very active in his professional life and was a Member of the Melbourne Division Committee of the Institution of Engineers Australia. He was also a part-time lecturer in the School of Civil Engineering, Melbourne University and a Member of the Highways Advisory Panel, University of New South Wales.

His retirement brings to a close a long period of distinguished service to the Board and the State of Victoria as both an engineer and an administrator.

CO-OPERATION WITH CITIZEN MILITARY FORCES

The Country Roads Board, with other Government instrumentalities, sponsors units of the Australian Army Supplementary Reserve to provide specialist engineer construction capacity for the Citizen Military Forces. These units are organised in 6 Construction Group which is commanded by Col. R. C. Handley, Divisional Engineer of the Board's Benalla Division.

Within the Construction Group the Board's special interest lies in Headquarters 22 Construction Regiment, 104 Construction Squadron and 107 Plant Squadron.

The Board encourages suitable members of the staff to serve with these units and grants normal military leave with pay to the limit prescribed by the regulations for training purposes.

On 21st June, 1967 Colonel R. C. Handley was appointed Army A.D.C. to His Excellency the Governor General Lord Casey.

The Regiment's annual camp was held at Puckapunyal during the fortnight ending 29th September, 1967.

Training was mainly devoted to the use of military bridging equipment, ferrying, and watermanship — activities in which members of the unit acquit themselves very well because of their civilian skills.

Interest was added to training by the inclusion in the camp programme of a two day bivouac in the Trentham Forest, where live firing practices were conducted under realistically simulated battle conditions.

PERSONNEL

The number of personnel employed by the Board at 30th June, 1967 and 30th June, 1968 was as follows:

	1968	*1967*
Salaried Staff	1297	1245
General Staff	858	837
Award Employees	2301	2259
	4456	4341

Recruitment

Officers of the Board's Personnel Section visited 65 schools and 51 careers nights during the year. It was evident that there is a widespread interest by parents, students and teachers in the Board's work. No difficulty was experienced during the year in recruiting staff of a high calibre for all classifications.

Arrangements were made for school groups and final year students in civil engineering from the universities to visit Head Office and nearby construction projects in order that students could obtain a better understanding of the Board's work and the career opportunities available.

Retirements

During the year the following officers retired from the Board after substantial service:

Staff		Completed years of service with Board
Menzies, R. B. (Miss)	Clerk	16
Wurm, M. (Miss)	Stenographer	26
Halafoff, K.	Engineer	18
Kitchen, N. T.	Stock Control Officer	20
Papp, G.	Clerk	18
Pearce, H. H. W.	Tax & Records Officer	24
Richie, M. J.	Engineering Assistant	16
Roeszler, N. G.	Assistant to Chief Engineer	17
General Staff		
Corrigan, C. J. G.	Assistant Purchasing	31
Johnson, H. J.	Depot Carpenter	26
King, H. P.	Plant Inspector	34
King, R. H.	Road Master	31
Leitch, A.	Superintendent of Works	37
Nicholls, G. B.	Overseer	33
Porter, J.	Bridge Overseer	35
Porter, R.	Overseer	33
Rae, T.	Overseer	41
Richey, W. J. A.	Sub Foreman	30
Sparrow, W.	Plant Tester	28
Weir, R. A.	Depot Foreman	29

With regret the Board records the death of the following Staff and General Staff:—

Staff		Completed years of service with Board
Collins, J. W.	Patrolman	26
Glare, C. J.	Engineer	5
Hewson, D. T.	Engineer for Plans & Survey	26
Jones, E. H.	Assistant Experimental Officer	15
Symons, J.	Assistant Asphalt Engineer	9
Watt, R. C.	Engineer	17

Industrial Relations

The important work value case in the Metal Trades Award produced substantial increases for the Board's metal trades employees numbering approximately 340. During the course of this case, the Board's workshop at Syndal was inspected by Mr. Justice Gallagher, Mr. Justice Moore and Mr. Commissioner Winter of the Conciliation and Arbitration Commission.

Other work value cases conducted during the year which concerned the Board were those affecting the Awards for carpenters and engine drivers. On the job inspections by members of the Conciliation and Arbitration Commission arising out of these cases occurred during the year. An interim Award was made concerning carpenters but the case affecting the Board's plant operators included in the Engine Drivers Award was still proceeding at the end of the financial year. Claims were also received for wage increases for builders labourers and transport drivers but negotiations were not completed during the year.

A claim was received from the Association of Professional Engineers for a review of the salary levels of the Board's senior engineers and for increases in the salaries of professional engineers generally. The Municipal Officers Association of Australia also served a comprehensive log of claims for salary increases and improvements to conditions. No finality was reached in these matters during the year.

First Aid Centre

The first aid centre at Head Office which serves approximately 900 staff has been placed under the control of a Nursing Sister.

National Service Training

At 30th June, 1968, ten officers were undergoing National Service training.

Training

Under the guidance of the Principal Training Officer a great variety of internal training courses were held during the year. Some courses were designed to impart technical knowledge; some to widen the knowledge and skills of non-technical staff; some to promote greater understanding of the Board's organization and operations, and some to improve the quality of supervision.

The main courses conducted during the year were:—

Induction of new Salaried Staff (five, one day courses).

Induction of Newly Appointed Cadets (one, one day course).

Transition Course for Newly Graduated Cadets (one, one week course).

Communication Course (one, two day course and one, three day course).

Industrial Relations Course for engineers of the Mechanical Sub Branch (one course of six evenings).

Specialist training courses in the Traffic & Location Section.

Bituminous Concrete Surfacing Course (one course of two days).

Contract Administration Appreciation Course for Divisional Engineers (2 days).

Contract Administration Appreciation Course for Assistant Divisional Engineers (3 days).

Letter Writing Course (two, one day courses).

Computer Appreciation Course (one, three day course and one, four day course).

Valuation Course (one course of six two hour sessions — lecturers provided by the Commonwealth Department of Taxation).

Supervising Engineers' Course (one, five-day course).

Officers of the Board attended the Advanced Course, Australian Administrative Staff College, the Traffic Planning and Control Course and the Construction Management Course at the University of New South Wales.

Over two hundred Board's officers undertook part-time studies during the year in courses beneficial to the Board's work. Such courses concerned civil engineering, mechanical engineering, drafting, geology, science, accountancy, commerce and surveying.

At Syndal the Apprentice Training School continued to provide full time training for first year motor mechanic apprentices.

The Board sponsored an officer to attend the University of Melbourne to study for the Master of Engineering Science (structures) degree.

Cadetships

The Board granted eleven cadetships in civil engineering and one in mechanical engineering at the commencement of the 1968 academic year.

The cadetship scheme, designed to ensure a steady supply of graduates is supporting 46 students at the universities and Royal Melbourne Institute of Technology during the 1968 academic year. Ten cadets completed their courses at the end of 1967 and commenced full time duty with the Board.

The following table shows the number of cadets in training during the 1968 academic year:

Subject	**Year of Training**			
	1st	2nd	3rd	4th
Civil Engineering	11	6	9	8
Mechanical Engineering	1			2
Science		1	1	
Surveying			4	1
Commerce			2	
Total	12	7	16	11

APPENDIX 1

STATE HIGHWAYS AND BY-PASS ROADS

SIGNIFICANT WORKS COMPLETED DURING FINANCIAL YEAR 1967/68.

PRINCES BY-PASS ROAD

LAVERTON	Construction of the Kororoit Creek Road interchange ramps. Construction of the overpass and approaches at Cooraminta Avenue, Laverton.

MALTBY BY-PASS ROAD

Sealing the left shoulder of the southern carriageway for a width of 3 feet over the whole by-pass road.

TULLAMARINE BY-PASS ROAD

Construction of 4.5 miles between Essendon Airport and Melbourne (Tullamarine) Airport.

PRINCES HIGHWAY WEST

FOOTSCRAY CITY	Reconstruction of 0.5 mile including channelised intersections between Millers Road and McDonald Road to provide six lane dual carriageways.
WERRIBEE SHIRE	Widening 2.3 miles between the eastern interchange with the Maltby By-pass Road and Wattle Avenue including the provision of turning lanes at the entrances to the State Research Farm and the Veterinary College. Redecking the bridge over the Werribee River which is now 268 feet long by 28 feet wide between kerbs with a 6 feet footway.
GEELONG CITY	Improvements at the intersection of Mercer Street and Keera Street, Geelong.
COLAC CITY	Reconstruction of 1.3 miles near the bird sanctuary in Colac East.
HAMPDEN SHIRE	Reconstruction of 6 miles in two sections east of Camperdown to provide a 24 feet wide sealed pavement.
PORTLAND SHIRE	Construction of a new bridge 150 feet long by 28 feet wide between kerbs over the Fitzroy River at Heywood.

Princes Highway West — Widening of Murray Street, Colac.

PRINCES HIGHWAY EAST

CAULFIELD AND MALVERN CITIES

Construction of six lane dual carriageways from Waverley Road to Repton Road including channelised intersections at Burke Road and Grange Road.

Princes Highway East — Waverley Road to Repton Road.

CRANBOURNE AND BERWICK SHIRES

Reconstruction of the southern carriageways at Doveton for a distance of 1.0 mile easterly from the junction with the South Gippsland Highway.

BERWICK SHIRE

Widening the formation and resealing 1.8 miles east of Mt. Ararat to provide a 24 feet wide sealed pavement.
Reconstruction of 2.5 miles at Tynong to provide a 24 feet wide sealed pavement and a climbing lane.

Princes Highway East — Widening East of Mt. Ararat.

TRARALGON CITY

Reconstruction of the junction at Breed Street to include a dual carriageway approach to the intersection. The Breed Street approach was regraded and channelised by the City Council.

SALE CITY

Construction of a road over rail overpass at Kilmany. The acute skew gives rise to a bridge with a span of 22 feet and an overall length of 208 feet. The approaches provide a sealed pavement 24 feet wide.

ORBOST SHIRE

Reconstruction of 3.2 miles at Wombat Creek east of Nowa Nowa to provide a sealed pavement 24 feet wide. The work included a three span reinforced concrete bridge 151 feet long by 28 feet wide between kerbs.

ORBOST SHIRE	Construction of two reinforced concrete bridges and approaches at Newton's Creek east of Orbost. One bridge is 92 feet long and the other 62 feet long, each 28 feet wide between kerbs.
	Reconstruction of 0.6 mile through Genoa township to provide a sealed pavement 24 feet wide.
	Realignment of 2.7 miles at Maramingo to provide a sealed pavement 24 feet wide.

WESTERN HIGHWAY

SUNSHINE CITY	Construction of a pedestrian overpass at Braybrook State School.
MELTON SHIRE	Construction of dual carriageways over 3.0 miles between Rockbank and Melton East as part of Special Project No. 5.
	Widening 5 miles at Melton to provide a sealed pavement 44 feet wide including the widening of bridges over Toolern Creek and Melton Creek.
BACCHUS MARSH SHIRE	Improvement of the curve at the foot of Stamford Hill in Bacchus Marsh.
	Reconstruction of 3.4 miles east of Trawalla including widening and resheeting to provide a 24 feet wide pavement.
	Widening and resheeting 3.6 miles between Middle Creek and Buangor to provide a 24 feet wide pavement.
	Provision of concrete kerb and channel and completion of initial sealing at the Grampians Road junction.
	Widening of the pavement from 20 feet to 26 feet between Dadswells Bridge and Flat Rock turn off.
DIMBOOLA SHIRE	Widening and resheeting with minor regrading over 13.9 miles between Lochiel and Salisbury.

CALDER HIGHWAY

KEILOR CITY	Resheeting and surfacing 3.1 miles.
	Reconstruction and widening to provide a climbing lane on the hill west of Keilor township.
GISBORNE SHIRE	Construction of a climbing lane at Gisborne North.
NEWHAM AND WOODEND SHIRE	Widening the pavement through the township of Woodend to provide a pavement 40 feet wide.
	Widening 2.1 miles between Harcourt and Porcupine Hill to provide a 24 feet wide sealed pavement.

Hume Highway — Dual carriageways south of Tallarook.

HUME HIGHWAY

BULLA-WHITTLESEA AND KILMORE SHIRES	Construction of 4.1 miles of dual carriageways between Kalkallo and Beveridge as part of Special Project No. 2.
SEYMOUR SHIRE	Realignment and part duplication over 1.7 miles north of Tallarook to connect with approaches to the new bridges over the Goulburn River and adjacent flood plain.
	Construction of approaches totalling 1.5 miles to the new bridge over the Goulburn River and across the floodway bridges.

MAROONDAH HIGHWAY

RINGWOOD CITY AND CROYDON SHIRE	Construction of dual carriageways over 2.31 miles between Mt. Dandenong Road and Stirling Road.
HEALESVILLE SHIRE	Reconstruction and realignment over 3.53 miles, north of Narbethong to provide a sealed pavement 24 feet wide.

BURWOOD HIGHWAY

NUNAWADING CITY	Construction of dual carriageways over 2.1 miles from east of Blackburn Road to Morack Road.

NEPEAN HIGHWAY

FRANKSTON CITY AND MORNINGTON SHIRE	Construction of 2 miles of dual carriageways between the Old Mornington Road and Wooralla Drive as part of Special Project No. 13.
MORNINGTON SHIRE	Realignment over 1.2 miles at Mt. Martha hill and widening a further 0.5 mile to provide a sealed pavement 24 feet wide.

BELLARINE HIGHWAY

GEELONG CITY	Reconstruction of 0.2 mile between Swanston Street and Myers Street as dual carriageways including channelisation of the Fitzroy Street intersection.
BELLARINE SHIRE	Extension of the Queenscliff carriageway by 0.5 mile between Boundary Road and Wilson Road.

BONANG HIGHWAY

ORBOST SHIRE	Widening, reconstruction and drainage improvement over 8.2 miles near Orbost in preparation for bituminous sealing.

CANN VALLEY HIGHWAY

ORBOST SHIRE	Widening, strengthening and curve improvements for 2.4 miles through Noorinbee township and for 1.25 miles north of Noorinbee to provide a 28 feet wide formation and a 20 feet wide sealed pavement.

GLENELG HIGHWAY

DUNDAS SHIRE	Reconstruction of 5.1 miles to provide a 24 feet wide pavement at Warrayure.
	Reconstruction of 2.6 miles west of Hamilton to provide a 24 feet wide pavement.

GOULBURN VALLEY HIGHWAY

SHEPPARTON SHIRE	Widening, resheeting and initial sealing of 6.1 miles to provide a pavement sealed 24 feet wide 4 miles north of Arcadia.
NUMURKAH SHIRE	Widening and resheeting to provide a 24 feet wide sealed pavement for 0.7 mile through Wunghnu including widening a reinforced concrete bridge 120 feet long to 28 feet between kerbs.
YEA SHIRE	Reconstruction of 0.6 mile and 1.0 mile east of Box Hill to provide a sealed pavement 20 feet wide.
	Reconstruction of 1.0 mile east of Yea to provide a sealed pavement 24 feet wide.

Glenelg Highway — Reconstructed section west of Hamilton.

HAMILTON HIGHWAY

NEWTOWN CITY	Widening 0.7 mile between Pakington Street and Shannon Avenue to provide a 42 feet wide sealed pavement.
CORIO SHIRE	Construction of the Geelong approach to the proposed new bridge over the Moorabool River at Fyansford.
HAMPDEN SHIRE	Construction of a reinforced concrete bridge 248 feet long and 28 feet wide between kerbs over the Mt. Emu Creek at Darlington.
	Reconstruction of 2.2 miles 24 feet wide in conjunction with the new bridge at Darlington.

HENTY HIGHWAY

WARRACKNABEAL SHIRE	Widening regrading and resheeting sections north of Kellalac over a distance of 4.0 miles to provide a pavement 24 feet wide.
KARKAROOC SHIRE	Widening priming and sealing 7.0 miles north of Woomelang turn off to provide a sealed pavement 24 feet wide.

Henty Highway — Widened and resheeted section north of Kellalac.

LODDON VALLEY HIGHWAY

GORDON SHIRE	Reconstruction of 3.8 miles north of Durham Ox to provide a sealed pavement 24 feet wide.

MIDLAND HIGHWAY

CORIO SHIRE	Construction and sealing of the southern carriageway over a distance of 0.6 mile.
	Reconstruction of 0.4 mile on Batesford Hill.
RODNEY SHIRE	Underpinning pile foundation of the No. 2 bridge at Shepparton in preparation for a deviation of the Goulburn River.
BENALLA CITY BENALLA SHIRE	Widening resheeting and initial sealing of 4.25 miles from Stockyard Creek to Benalla to provide a sealed pavement 24 feet wide.
MORWELL SHIRE	Widening and strengthening 1.1 miles south of Yinnar and including the construction of a two span reinforced concrete bridge, 28 feet wide between kerbs. The pavement is now sealed 24 feet wide.

Midland Highway — Reconstructed section south of Yinnar.

MURRAY VALLEY HIGHWAY

COBRAM SHIRE	Construction of a deviation 1.1 miles in length at Cobram to provide a sealed pavement 24 feet wide.
SWAN HILL SHIRE	Widening and reconstruction of two sections totalling 6.9 miles between Piangil and Hayesdale to provide a sealed pavement 20 feet wide.
	Reconstruction and realignment of the existing unsealed pavement over 5.5 miles west of Bannerton to provide a sealed pavement 18 feet wide.

NORTHERN HIGHWAY

KILMORE SHIRE	Widening and realignment of 0.9 mile north of the Hume Highway junction to provide a 24 feet wide sealed pavement.
PYALONG SHIRE	Widening and resheeting 0.6 mile south of Pyalong to provide a sealed pavement 24 feet wide.
WARANGA SHIRE	Reconstruction of 2.9 miles north of Runnymede to provide a sealed pavement 24 feet wide.
ROCHESTER SHIRE	Reconstruction of 3.1 miles north of Rochester to provide a sealed pavement 24 feet wide.
ECHUCA CITY	Construction of dual carriageways over 1.1 miles in High Street Echuca.

Northern Highway — Dual carriageways at Echuca.

NORTH WESTERN HIGHWAY

LEXTON SHIRE

Widening, resheeting and reconstruction of 1.5 miles at Waubra to provide a sealed pavement 24 feet wide.

Widening, resheeting and reconstruction of 1.7 miles west of Waubra to provide a sealed pavement 24 feet wide.

OMEO HIGHWAY

OMEO SHIRE

Reconstruction and realignment with easy curves of 4.5 miles south of Omeo to provide a pavement width of 20 feet.

Construction of a deviation to eliminate steep grades over 0.6 mile to provide a 22 feet wide pavement more readily trafficable in winter snow conditions.

Omeo Highway—New section south of Omeo.

TOWONG SHIRE

Reconstruction of 2.1 miles between Mitta Mitta and Eskdale to provide a sealed pavement 20 feet wide.

Reconstruction north of Mitta Mitta over a distance of 1.3 miles to provide a sealed pavement 20 feet wide.

Replacement of a bridge 50 feet long by 28 feet wide between kerbs and construction of the approaches at Eskdale.

OUYEN HIGHWAY

WALPEUP SHIRE	Reconstruction of 5.9 miles near Galah to provide a sealed pavement 20 feet wide.

OVENS HIGHWAY

BEECHWORTH SHIRE	Construction of Bluebell Deviation to eliminate two level crossings and provide a sealed pavement 24 feet wide.

PYRENEES HIGHWAY

TULLAROOP SHIRE	Widening and resheeting 1.4 miles west of Maryborough to provide a sealed pavement 24 feet wide.
AVOCA SHIRE	Reconstruction and realignment of 1.1 miles at Avoca to provide a sealed pavement 24 feet wide.

SOUTH GIPPSLAND HIGHWAY

CRANBOURNE SHIRE	Widening 3.1 miles west of Tooradin to provide a 24 feet wide sealed pavement. Widening and resheeting and curve improvement of 1.6 miles east of Tooradin to provide a sealed pavement 24 feet wide. Construction of approaches to new bridge over Bunyip and Little Bunyip Rivers including widening and resheeting to provide a sealed width of 24 feet. Widening and resheeting of 0.8 mile between Caldermeade and Lang Lang River to provide a sealed width of 24 feet.
WOORAYL SHIRE	Construction of a 14 span reinforced concrete bridge 631 feet long by 28 feet wide over the Tarwin River at Meeniyan on a deviated alignment. The new approaches provide a sealed pavement 24 feet wide. Construction of a new deviation 1.5 miles in length between Meeniyan and Stony Creek to provide a 24 feet wide sealed pavement. The work included a new railway level crossing and the installation of flashing lights at the crossing.
SOUTH GIPPSLAND SHIRE	Reconstruction and realignment of a further 1.26 miles between Stony Creek and Foster west of the Falls Road turnoff. The pavement has been sealed 22 feet wide.
ALBERTON SHIRE	Widening and strengthening a further 2.1 miles north east of Yarram to provide a sealed pavement 24 feet wide.

WARBURTON HIGHWAY

LILLYDALE SHIRE	Realignment and reconstruction over 0.6 mile at Seville Hill to provide a sealed pavement 22 feet wide with an additional climbing lane.
UPPER YARRA SHIRE	Construction of a deviation 1.3 miles in length west of Hoddles Creek to provide a sealed pavement 22 feet wide.

WIMMERA HIGHWAY

HORSHAM CITY	Widening of 0.6 mile between Darlot Street and Bennetts Road to provide a sealed pavement 40 feet wide. Strengthening and surfacing of shoulders over a distance of 2.6 miles west of Horsham.

APPENDIX 2

TOURISTS' ROADS AND FOREST ROADS

TOURISTS' ROADS

ALPINE ROAD	Reconstruction of 3.4 miles from Jim and Jack towards Cobungra to improve alignment by removing a number of sharp crests and curves.
	Development of operators quarters and plant shelter at Mother Johnson Flat five miles from the summit of Mt. Hotham to aid snow clearing operations.
DONNA BUANG ROAD	Realignment and widening of 1.3 miles to the M.M.B.W. aqueduct to provide a sealed pavement 20 feet wide.
MOUNT BUFFALO ROAD	Widening formation and drain and constructing the pavement to a sealed width of 25 feet on two sections totalling 2.24 miles.
	Reconstruction of the Dingo Dell car park in conjunction with the National Parks Authority.
MOUNT BULLER ROAD	Resheeting and sealing 2.9 miles through Mirimbah township to provide a sealed pavement 20 feet wide.
	Widening the formation to 25 feet over two sections totalling 4.55 miles.
OCEAN ROAD	Construction of traffic island at the intersection with the Anglesea Main Road at Bellbrae.
	Construction of a reinforced concrete bridge 137 feet long by 28 feet wide with two footways each 5 feet wide over the Anglesea River at Anglesea.
	Realignment in the Anglesea shopping centre in collaboration with Barrabool Shire Council.
	Reconstruction, realignment and sealing between Big Hill and Reedy Creek including the replacement of a timber bridge over Big Hill Creek with a concrete culvert.
	Reconstruction of 8.5 miles between Lower Gellibrand and Princetown to provide a sealed pavement 20 feet wide.

Ocean Road — Reconstruction between Lower Gellibrand and Princetown.

GRAMPIANS TOURISTS' ROAD	Widening Delly's Bridge over Fyans Creek from 20 feet to 26 feet wide between kerbs.
WILSONS PROMONTORY ROAD	Realignment and reconstruction of 1.4 miles between Darby River and Tidal River to provide a sealed pavement 20 feet wide.

Grampians Tourists' Road — Widening of Delly's Bridge.

FOREST ROADS

FORREST — APOLLO BAY ROAD	Reconstruction of a further 0.5 mile.
LAVERS HILL — COBDEN ROAD	Reconstruction of 1.5 miles and extension of the sealed section by 1.2 miles.
MEREDITH — STEIGLITZ — MAUDE ROAD	Realignment at Steiglitz and extension of the bituminous seal by 1.0 mile.
BRUTHEN — BUCHAN ROAD	Widening of 6.2 miles north of Bruthen to provide a sealed pavement 20 feet wide.
RED KNOB ROAD	Construction of a single span reinforced concrete bridge 59 feet long by 24 feet wide between kerbs over the Orbost railway line at Nowa Nowa together with approaches totalling 0.5 mile with a sealed pavement 20 feet wide.
WALHALLA ROAD	Widening 1.0 mile north of Walhalla to provide a 22 feet wide gravelled formation.

APPENDIX 3

MAIN ROADS

SIGNIFICANT WORKS COMPLETED DURING FINANCIAL YEAR 1967/68.

BAIRNSDALE DIVISION

AVON SHIRE	Dargo Road—Completion of a 2 mile deviation preparatory to sealing.
OMEO SHIRE	Benambra Road—Reconstruction of 1.75 miles on an improved grade and alignment to provide a sealed pavement 18 feet wide.
ORBOST SHIRE	Buchan-Orbost Road—Widening and realigning 5.8 miles preparatory to sealing at Bete Bolong.
TAMBO SHIRE	Nicholson-Tambo Upper Road—Reconstruction of 1.25 miles at Tambo Upper to improve grades and alignment to provide a formation width of 24 feet. Gelantipy Road—Widening and extension of sealed pavement 18 feet wide for a further 2 miles.

BALLARAT DIVISION

RIPON SHIRE	Beaufort-Carngham Road—Reconstruction and realignment of 3.0 miles south of the junction with the Western Highway to provide a sealed pavement 18 feet wide. Skipton Road—Reconstruction of 3.0 miles near Lake Goldsmith to provide a sealed pavement 20 feet wide.

BENALLA DIVISION

BRIGHT SHIRE	Bright-Tawonga Road—Widening the formation over a distance of 4.3 miles to provide a 21 feet wide pavement. Buckland Valley Road—Reconstruction and initial sealing of 2.9 miles to provide a sealed pavement 20 feet wide.
MANSFIELD SHIRE	Euroa-Mansfield Road—Realignment of 0.55 mile including the construction of a new bridge 60 feet long, 24 feet wide between kerbs, pavement sealed 20 feet wide.
OXLEY SHIRE	Wangaratta-Kilfeera Road—Reconstruction and realignment of 4.6 miles to provide a 20 feet wide sealed pavement.
TOWONG SHIRE	Tallangatta-Corryong Road—Reconstruction and initial sealing at Koetong Level Crossing in conjunction with the provision of flashing lights to provide a sealed pavement 18 feet wide. Yabba Road—Reconstruction and initial sealing of 3.9 miles to provide a sealed pavement 18 feet wide.
UPPER MURRAY SHIRE	Tintaldra Road—Reconstruction and initial sealing of 5.7 miles to provide a sealed pavement 18 feet wide including the construction of a bridge 22 feet long and 30 feet wide between kerbs.
YACKANDANDAH SHIRE	Dederang Road—Realignment, reconstruction and initial sealing of 0.7 mile to provide a pavement 22 feet wide ready for sealing to a width of 20 feet.
YARRAWONGA SHIRE	Tungamah-Peechelba Road—Realignment reconstruction and initial sealing of 5.6 miles to provide a sealed pavement 18 feet wide.

Tungamah-Peechelba Road — Yarrawonga Shire.

Bendigo-St. Arnaud Road — Bet Bet Shire.

BENDIGO DIVISION

BET BET SHIRE	Bendigo-St. Arnaud Road—Construction of a deviation 1.45 miles long to be sealed 20 feet wide.
COHUNA SHIRE	Cohuna-McMillans Road—Construction and sealing of 0.85 mile to provide a sealed pavement 22 feet wide including construction of a culvert.
DEAKIN SHIRE	Echuca-Kyabram Road—Widening and initial sealing of 4.15 miles to provide a sealed pavement 20 feet wide.
EAST LODDON SHIRE	Bendigo-Pyramid Road—Widening and initial sealing of 4.8 miles to provide a sealed pavement 22 feet wide.
GORDON SHIRE	Bendigo-Pyramid Road—Reconstruction and initial sealing of 3.0 miles to provide a sealed pavement 20 feet wide.
	Boort-Kerang Road—Reconstruction and initial sealing of 2.0 miles to provide a sealed pavement 20 feet wide.

	Charlton-Durham Ox Road—Reconstruction and initial sealing of 2.0 miles to provide a sealed pavement 20 feet wide.
	Pyramid-Durham Ox Road—Reconstruction and initial sealing of 3.2 miles to provide a sealed pavement 20 feet wide.
KERANG SHIRE	Koondrook-Murrabit Road—Reconstruction and initial sealing of 6.7 miles to provide a pavement sealed 20 feet wide.
	Murrabit Road—Construction of a bridge over Pyramid Creek, 90 feet long by 22 feet wide between kerbs.
MARONG SHIRE	Bendigo-Eddington Road—Widening and initial sealing of 5.3 miles to provide a 20 feet wide sealed pavement.
STRATHFIELDSAYE SHIRE	Strathfieldsaye Road—Widening and initial sealing of 5.0 miles to provide a sealed pavement 22 feet wide.
SWAN HILL SHIRE	Nyah-Ouyen Road—Reconstruction of 7.6 miles to provide a gravel pavement 14 feet wide.
	Ultima Road—Reconstruction and initial sealing of 3.3 miles to provide a sealed pavement 20 feet wide.
WARANGA SHIRE	Heathcote-Rochester Road—Widening and initial sealing of 2.0 miles to provide a sealed pavement 20 feet wide.
	Tatura-Rushworth Road—Widening and initial sealing of 2.0 miles to provide a sealed pavement 20 feet wide.

Korumburra-Wonthaggi Road — Bass Shire.

DANDENONG DIVISION

BASS SHIRE	Korumburra-Wonthaggi Road—Reconstruction and realignment of 2.5 miles north of Wonthaggi.
DONCASTER AND TEMPLESTOWE CITY	Heidelberg-Warrandyte Road—Intersection treatment at Taroona Avenue south of Warrandyte.
HASTINGS SHIRE	Frankston-Flinders Road—Construction of dual carriageways over 0.25 mile at Tyabb.
KNOX SHIRE	Dorset Road—Construction of a new western carriageway, 0.75 mile in length, north of Boronia.
LILLYDALE SHIRE	Lilydale-Montrose Road—Reconstruction and realignment of 1.1 miles northerly from Olinda Creek.

NUNAWADING CITY	Canterbury Road—Construction of 1.0 mile of dual carriageways easterly from Mount Pleasant Road including a channelized intersection with Boronia Road and Mitcham Road, Vermont.
SPRINGVALE CITY	Springvale Road—Construction of 0.9 mile of the new eastern carriageway southerly from the Main Gippsland railway line.
WAVERLEY CITY	Ferntree Gully Road—Completion of dual carriageways over 0.75 mile easterly from Huntingdale Road.
YEA SHIRE	Yarra Glen-Glenburn Road—Construction of a deviation over 1.3 miles between Ton Bridge and north of West Bridge to provide a sealed pavement 22 feet wide.

GEELONG DIVISION

BACCHUS MARSH SHIRE	Bacchus Marsh-Balliang Road—Reconstruction of 1.5 miles to provide a sealed pavement 18 feet wide.
BELLARINE SHIRE	Barwon Heads-Ocean Grove Road—Construction of traffic islands at the intersection with the Wallington-Ocean Grove Road at Ocean Grove.
BULLA SHIRE	Mickleham Road—Construction of 1.6 miles to provide a sealed pavement 18 feet wide.
COLAC SHIRE	Colac-Ballarat Road—Reconstruction and widening of 1.1 miles to provide a sealed pavement 24 feet wide. Corangamite Lake Road—Extension of the 12 feet wide bituminous seal for a distance of 1.5 miles.
COLAC CITY	Colac-Beech Forest Road—Construction of traffic islands at the Wilson Street intersection.
GEELONG CITY	Geelong-Portarlington Road—Construction of traffic islands at the Garden Street intersection.
LEIGH SHIRE	Colac-Ballarat Road—Reconstruction of 3 miles to provide a sealed pavement 18 feet wide. Rokewood-Shelford Road—Reconstruction of 2.4 miles to complete the widening between Geelong and Rokewood to a sealed pavement 18 feet wide.
MELTON SHIRE	Keilor-Melton Road—Widening of the bridge over Kororoit Creek to 28 feet between kerbs.
OTWAY SHIRE	Beech Forest-Lavers Hill Road—Reconstruction of 2.8 miles and sealing of the pavement enabling the 5 ton axle load limit to be lifted. Colac-Forrest Road—Reconstruction and sealing at Forrest. Gellibrand River Road—Extension of the sealed pavement by 1 mile.
ROMSEY SHIRE	Melbourne-Lancefield Road—Reconstruction of 2 miles to provide a sealed pavement 18 feet wide.
SOUTH BARWON SHIRE	Barrabool Road—Reconstruction of 1 mile between Moorabool Street Bridge and Princes Bridge to provide a sealed pavement 24 feet wide.
WINCHELSEA SHIRE	Birregurra-Deans Marsh Road—Widening of the sealed pavement over 2.2 miles to provide a width of 18 feet.

HORSHAM DIVISION

BIRCHIP SHIRE	Birchip-Warracknabeal Road—Reconstruction, widening and initial sealing of 2.4 miles to provide a sealed pavement 18 feet wide.
DIMBOOLA SHIRE	Rainbow River Road—Construction of a two span reinforced concrete bridge over Outlet Creek, 50 feet long by 24 feet wide between kerbs.

DUNMUNKLE SHIRE	Stawell-Warracknabeal Road—Reconstruction widening and initial sealing of 2.2 miles to provide a sealed pavement 18 feet wide.
KANIVA SHIRE	South Lillimur Road—Reconstruction widening and initial sealing of 2.3 miles to provide a sealed pavement 18 feet wide.
KARA KARA SHIRE (Joint Stawell Shire)	Navarre Road—Construction west of Navarre township of two span reinforced concrete bridge 40 feet long by 24 feet wide between kerbs.
KOWREE SHIRE	Kaniva-Edenhope Road—Widening the pavement over 7.45 miles to provide an 18 feet wide sealed pavement.
STAWELL SHIRE	Stawell-Warracknabeal Road—Construction of a three span prestressed concrete slab deck bridge 90 feet long by 24 feet wide between kerbs over Brim Creek south of Glenorchy Township.
WIMMERA SHIRE	Grampians Road—Reconstruction, widening and initial sealing of 3.2 miles to provide a sealed pavement 18 feet wide. Kalkee Road—Reconstruction strengthening and initial sealing of 4.4 miles to provide a sealed pavement 18 feet wide.

Grampians Main Road — Wimmera Shire.

METROPOLITAN DIVISION

ALTONA SHIRE	Millers Road—Continuation of reconstruction and duplication between Civic Parade and Kororoit Creek Road.
FOOTSCRAY CITY	Hyde Street—Continuation of reconstruction and duplication between Napier Street and Somerville Road.
HAWTHORN CITY	Barkers Road—Continuation of reconstruction and widening between Auburn Road and Burke Road.
HEIDELBERG CITY	Heidelberg-Eltham Road—Continuation of reconstruction and widening between St. James and Lower Plenty Roads.
KEW CITY	Studley Park Road—Continuation of reconstruction between High Street and The Boulevard.
MOORABBIN CITY	North Road—Completion of reconstruction and duplication between Grange Road and East Boundary Road.
OAKLEIGH CITY	Doncaster-Mordialloc Road—Completion of reconstruction and widening between Ferntree Gully Road and Princes Highway East.

PRESTON CITY	Whittlesea Road—Continuation of reconstruction and duplication between Barwon Avenue and Curtain Street including construction of a second bridge over Darebin Creek.
SANDRINGHAM CITY	Beach Road—Continuation of the programme for improvements and strengthening between New Street and Black Rock.
ST. KILDA CITY	Beach Road—Completion of the construction of new twin bridges over Elwood Canal and road duplication of Shakespeare Grove.
WILLIAMSTOWN CITY	Kororoit Creek Road—Continuation of reconstruction between Douglas Parade and the municipal boundary, including the provision of boom gates at North Williamstown level crossing and channelisation at the intersection of Champion Road, Victoria Street and Swanston Street.

TRARALGON DIVISION

ALBERTON SHIRE	Albert River-Welshpool Road—Reconstruction and realignment of 1.8 miles to Binginwarri to provide a 20 feet wide gravel pavement.
BULN BULN SHIRE	Main Neerim Road—Reconstruction of 1.5 miles north of Neerim South to provide a sealed pavement 20 feet wide.
KORUMBURRA SHIRE	Korumburra-Wonthaggi Road—Construction of a new reinforced concrete bridge 105 feet long by 24 feet wide between kerbs over Foote Creek.
MORWELL SHIRE	Morwell-Thorpdale Road—Reconstruction and realignment of two sections totalling 2 miles south of Morwell to provide a 20 feet wide sealed pavement.
ROSEDALE SHIRE	Seaspray Road—Reconstruction and widening of 7.6 miles south of Longford to provide a sealed pavement 20 feet wide.
SOUTH GIPPSLAND SHIRE	Amey's Track—Reconstruction and realignment of 2.0 miles near Foster to provide a sealed pavement 18 feet wide.
TRARALGON SHIRE	Traralgon Creek Road—Reconstruction and widening over 3.2 miles south of Traralgon to provide a sealed pavement 20 feet wide.
WARRAGUL SHIRE	Brandy Creek Road—Realignment, regrading and reconstruction of 1.6 miles north of Warragul township to provide a sealed pavement 20 feet wide. Lardners Track—Reconstruction, including realignment to provide 2.7 miles of 18 feet wide sealed pavement.

WARRNAMBOOL DIVISION

BELFAST SHIRE	Hamilton Road—Reconstruction, realignment and sealing 1.0 mile to provide a sealed pavement 20 feet wide.
DUNDAS SHIRE	Hamilton-Port Fairy Road—Reconstruction widening and sealing of 1.6 miles to provide a sealed pavement 20 feet wide. Mt. Napier Road—Reconstruction, widening and sealing of 1.6 miles to provide a sealed pavement 20 feet wide.
HEYTESBURY SHIRE	Cobden-Port Campbell Road—Regrading and forming 0.6 mile, 22 feet wide.
PORTLAND SHIRE	Dartmoor-Hamilton Road—Resheeting and sealing of 4.4 miles to provide a sealed pavement 20 feet wide.

APPENDIX 4

UNCLASSIFIED ROADS

SIGNIFICANT WORKS COMPLETED DURING FINANCIAL YEAR 1967/68.

BAIRNSDALE DIVISION

BAIRNSDALE SHIRE	Paynesville Ferry—Completion of structural work on the new ferry which will have a load capacity 40 tons.
TAMBO SHIRE	Nicholson-Tambo Upper Road—Reconstruction of 1.25 miles to improve grades and alignment providing a formation 24 feet wide in preparation for a sealed pavement.
	Wallers Road—Improvement of access to the Glenaladale National Park by extension of Wallers Road and construction through the park for a distance of 1.6 miles to provide a gravel pavement 24 feet wide and a car park/turning area.

Wallers Road — Access to Glenaladale National Park.

BALLARAT DIVISION

ARARAT SHIRE	Mount William Road—Construction of "Travellers Rest" three span bridge 120 feet long by 22 feet wide between kerbs over Fiery Creek.

BENALLA DIVISION

BENALLA SHIRE	Samaria Road—Reconstruction and initial sealing of 4.75 miles to provide a 20 feet wide pavement sealed 12 feet wide.
	Rules Road—Construction of a two span bridge 61 feet 6 inches long by 12 feet wide between kerbs to replace the bridge destroyed by the flood in December 1966.
EUROA SHIRE	Creighton's Creek Road—Replacement of two bridges 65 feet and 35 feet long each 22 feet wide between kerbs.
GOULBURN SHIRE	Nagambie-Locksley Road—Reconstruction and initial sealing of 2.1 miles to provide a pavement 16 feet wide sealed 12 feet wide.
YACKANDANDAH SHIRE	Mullalong Road—Reconstruction and initial sealing of 3.1 miles to provide a 20 feet wide pavement sealed 12 feet wide.

BENDIGO DIVISION

BENDIGO CITY	Belle Vue Road—Construction and initial sealing of 0.6 mile with a sealed pavement 22 feet wide.
COHUNA SHIRE (Joint Kerang Shire)	Flannery's Road—Construction of a bridge 90 feet long by 22 feet wide between kerbs over Pyramid Creek.
DEAKIN SHIRE	Tongala-Undera Road—Construction and initial sealing of 1.6 miles to provide a sealed pavement 18 feet wide.
ECHUCA CITY	High Street—Reconstruction and initial sealing of 1.1 miles to provide in conjunction with duplication of the highway two additional lanes each 9 feet 6 inches wide.
KERANG SHIRE	Kerang-Leitchville Road—Construction of a new bridge 90 feet long by 24 feet wide between kerbs and its approaches.
MILDURA CITY	Thirteenth Street—Reconstruction and initial sealing of 0.4 mile with a sealed pavement 48 feet wide.
SWAN HILL	Robinvale Settlement Road—Sealing of 8.24 miles, 12 feet wide.
WARANGA SHIRE (Joint Huntly Shire)	Barnedown Road—Construction of a bridge 227 feet long by 22 feet wide between kerbs over the Campaspe River.
WYCHEPROOF SHIRE	Nullawil-Birchip Road—Reconstruction and initial sealing of 2.5 miles to provide a sealed pavement 12 feet wide.

DANDENONG DIVISION

ALEXANDRA SHIRE	Taylor Bay Road—Construction as part of Special Project No. 12 of 5.3 miles of new road for tourists from Haines Saddle to Maintongoon Road. Devils River Road (Fraser National Park)—Widening, re-sheeting and sealing of 2.3 miles from Haines Saddle to Coller Bay to provide an 18 feet wide sealed pavement.
FLINDERS SHIRE	Cape Schanck Road—Reconstruction of 1.0 mile commencing 0.5 mile south of the Rosebud-Flinders Road.
HASTINGS SHIRE	Bayview Road and Long Island Drive—Construction of 2.0 miles to provide access to the Westernport development area.
KNOX SHIRE	Scoresby Road—Reconstruction and widening of 1 mile northerly from Boronia Road.
RINGWOOD CITY	Wonga Road—Reconstruction and widening of 0.3 mile north easterly from the Ringwood-Warrandyte Road.

Old Belgrave Road — Sherbrooke Shire.

SPRINGVALE CITY	Springvale Road—Construction of a pedestrian underpass at Springvale shopping centre.
SHERBROOKE SHIRE	Old Belgrave Road—Reconstruction of 0.3 mile westerly from the Monbulk Road at Upwey.

GEELONG DIVISION

BANNOCKBURN SHIRE	Bannockburn-Maude Road—Realignment of 0.5 mile at Russell's Bridge and major repairs to the bridge over the Moorabool River.
BULLA SHIRE	Oaklands-Cragieburn Road—Sealing 1.5 miles 12 feet wide to complete the sealed pavement to Craigieburn. Widening of 0.75 mile near the shopping centre.
COLAC CITY (Part Colac Shire)	Pound Road—Construction and sealing of 1.0 mile.
COLAC SHIRE	Barpinda-Porneet Road—Extension of the 12 feet wide sealed pavement by 1.0 mile.
CORIO SHIRE	Sandy Creek Road—Construction and sealing of 2.8 miles near the You Yang sand pits to provide a sealed pavement 20 feet wide. Granite Road—Extension of the 20 feet wide sealed pavement by 1.3 miles to Tuckers pit.
GEELONG CITY	Gheringhap Street—Construction and sealing of 0.8 mile to provide a 48 feet wide pavement. Currier Street—Construction of a low level bridge 196 feet long and 20 feet wide on top of the breakwater over the Barwon River at South Geelong.
GISBORNE SHIRE	Riddell-Sunbury Road—Realignment, surfacing and sealing of 1.8 miles to provide a sealed pavement 18 feet wide.
KYNETON SHIRE	Lancefield-Mia Mia Road—Extension of the 18 feet wide sealed pavement by 1.0 mile.
LEIGH SHIRE	Mount Mercer-Dereel Road—Replacement of an old concrete bridge by a twin cell 72 inch diameter reinforced concrete pipe culvert.
OTWAY SHIRE	Carlisle-Colac Road—Reconstruction of a further 2.0 miles towards the Colac Shire boundary.
ROMSEY SHIRE	Bolinda-Durraweit Road—Reconstruction of a further 1.5 miles.
BARWON SHIRE	Breakwater Road—Construction of 0.5 mile to link Barwon Heads Road with the new bridge at the breakwater. South Valley Road—Extension of the reconstruction southwards towards Princes Highway West.
WERRIBEE SHIRE	Fitzgeralds Road—Widening 2.0 miles to provide a sealed pavement 24 feet wide to the shire boundary. Derrimut Road—Widening 2.0 miles to provide a sealed pavement 24 feet wide.
WINCHELSEA SHIRE	Cape Otway Road—Construction and sealing of the final 2.0 miles between Princes Highway West at Moriac and Birregurra. Rifle Butts Road—Construction and sealing of 2.0 miles to complete the sealed pavement.

HORSHAM DIVISION

ARAPILES SHIRE (Joint Kowree Shire)	Telangatuk East Road—Reconstruction and initial sealing of 2.5 miles to provide a sealed width of 12 feet.
DIMBOOLA SHIRE	Rainbow-Nhill Road—Reconstruction, widening and initial sealing of 2.0 miles to provide a sealed width of 12 feet.

KANIVA SHIRE	Serviceton Road North—Reconstruction, widening and initial sealing of 6.0 miles to provide a sealed width of 18 feet.
KARA KARA SHIRE	McIntyres Road—Construction of Langdon's Bridge; a three span prestressed concrete beam and reinforced concrete bridge 120 feet long and 20 feet wide between kerbs.

McIntyres Road — Construction of Langdon's Bridge — Kara Kara Shire.

KOWREE SHIRE	Harrow-Clear Lake Road—Construction of a three span reinforced concrete bridge 75 feet long by 22 feet wide between kerbs over Salt Creek just east of Harrow.
LOWAN SHIRE	Nhill-Gymbowen Road—Reconstruction of 2.0 miles to provide a sealed pavement 18 feet wide.
STAWELL SHIRE	Mt. William Access Road—Construction of 1.28 miles from the turntable to the summit providing a sealed pavement 18 feet wide.
WIMMERA SHIRE	Mt. Difficult Lookout Access Road—Surfacing and regrading of 3.5 miles from Mt. Victory Tourists' Road to the Lookout.

BIG DESERT ROADS

KANIVA SHIRE	Construction of 9.92 miles of roads in the AMP Development Area—Boundary Road, Chappel Road and Murrawong North Road.
LOWAN SHIRE	Millers Road—Clearing, forming and spreading clay and sandstone surfacing over 1.9 miles, 28 feet wide.

METROPOLITAN DIVISION

ALTONA SHIRE	Mason Street—Completion of dual carriageways between Mills Road and Hansen Street.
BOX HILL CITY	Station Street—Continuation of the reconstruction and widening northerly from Maroondah Highway.
FOOTSCRAY CITY	Hopkins Street—Completion of reconstruction and duplication between Moreland Road and Moore Street.
PRESTON CITY	Kingsbury Drive—Construction of a new bridge 260 feet long by 40 feet wide between kerbs on the new road through Latrobe University.
SOUTH MELBOURNE CITY	Canterbury Road—Completion of the reconstruction and duplication between Frazer Street and Mills Street.

Canterbury Road — St. Kilda City.

TRARALGON DIVISION

ALBERTON SHIRE	Darriman-Seaspray Road—Reconstruction and sealing of 1.5 miles east of the South Gippsland Highway at Darriman to provide a sealed pavement 12 feet wide.
KORUMBURRA SHIRE	Anderson's Inlet Road—Reconstruction of 1.0 mile between the South Gippsland Highway and the Korumburra-Wonthaggi Road to provide an unsealed pavement 20 feet wide.
MOE CITY	Thompsons Road—Reconstruction and sealing of 1.1 miles to provide a sealed pavement 22 feet wide.
WARRAGUL SHIRE	Gainsborough Road—Reconstruction and sealing of 1.6 miles south of Darnum to provide a pavement sealed 12 feet wide.

WARRNAMBOOL DIVISION

SHIRE OF HAMPDEN (Joint with Ripon Shire)	Vite Vite-Skipton Road—Construction of a new bridge 120 feet long by 24 feet wide between kerbs over Mt. Emu Creek.
MORTLAKE SHIRE	Warings Lane—Resheeting 4 miles to provide 16 feet wide pavement.
PORTLAND SHIRE	Portland-Nelson Road—Reconstruction of 3.2 miles to provide a 20 feet wide pavement.

APPENDIX 5

MOTOR REGISTRATION

Registrations effected during the year under the Motor Car Act totalled 1,343,501, an increase of 10.0 per cent. on the registrations effected during the previous year. But as the bulk of the increase occurred in the number of trailers due to new legislation on private trailers, it should be noted that if trailers were excluded from this table, the increase would be only 3.2%.

Vehicle	Financial Year 1966/67		Financial Year 1967/68		Increase	Decrease
Private —						
New	87,996		99,293			
Secondhand						
Re-registered	28,869		30,321			
Renewals	855,709		880,806			
		972,574		1,010,420	37,846	—
Commercial and Hire —						
New	13,596		14,467			
Secondhand						
Re-registered	4,342		4,525			
Renewals	110,284		109,592			
		128,222		128,584	362	—
Primary Producers' Trucks —						
New	5,176		3,732		—	
Secondhand						
Re-registered	4,563		3,946			
Renewals	74,378		75,082			
		84,117*		82,760†	—	1,357
Licences under Motor Omnibus Act		792		799	7	
Trailers		22,934		106,614	83,680	
Motor Cycles		12,713		14,324	1,611	
TOTAL		1,221,352		1,343,501	123,506	1,357

*Includes 42,594 No Fee Tractors

†Includes 42,407 No Fee Tractors

APPENDIX 6

COUNTRY ROADS BOARD

STATEMENT OF RECEIPTS AND PAYMENTS FOR YEAR ENDED 30TH JUNE, 1968
(Adjusted to nearest dollar)

—		Country Roads Board Fund		Loan Funds	Commonwealth Aid Roads				Total
		Act 6229	Act 6222 Road Maintenance Account		Act 1964 Sec. 5 (1)	Act 1964 Sec. 5 (2)			
RECEIPTS	$	$	$	$	$	$	$	$	$
Balance as at 1st July, 1967		2,299,798	..	..	..	..	..	..	2,299,798
Motor Car Act 1958 (No. 6325)									
Motor Car Registration Fees	26,915,180								
Additional Registration Fees	1,702,683								
Drivers' Licence Fees	694,995								
Drivers' Licence Testing Fees	232,507								
Trailer Registration Fees	454,132								
Examiners' Licence Fees	7,990								
Sale of Log Books	21,684								
	30,029,171								
Less Cost of Collection	3,223,835	26,805,336	..	..	..	..	..	26,805,336	
Municipalities Contributions—									
Permanent Works — Main Roads	97,118								
Maintenance Works — Main Roads	1,748,221	1,845,339	..	..	..	..	..	1,845,339	
Commercial Goods Vehicles Act No. 6222		..	7,247,589	..	..	..	..	7,247,589	
Public Works Loan Application Act No. 7649		700,000	..	..	..	..	..	700,000	
Fines — *Country Roads Act* No. 6229		3,807	..	..	..	..	..	3,807	
General Receipts		376,311	..	..	..	..	..	376,311	
State Loan Funds — Act No. 6229		..	..	987,000	..	..	..	987,000	37,965,382
Commonwealth Aid Roads Act 1964		..	..	..	18,380,641	12,514,479	..	..	30,895,120
		32,030,591	7,247,589	987,000	18,380,641	12,514,479	..	..	71,160,300
PAYMENTS									
Road Expenditure									
Main Roads—									
Construction and Reconstruction		8,122,731	..	354,732	3,825,731	..	12,303,194	..	
Maintenance		2,219,778	2,232,232	..	13,901	..	4,465,911	16,769,105	
State Highways—									
Construction and Reconstruction		4,908,893	..	632,268	6,193,582	..	11,734,743	..	
Maintenance		333,652	5,015,357	..	..	..	5,349,009	17,083,752	
By-pass Roads—									
Construction and Reconstruction		2,641,486	..	..	4,736,781	..	7,378,267	..	
Maintenance		128,596	..	..	..	..	128,596	7,506,863	
Tourists' Roads—									
Construction and Reconstruction		598,699	..	..	1,181,113	650,139	2,429,951	..	
Maintenance		427,252	..	..	..	..	427,252	2,857,203	
Forest Roads—									
Construction and Reconstruction		..	..	..	..	424,409	424,409	..	
Maintenance		..	..	..	..	233,989	233,989	658,398	
Unclassified Roads—									
Construction and Reconstruction		..	..	..	2,203,567	9,075,291	11,278,858	..	
Maintenance		..	..	..	58,780	2,130,651	2,189,431	13,468,289	
Murray River Bridges and Punts		82,276	..	..	..	..	..	82,276	
Traffic Line Marking		239,683	..	..	..	..	..	239,683	58,665,569
Statutory Payments									
Interest and Sinking Fund	2,189,778								
Metropolitan Transportation Survey	15,948								
Traffic Commission Fund	29,779								
Tourist Fund	517,430								
Transport Regulation Fund	403,939								
Transportation Research	5,000	3,161,874	..	..	..	..	..	..	3,161,874
Contribution to Australian Road Research Board		..	..	..	167,186	..	..	..	167,186
Capital Expenditure									
Plant Replacements and Additions	1,234,356								
Buildings, Workshops, etc.	745,814	1,980,170	..	..	..	..	..	..	1,980,170
Management and Operating Expenditure		5,816,225	..	..	..	..	..	..	5,816,225
		30,661,315	7,247,589	987,000	18,380,641	12,514,479	..	..	69,791,024
Balance at 30th June, 1968		1,369,276	..	..	..	..	..	..	1,369,276

NOTE: Relief to Municipalities granted under Act 6229 Section 32 amounted in 1967/68 to $37,015.49.

R. G. COOPER,
Accountant,
12th November, 1968.

AUDITOR GENERAL'S CERTIFICATE

The accounts of the Country Roads Board for the year ended 30th June, 1968, have been audited. In my opinion the above Statement of Receipts and Payments fairly presents in summary form the transactions during that period.

A. J. A. GARDNER,
Auditor General,
21st November, 1968.

APPENDIX 7

COUNTRY ROADS BOARD

LOAN LIABILITY AS AT 30TH JUNE, 1968

	Main Roads etc.	Developmental Roads	Total
	$	$	$
Permanent Works			
Main Roads	16,450,915.71		16,450,915.71
State Highways	15,506,710.65		15,506,710.65
Tourists' Roads	227,316.44		227,316.44
Forest Roads	2,167.89		2,167.89
Developmental Roads		12,851,515.09	12,851,515.09
Discount and Expenses	680,869.66	571,843.72	1,252,713.38
Total Amount Borrowed	32,867,980.35	13,423,358.81	46,291,339.16
Less Redemption of Loans			
Redemption Funds	170,438.11	1,292,772.73	1,463,210.84
Main Roads Sinking Fund	571,376.76		571,376.76
Developmental Roads Sinking Fund		110,166.02	110,166.02
State Loans Repayment Fund	2,873,685.47		2,873,685.47
National Debt Sinking Fund	4,966,124.52	5,327,920.15	10,294,044.67
	8,581,624.86	6,730,858.90	15,312,483.76
Loan Liability at 30th June, 1968	24,286,355.49	6,692,499.91	30,978,855.40

APPENDIX 8

WORKS EXECUTED ON BEHALF OF COMMONWEALTH AND STATE GOVERNMENT AUTHORITIES ETC. FOR THE YEAR ENDED 30TH JUNE, 1968

(Adjusted to nearest dollar)

Departments	Description of Works	Expenditure	
		$	$
Commonwealth—			
Department of Works	Access roads to various Commonwealth establishments and to Tullamarine Freeway.	124,696	
			124,696
Victoria—			
Lower Yarra Crossing Authority	Authority's share of costs of acquiring land in connection with Williamstown Road Interchange as part of Lower Yarra Crossing Project.	222,991	
State Rivers and Water Supply Commission	Construction of various bridges over Commission Channels, completion of roadworks in connection with Lake Nillahcootie deviation.	26,194	
Rural Finance and Settlement Commission	Roads in Commission land settlement projects throughout the State.	99,098	
Lands and Survey Department	Roadworks in Kaniva and Lowan Shires.	50,349	
Public Works Department	Bituminous sealing of Ararat Mental Hospital Grounds.	4,817	
Melbourne City Council	Roadworks and bridgeworks on Dynon Road Bridge over railway line and approaches.	569,306	
Melbourne and Metropolitan Board of Works	Roadworks in Healesville Shire.	2,536	
Premier's Department	Roadworks — Wonderland and Sundial Roads — Stawell Shire.	600	
			975,891
State Treasury	Kings Bridge — Land compensation and sundry expenditure less proceeds of rental of properties acquired in connection with the construction of Kings Bridge.	46,484	
" "	Grade separation projects, etc., charged to Level Crossings Fund ($125,496.14) and Railways Department ($356,962.84).	482,459	
" "	Construction of roads and bridges charged to Roads (Special Projects) Fund.	2,652,122	
" "	Maintenance and reconstruction of various roads in providing unemployment relief in drought affected areas.	260,859	
			3,441,924
			4,542,511

APPENDIX 9

CHIEF ENGINEER'S REPORT

Country Roads Board
Melbourne
November, 1968

THE CHAIRMAN,

Sir,

I have the honour to report on matters of technical interest carried out during the year 1967/68. The report is divided into four major subdivisions corresponding to the four sub-branches of the Chief Engineer's Branch, followed by some matters of a general engineering nature.

WORKS SUB-BRANCH

1. ROAD CONSTRUCTION AND MAINTENANCE

BATTER STABILISATION

Earthworks at the eastern end of the Princes By-pass Road at Moe required cuttings up to 50 feet deep in a hard clay which is easily eroded by water. The cut batters were excavated to a 1½ horizontal to 1 vertical slope with a smooth and uniform surface.

Catch drains were constructed at the top of the batters. However, the amount of rain falling on the batter area was sufficient to cause serious scouring during the first winter. Plate 1 indicates the extent of the erosion after a very brief period of service.

Stabilisation of 30,000 square yards of batter surface was undertaken to stop the erosion.

The work was carried out as follows:—

(a) The top of the batter was rounded off. In the initial stages loam was spread to 12 inches depth in an attempt to restore uniformity of the batter. The first heavy rain caused the loam to slump in isolated areas, which were repaired. Following this experience, the depth of loam was limited to 2 inches. Grass roots will penetrate this depth into the clay and thus help to stabilise the surface.

(b) The batter face was then covered with oaten hay spread out at a rate of 5 tons per acre, giving a loose cover of approximately 3 inches. Meadow hay was not used, as it contains seeds which encourage weed growth.

The hay was held to the batter surface with 48 inches wide 4 inch x 4 inch 18 gauge galvanised wire mesh. The mesh was fixed to the upper end of the batter by burying its end in an 18 inch deep trench immediately above the rounded crest (Figure 1). The mesh was anchored to the batter face by ¼ inch mild steel hooks, 15–18 inches long, driven into the batter at 24 inch centres.

Where necessary, work was performed from 60 feet extension ladders laid on the batter slopes.

(c) A complete fertilizer was broadcast at a rate of ½ ton per acre. This was followed by a seed mixture per acre of:—

Wimmera Rye	40 pounds
Cluster Clover	20 pounds
Subterranean Clover	20 pounds
Dry Land Brown Top	20 pounds

A very quick cover growth resulted (Plate 2).

The average cost of the work per square yard was as follows:—

Preparatory work — trimming, loaming, etc.	20 cents
Covering and planting:	
Materials — hay, mesh, fertilizer, seed, etc.	23 cents
Labour	32 cents
Total	75 cents

It is considered that if stabilisation of cut batters is intended from the outset, roughing of the batter surface would be an advantage. A serrated blade was used on a grader on part of the Moe By-pass work and gave satisfactory results.

Future planting of mesembryanthemum on the Moe batters is proposed, to provide an attractive cover.

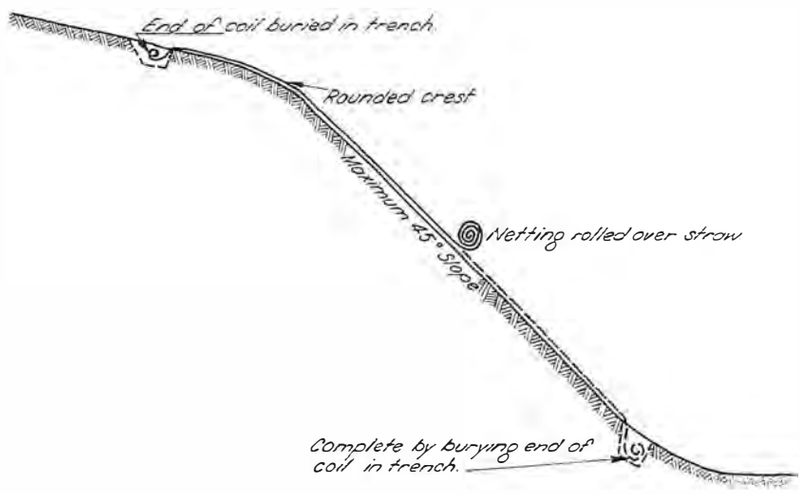


Figure 1 — Batter Stabilisation.
Cross Section showing Method of Securing Straw with Wire Mesh.

Plate 1 — Batter Stabilisation, Princes By-pass Road, Moe.
Erosion Effects on Unstabilised Batter before Treatment.

Plate 2 — Batter Stabilisation, Princes By-pass Road, Moe.
Cover Growth for Stabilisation after Treatment.

Subsurface Drainage Pipes

The Board has recently used polyvinyl chloride subsurface drainage pipes as an alternative to conventional clay agricultural drainage pipes, in circumstances where the weight of the clay pipes, and the time consumed in laying them, were considered to be serious disadvantages.

The following table sets out information regarding the various sizes of this p.v.c. pipe that are obtainable:—

Internal diameter (inches)	1.50	2.36	2.87	4.00
Coil length (feet)	1,000	800	660	400
Price per foot (1 coil)	$0.085	$0.125	$0.200	$0.330

Coupling sockets, end plugs and elbows are available.

The pipe is corrugated, and flexible enough to roll into coils of between six and eight foot diameter. However, in cold weather, flexibility is reduced considerably, and the pipe tends to retain a permanent bend after uncoiling. It must be stored in shade, as it deteriorates after prolonged exposure to sunlight.

The pipe is slotted on three longitudinal lines for the ingress of water. The inlet area is approximately one square inch per lineal foot of pipe, which is about one-third that of clay pipe. Good results have been obtained in all cases of use of these p.v.c. pipes for subsurface drainage.

It is doubtful whether the p.v.c. pipe could withstand traffic loads if installed transversely under a pavement, even if carefully bedded. However, it can be used satisfactorily in longitudinal drains outside the edge of the pavement. The flexible quality of the pipe allows faster preparation of the bottom of the trench than is the case for clay pipe. Care must be taken to remove sharp protrusions from trenches, to avoid puncturing the pipe.

A typical application of this pipe was in arresting subsurface seepage over a length of several hundred feet of roadway in a cutting on the Warburton Highway at Launching Place. The pipe was placed in a trench excavated in clay and mudstone to a depth of 18 inches below subgrade in the table drain. Due to the very light weight of the pipe, two men were able to lay 1,000 feet in 10 minutes. Eighty-one cubic yards of filter material comprising coarse sand and ½ inch aggregate mixture was placed in the trench around the pipe in a further 1¼ hours. The operation was carried out at a faster rate than would be possible with clay pipes, because of the absence of risk of displacing the p.v.c. pipe.

Although the use of p.v.c. pipe results in a considerable reduction in costs of handling, transportation, placing and backfilling, this saving is largely offset by the increased cost of

the pipe, compared with clay pipe. As a result, the overall costs of underground drainage using either type of pipe are comparable. There may be a warrant for the use of p.v.c. pipe when time and shortage of skilled labour are the critical factors.

Plate 3 — Sand Drift Control.
Sand Drift Across Roads, Before Application of Control Measures.

Plate 4 — Sand Drift Control.
Machine Designed by Soil Conservation Authority for Production of Slat Fencing.

Sand Drift Control

The increasing popularity of Victoria's ocean beaches is causing denuding of coastal sand dunes in some areas, and in some places sand drifts from these denuded areas present a constant road maintenance problem (Plate 3).

The 1962/63 Annual Report described some work done on this problem in 1962 when a denuded area at Fairhaven on the Ocean Road was successfully re-established using brush fences and marram grass plantings. For this type of work improved techniques have since been developed by the Board in consultation with the Soil Conservation Authority.

The major development has been the replacement of brush fencing with 3 feet high timber slat fencing supported on 4 inch diameter treated pine posts at approximately 22 feet centres. The slat fencing consists of 1 inch x 3/8 in. timber slats 3 feet long sewn together at 1 inch spacings with two pairs of 16 gauge high tensile wires 21 inches apart, and is made up in a simple hand operated wire twisting machine of Soil Conservation Authority design (Plate 4).

The slat fences cause a reduction in wind velocity on their leeward side and when set across the prevailing winds cause a drift to be built up in the lee of the fence. This effect is used to close off the main erosion gullies in the dunes by setting slat fencing across the mouth of the gully against the prevailing on-shore winds, until the mouth is eventually covered with sand by the resulting drift. A new slat fence is then built on top of this drift and the process continued until the gully is closed off, after which marram grass plantings are used finally to establish vegetative cover.

During 1967 these techniques were successfully used to commence re-establishment of 10 acres of sand drift areas adjacent to the road along the bluff between Barwon Heads and Torquay.

Six major drift areas were involved covering a total of 23 eroding sand gullies. These areas were first fenced off for their full perimeter with a total length of 130 chains of 5 feet high plain and barbed wire fencing to control pedestrian access. Then 30 chains of slat fences were erected across the gully entrances, inside the boundary fences but close to the beach (Plate 5). Bared areas behind the gully entrances were levelled off by horse and scoop and planted down with marram grass.

The marram grass was planted by hand in rows 10 inches apart with shoots at 8 inch centres. Granulated complete-fertilizer pellets were placed in the grass root zone during planting and these assisted in obtaining a good strike (98%) in spite of the prevailing drought conditions.

The slat fences are also working as planned (Plate 6) and the substantial closing drifts already developed suggest that total re-establishment of the area can be anticipated within about 5 years.

Plate 5 — Sand Drift Control.
Slat Fence Erected Across Gully Entrance.

Plate 6 — Sand Drift Control.
Closing Drift Built Up Behind Slat Fence.

Purchase of Quarry Products by Weight

In July, 1967, members of the Crushed Stone Association in the Melbourne metropolitan area changed the basis for sales of crushed quarry products from sales by volume to sales by weight.

Following this, the Board approved adoption of measurement by weight for purchase of crushed quarry products, and adopted a new Standard Specification for Supply and Delivery of Roadmaking Materials, to provide alternatives of measurement by weight, by volume in trucks, or by volume in stacks.

Direct Labour Road Construction Costs

Costs of 114 roadwork jobs completed in 1967/68 at a cost of $7.26 million, were analysed in detail. The analyses are summarised in Tables 1—4.

TABLE 1 —
DISTRIBUTION OF EXPENDITURE

	1967-68	Five Year Average 1963-64 to 1967-68
	%	%
Plant	35.0	34.0
Labour	32.1	32.0
Materials	24.4	25.3
Stores	8.5	8.7

TABLE 2 —
WORKS OVERHEAD EXPENDITURE
(Percentage of productive costs)

	1967-68	Five Year Average 1963-64 to 1967-68
	%	%
Construction overhead expenses	10.5	9.3
Camp expenses	11.5	15.6
	22.0	24.9

TABLE 3 — FORMATION COSTS
(Including distributed overhead expenditure)

	Rock		Earth Unclassified		Total	
	Quantity	Unit Cost	Quantity	Unit Cost	Quantity	Unit Cost
	cu. yds.	$	cu. yds.	$	cu. yds.	$
1967-68	254,750	1.32	1,735,684	1.04	1,990,434	1.07
Five year average 1963-64 to 1967-68	152,036	1.35	1,378,611	1.06	1,530,647	1.10

TABLE 4 — PAVEMENT MATERIAL COSTS

(Consolidated in place including distributed overhead expenditure)

	Fine Crushed Rock		Coarse Crushed Rock		Gravel, etc.		Total	
	Quantity	Unit Cost	Quantity	Unit Cost	Quantity	Unit Cost	Quantity	Unit Cost
	cu. yards	$	cu. yards	$	cu. yards	$	cu. yards	$
1967-68	141,789	5.01	40,730	5.49	1,112,826	2.05	1,295,345	2.49
Five year average 1963-64 to 1967-68	114,073	5.01	48,799	3.86	1,044,479	2.10	1,207,350	2.45

2. TESTING OF MATERIALS AND RESEARCH

Ultrasonic Technique of Weld and Plate Inspection

There has been an increase in the amount of ultrasonic testing carried out on butt welds in bridge girder fabrication. The technique depends on the reflection of ultrasonic waves from internal defects, the vibrations (frequency 2–6 megacycles per second) being generated by a crystal using the piezoelectric effect. The ultrasonic beam is introduced into the weld to be tested, at a known angle, and the nature of the reflected waves is displayed on an oscilloscope. The oscilloscope screen is graduated to give a direct measure of the beam length from the crystal to the defect, so that the depth of the defect below the surface, and whether it is occurring in the weld, or in the heat affected zone, can be determined. This ready location of defect position is an advantage which ultrasonic testing has over conventional radiography. The technique is also faster, cheaper and more sensitive than radiography.

At the present time sufficient experience has been gained to test all butt welds which were previously radiographed. If defects are discovered confirmation can be sought by radiography before the decision is made as to whether to repair or to accept.

Ultrasonic testing can also be used to test for plate cleanliness. The extent of a laminated area or an area of scattered non-metallic inclusions within a plate can be determined.

Radiography is still employed to give a permanent record of flaws which have been found by ultrasonic tests, but ultrasonic testing is much faster and cheaper for detection of the flaws in the first instance.

Foundation Investigations

The design and construction of freeways and railway overpasses has necessitated an increased number of embankments, bridges and interchange structures — all requiring thorough foundation investigations to be carried out before designs are completed.

At critical sites where the foundations are soft and likely to consolidate under load, it is essential to take numerous undisturbed samples for testing. Six special air operated consolidometers have been designed and manufactured in the Materials Research Division to increase the number of consolidation tests that can be carried out simultaneously.

A 10 inch diameter Rowe consolidation cell has been purchased by the Board to accurately determine the coefficient of consolidation. A knowledge of this coefficient is essential, to determine whether sand drains should be installed under embankments.

3. ROADSIDE DEVELOPMENT

Planting Activities

In 1967/68, over 50,000 trees were planted along roadsides by the Board. Despite the drought conditions there was a normal survival rate of 85 per cent. Preparation of the soil by deep working and 12 months' fallowing, was the main factor in achieving this result. However, contrary to normal practice, it was necessary to carry out some watering.

Some 200,000 ground cover plants were established on the steeper roadside slopes which cannot be mown. Areas for the propagation of these plants were set up by the Board at Carrum Downs, Deer Park, Geelong and Horsham.

Roadside Stopping Places

Ten rest areas were under development during the year. Rest areas are defined as "off-roadway spaces, with provision for the parking of vehicles, and relaxation facilities for travellers". The locations of such areas are being planned so that in conjunction with existing facilities in towns, stopping places will be available every half hour of driving time on the Board's highway system. The locations now under development will eventually be provided with drinking water and toilets.

Over 100 wayside stopping places were under development in 1967/68. These are defined as "small spaces for off-roadway parking, provided (as are the rest areas) with table and bench units, fire places, and litter bins". Wayside stopping places are established on routes frequented by tourists. These facilities enable small parties to rest and picnic in quiet, sheltered areas.

TABLE 5 — BITUMINOUS SURFACING WORK COMPLETED

Type of Road and Plant Used	1966/67		1967/68	
	Miles		Miles	
Work on roads to which the Board contributed funds:				
(a) C.R.B. declared roads:—				
(i) Board's plant	1911		1683	
(ii) Municipal plant	49		67	
(iii) Contractors' plant	84		79	
		2044		1829
(b) Undeclared roads:—				
(i) Board's plant	975		1059	
(ii) Municipal plant	50		46	
(iii) Contractors' plant	25		24	
		1050		1129
Sub Totals		3094		2958
(c) Work done for other Authorities by Board's plant (no Board contributions for these works):—				
(i) Municipalities	114		117	
(ii) State Instrumentalities	6		3	
(iii) Commonwealth Works	—		—	
		120		120
Totals		3214		3078

TABLE 6 — BITUMINOUS WORK ON VARIOUS ROAD CATEGORIES

	State Highways	By-pass Roads	Tourists' & Forest Roads	Main Roads	Total Board's Declared System	Unclassified Roads	Totals
	Miles	Miles	Miles	Miles	Miles	Miles	Miles
Initial Treatments:—							
Extensions to sealed system —							
(a) Sprayed work	8.2	2.8	4.0	137.0	152.0	664.0	816.0
(b) Plant mix work	—	2.5	—	—	2.5	2.3	4.8
Reconstruction of lengths of previously sealed pavements —							
(a) Sprayed work	154.4	0.9	1.5	213.6	370.4	74.3	444.7
(b) Plant mix work	9.3	—	—	8.1	17.4	9.4	26.8
Widening of existing sealed pavements —							
(a) Sprayed work	82.1	18.3	—	191.3	291.7	48.4	340.1
(b) Plant mix work	0.3	—	—	2.1	2.4	0.6	3.0
Duplication of existing sealed pavements —							
(a) Sprayed work	11.9	—	—	3.1	15.0	0.8	15.8
(b) Plant mix work	4.5	—	—	8.7	13.2	1.4	14.6
Retreatments:—							
(a) Sprayed reseals	418.1	1.7	21.5	479.1	920.4	317.4	1237.8
(b) Plant mix work	21.4	4.8	—	17.3	43.5	10.7	54.2
Totals	710.2	31.0	27.0	1060.3	1828.5	1129.3	2957.8

Table 6 summarizes the lengths of different categories of bituminous work to which the Board contributed funds during 1967/68.

TABLE 7—AVERAGE COST OF SPRAYED BITUMINOUS SURFACING DONE BY C.R.B. PLANT

(On roads to which the Board contributed funds during 1967/68)

(Cost in cents per square yard)

Item	Nature of Work																	
	I.T.P. & S. $\frac{5}{8}$ in. & Over		I.T.P. & S. $\frac{1}{2}$ in.		I.T.P. & S. $\frac{3}{8}$ in.		I.T.P. & S. $\frac{1}{4}$ in. & Sand		Primerseals		Two-Application Seals		I.T.S.O. and Reseals $\frac{5}{8}$ in. & Over		I.T.S.O. and Reseals $\frac{1}{2}$ in.		I.T.S.O. and Reseals $\frac{3}{8}$ in.		I.T.S.O. and Reseals $\frac{1}{4}$ in. & Sand	
Square Yards Costed	565,779		2,977,887		2,215,318		883,273		839,054		163,357		623,420		5,500,178		5,800,373		6,986,274	
	cents	%	cents	%	cents	%	cents	%	cents	%	cents	%	cents	%	cents	%	cents	%	cents	%
Material	17.4	49.4	17.6	53.7	17.4	60.8	13.8	61.9	10.4	43.7	19.8	44.5	17.0	51.2	13.9	57.4	11.5	60.6	9.1	60.6
Stores	1.3	3.7	1.1	3.4	0.8	2.8	0.7	3.1	1.2	5.0	1.8	4.0	0.9	2.7	0.6	2.5	0.5	2.6	0.4	2.6
Plant Hire	7.1	20.2	6.0	18.3	4.6	16.1	3.4	15.2	5.4	22.7	9.8	22.0	6.2	18.6	4.1	16.5	3.0	15.8	2.3	15.4
Labour	9.4	26.7	8.1	24.6	5.8	20.3	4.4	19.8	6.8	28.6	13.3	29.5	9.1	27.5	5.5	23.6	4.0	21.0	3.2	21.4
TOTALS	35.2	100.0	32.8	100.0	28.6	100.0	22.3	100.0	23.8	100.0	44.7	100.0	33.2	100.0	24.1	100.0	19.0	100.0	15.0	100.0

I.T.P. & S. indicates "initial treatment prime and seal"

I.T.S.O. indicates "initial treatment seal only"

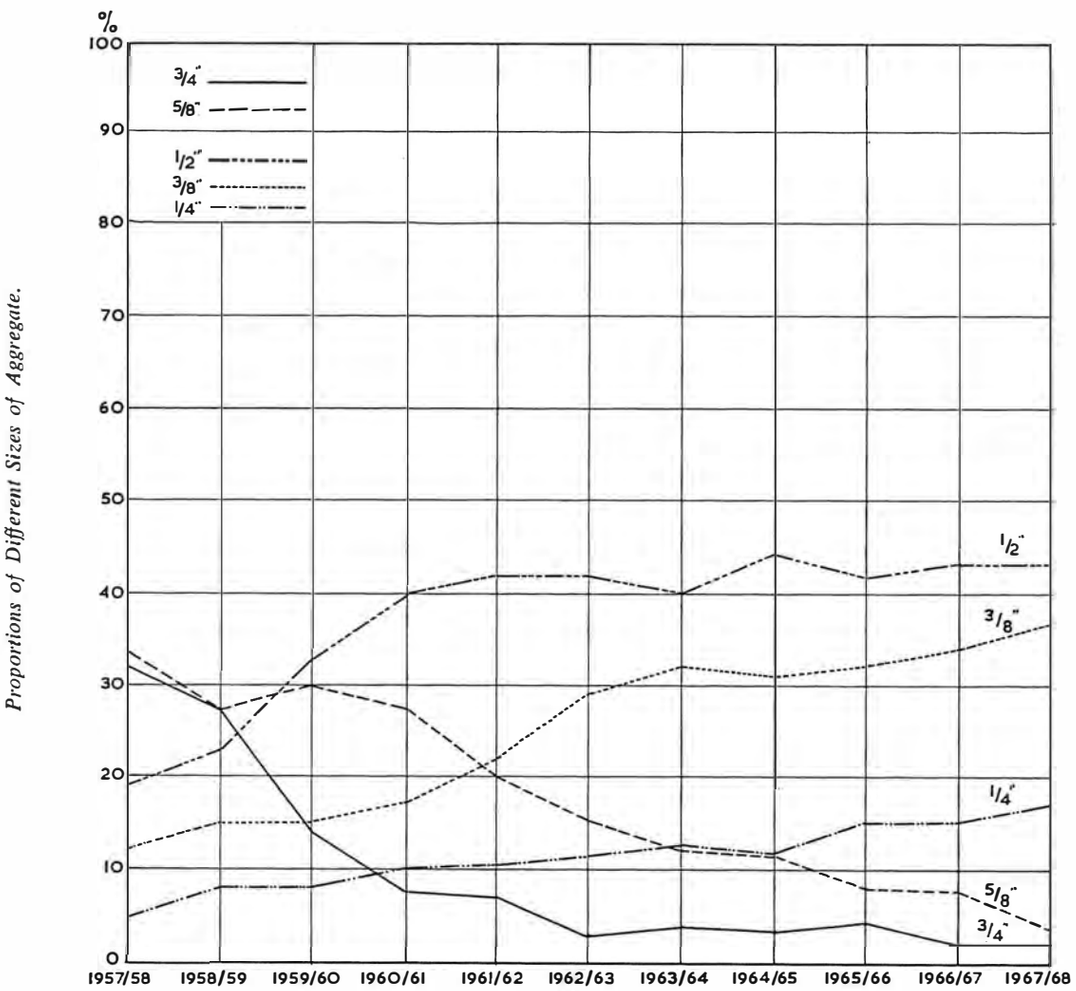


Figure 2 — Change in Usage of Different Sizes of Aggregate, 1957/58–1967/68.

TABLE 8 — AVERAGE PRICE OF AGGREGATE FOR BITUMINOUS SURFACING

(in roadside stacks)

Material	Prices per cubic yard				
	1963-64	1964-65	1965-66	1966-67	1967-68
	$	$	$	$	$
Screenings	4.81	4.92	5.04	5.04	5.19
Gravel	3.95	4.12	4.20	4.04	4.57
Sand	2.31	2.48	2.50	2.93	2.32
Scoria	2.98	2.90	2.78	2.90	2.80
Average price all aggregates	4.48	4.58	4.70	4.76	4.89

4. BITUMINOUS WORK

Extent of Work

The mileages of all types of bituminous surfacing completed during 1966/67 and 1967/68 are compared in Table 5. This shows that 3,078 miles were completed in 1967/68 compared with 3,214 miles in 1966/67, a decrease of about 5 per cent.

The length of sealed pavements on the Board's declared road system was increased by 154.5 miles in 1967/68 and the length on unclassified roads was increased by 666 miles, as shown in Table 6. Reconstruction of existing sealed pavements and restoration of the seal coat amounted to 387.8 miles of the declared system, 2.6 per cent. of the sealed sections, compared with 3.3 per cent. in 1966/67. Retreatments amounted to 964 miles or 6.6 per cent. of the sealed sections, compared with 9.3 per cent. in 1966/67. Over the previous 10 years the lowest amount of retreatment was 6.7 per cent. in 1961/62 and the highest was 9.4 per cent. in 1957/58, while the average rate of retreatment was 8.0 per cent.

Types of Work

Sprayed work (initial treatments and retreatments) was again the main type of work, amounting to 96.6 per cent. of the total length of work completed.

A length of 103 miles of plant mix work was completed during the year, that is, 3.4 per cent. of the bituminous surfacing programme, compared with 94 miles and 3 per cent. in 1966/67 (for further details see Table 6). For plant mix work completed during the year, a total of 214,481 tons of bituminous concrete was supplied and spread by contractors operating fixed plants near Melbourne and Geelong.

Costs of Work

The average unit cost of sprayed work completed by the Board's 23 bituminous surfacing units during the year is shown in Table 7. The average costs of sprayed work have increased slightly compared with those for 1966/67.

Materials

(a) Aggregate

A total quantity of approximately 301,000 cubic yards of covering aggregate was used in sprayed work done by the Board's plant.

Table 8 sets out the average costs of aggregates over the past five years and shows that the 1967/68 average rose 2.7 per cent. above the 1966/67 average.

Over a period of years, the quantities of ½-inch, 3/8-inch and ¼-inch one sized aggregates used, have increased, and the usage of 5/8-inch and ¾-inch sizes has decreased. The change in proportions of usage is shown in Figure 2.

A new grade of petroleum tar, lighter in viscosity than that previously used, has been produced following investigations as previously reported, into precoating limestone aggregates used for single application work in North-Western Victoria. Preliminary field trials have indicated the desirability of conducting field trials on a larger scale.

A preliminary inspection has been made of an extensive field experiment to check design factors used in the determination of the rate of application of binder for a single application seal using limestone aggregate. Present appearances indicate, at this stage, that the present rate of application of binder may be slightly on the light side. It would appear that it will not be possible to make a final assessment until the work has been subjected to traffic for several years.

(b) Bitumen

During 1967/68 the Board purchased directly 29,885 tons of bitumen which was distributed by road and rail by four marketing companies.

The installation at Hamilton of two 8,000 gallon electrically heated bitumen tanks, similar to those at Horsham, was completed, and the tanks were in operation throughout the 1967/68 season.

Arrangements have been made for the manufacture and installation at Benalla of two bitumen tanks, similar to those at Hamilton and Horsham, and these should be available and in operation for the 1968/69 season.

(c) Primerseals

The use of primerseals during the winter months has been continued with success and work is continuing with regard to evaluating the value of the various primerbinders available.

In the 1966/67 Report, reference was made to primersealing successfully a slick bituminous surface under adverse conditions. This surface was still in a satisfactory skid-resistant condition after nine months, when a bituminous concrete surface was laid over the section.

BRIDGE SUB-BRANCH

1. DESIGN

Use of Digital Computers

The direct use of the Board's computer in bridge design work increased considerably during 1967/68. A total of 682 hours of computer time was used, representing a 76% increase in comparison with 1966/67. The number of bridge designs in which the computer was used also showed a marked increase of 60%, to 80 for the year.

The table below records the variety and volume of bridge design work handled by the computer.

Programme	Number of Jobs
Geometry (Bridges on Curves)	59
Continuous Beams	
(a) Deflections	20
(b) Moments and Shears	112
Two Column Pier Analysis	56
Analysis of R.C. Columns	
(a) Circular	23
(b) Rectangular	171
(c) Unsymmetrical	61
Prestressed Concrete Girders	33

Development of New Computer Programmes

Work on new programmes took 164 hours of computer time in addition to direct design use. This work was directed mainly to extending existing systems for superstructure and substructure design. Three programmes were developed to assist in the design of non-prismatic continuous beams. Two of the programmes give the envelopes of moment, shear and reaction, and tabulate the resulting flexural stresses. The third programme determines final bending moments due to prestressing moments applied by post-tensioning.

A programme to calculate required flange areas for simple span composite girders was also completed. The design of a plate girder is now a direct process when web depth is known.

Preparation of Bridge Specifications

The 1966/67 Report gave details of the development of a three-programme system for the preparation of bridge specifications, and direct printing of the specification mastercopy by the Board's computer.

The Board's Bridge Specifications Committee have since almost completed revision and updating of all standard bridge specifications, which have been punched on to cards for use on the computer.

Each line of the standard specification is contained in one 80 column card and the complete set of standard specifications is held in a large deck of cards called a "masterfile". From this, a reference listing is prepared on the computer, printing out all of the standard specification information contained on the cards, and in addition numbering each line.

Engineers writing a specification for a bridge job, work from a standard specification reference-listing book containing a complete up-to-date set of the listings. On an assembly sheet they enter the numbers of the first line and last line of standard text required, together with full details of any new clause or special text desired. Deletion of unnecessary portions of the standard specification follows automatically.

The computer programme, following the instructions on the pages of assembly data, prints out a complete master-copy of the specification for the bridge, including page numbers, index and title page. The present machine prints out the master-copy at a rate of 150 lines per minute. Multiple copies for the tender stage are then produced by offset printing, the plates being prepared by the Photo-Direct process.

The system has the advantage of producing clear, identical sets of specifications for each job, free from stickers, insertions and deletions. It also has the further advantage that amendment and updating of the standard specifications merely requires substitution of appropriate cards in the "masterfile", together with replacement of the appropriate printed sheets in the limited issue of standard specification reference listing books.

Strathmore By-Pass Road Bridges

Construction has either been recently commenced or completed, of four of the eight bridges associated with the above by-pass road. A plan of the by-pass road showing the positions of the bridges, and pictures of models, were included in the 1966/67 Report. Several design features of the bridges are unusual compared with past designs.

Three bridges are of 4 spans continuous construction, using precast pretensioned concrete beams with spans ranging from 30 feet to 85 feet. Continuity is achieved by placing negative moment reinforcing bars in the section of deck slab cast composite with the beams over the piers.

The piers consist of two or more rectangular section reinforced concrete columns of constant thickness, and tapering in width in the plane of the pier from top to bottom.

The beams landing over columns are supported on rhomboidal shaped elastomeric pot bearings designed to suit the skew. These bearings include Glacier "DU" strips against hard chrome plating to provide for longitudinal movements. At the abutments the beams are supported on cast steel rockers curved on the lower surface only, and with phosphor bronze plates to provide for the longitudinal movements.

The ends of the inner beams which are not supported over pier columns are propped, while a combined diaphragm beam-pier crosshead is cast around and between the beams, and post-tensioned transversely. The portions of deck over the piers, including continuity reinforcing is then cast, followed by the remaining deck sections.

The bridge over Pascoe Vale Road on the northbound carriageway of the by-pass was constructed early to allow earth moving machinery to use the overpass in the construction of the by-pass road. To provide for the construction traffic this bridge was designed for a single 80 ton scraper, 10 feet 4 inches wide with axles at 30 feet centres, in addition to the usual A.A.S.H.O. H20 S16 design loading.

Design for construction traffic required heavier members than usual. This is apparent in the superstructure with closer beam spacing and thicker and more heavily reinforced deck.

This bridge has continuous spans of 49 feet, 62 feet, 67 feet, 60 feet, by 34 feet between kerbs, with provision in the pier crosshead-diaphragms for future widening to 66 feet between kerbs. Couplers were provided on each of the 3 V.S.L. 12 x ½ inch diameter strand tendons in the pier crossheads to assist in future widening.

The southbound carriageway overpass of Pascoe Vale Road will have spans of 48 feet, 61 feet, 66 feet and 59 feet continuous, and including the width for a collector-distributor road, will be 58 feet between kerbs with a 4 feet wide median, with provision for widening the bridge to 66 feet between kerbs.

The third bridge of similar design, to carry Bulla Road over the by-pass road, will have spans of 37 feet, 85 feet, 85 feet and 30 feet continuous by 70 feet wide, including a footway 6 feet wide and a variable width median.

The Napier Street bridge now under construction will provide a crossing for Napier Street over the Strathmore By-pass Road. This bridge consists of a 4 cell continuous prestressed concrete post-tensioned box girder cast in situ, with 4 spans continuous of 45 feet, 106 feet, 106 feet, 45 feet. Initially the width between kerbs will be 28 feet with two footways each 7 feet wide. The form of construction would permit removal of the footways at a later stage to give a 40 feet roadway if required.

The piers again consist of rectangular section reinforced concrete columns tapered from top to bottom, but Freyssinet type concrete hinges have been provided connecting the tops of the pier columns and the box girders. The hinges were designed in accord with the U.K. Ministry of Transport Memorandum No. 577/1: "Rules for the Design and Use of Freyssinet Concrete Hinges in Highway Structures". They have a 4 inch wide rectangular throat with 1 inch diameter anchor bars placed through the middle at approximately 18 inch centres. The maximum stresses in the hinges will be approximately 2,700 pounds per square inch under direct dead load plus live load and 3,600 pounds per square inch under the above load conditions plus maximum rotation.

The piers nearest the abutments will be inclined by $\frac{1}{2}$ inch to ensure that they finish vertical under the effects of prestress, shrinkage and creep of the box girders.

Kororoit Creek Road Bridge

This structure will cross the Princes By-pass Road at 11.4 miles near Laverton, at a 52° skew, maintaining the existing alignment of Kororoit Creek Road.

The basic requirements for the design of this overpass were:—

(a) minimum interference to traffic on the by-pass road during construction and possible future duplication;

(b) to maintain an open appearance of the piers taking into account the possible future duplication of Kororoit Creek Road.

These points led to the adoption of a continuous steel box superstructure with a reinforced concrete deck, on single column intermediate piers. The total length of the bridge will be 418 feet 10 inches comprising four spans of 67 feet, 141 feet, 141 feet and 67 feet.

Under certain cases of loading, the use of single column piers leads to large torsional effects. These are best resisted by the box type superstructure adopted. To aid in this resistance to torsion, $\frac{3}{4}$ inch thick unstiffened webs were adopted for the boxes. It is also expected that the thicker webs and absence of intermediate stiffeners will reduce unsightly buckling within the web, and lead to economies in fabrication.

At the piers, transverse steel boxes were designed within the main boxes, to act as crossheads and diaphragms. All field splices in the main girder, and almost all of the field connections between the crossheads and the main girders, are high tensile bolted connections. These bolted connections were chosen to eliminate field welds in tension zones of the main load carrying components, and also because of the simplicity of completing the joints in the field. The above aspects of the construction are illustrated in Figure 3.

The maximum length of girder unit adopted was 80 feet and the maximum weight 28 tons.

Separation Street Railway Overpass

The new overpass will comprise four bridges on two carriageways each of 3 lanes, and will span two underpass roads and approximately ten sets of railway tracks, at the 43.0 mile post of the Princes Highway West. They will replace two existing Victorian Railways bridges.

The new bridges are square to the road centreline at the Melbourne end, and vary up to a skew angle of approximately 60° at the Geelong end. The pier positions were rigidly controlled by the position of the railway tracks, leading to spans varying from 64 feet to 107 feet long.

Welded steel plate girders were designed using constant depth throughout, and constant spacing where possible. The various skews and splays required, affected the girder layout considerably. Stiffened webs 3/8 inch thick were used with flanges varying in thickness and width. The stability of some of the girders, with respect to top flange buckling before casting the concrete deck, was found to be critical, and the size of the top flange was amended where required.

At the Geelong end of the bridges, the highway is on a 450 feet radius curve, and passes over the Bent Street underpass. To maintain a reasonable appearance for traffic approaching the bridge, each outer girder in this end span is to be shaped to follow the circular curve in plan, and thus keep the deck overhang constant. These curved girders would be unstable when supported at their ends only, and so to make transport and erection easier, the curved girders were required to be fastened to the respective adjacent straight girders at the fabrication stage, by having the crossframes between the girders welded on in the shop. The weights of the assemblies are approximately 9 tons and 18 tons.

The curved girder and the curved girder-straight girder assemblies were designed for all normal loads plus torsional effects.

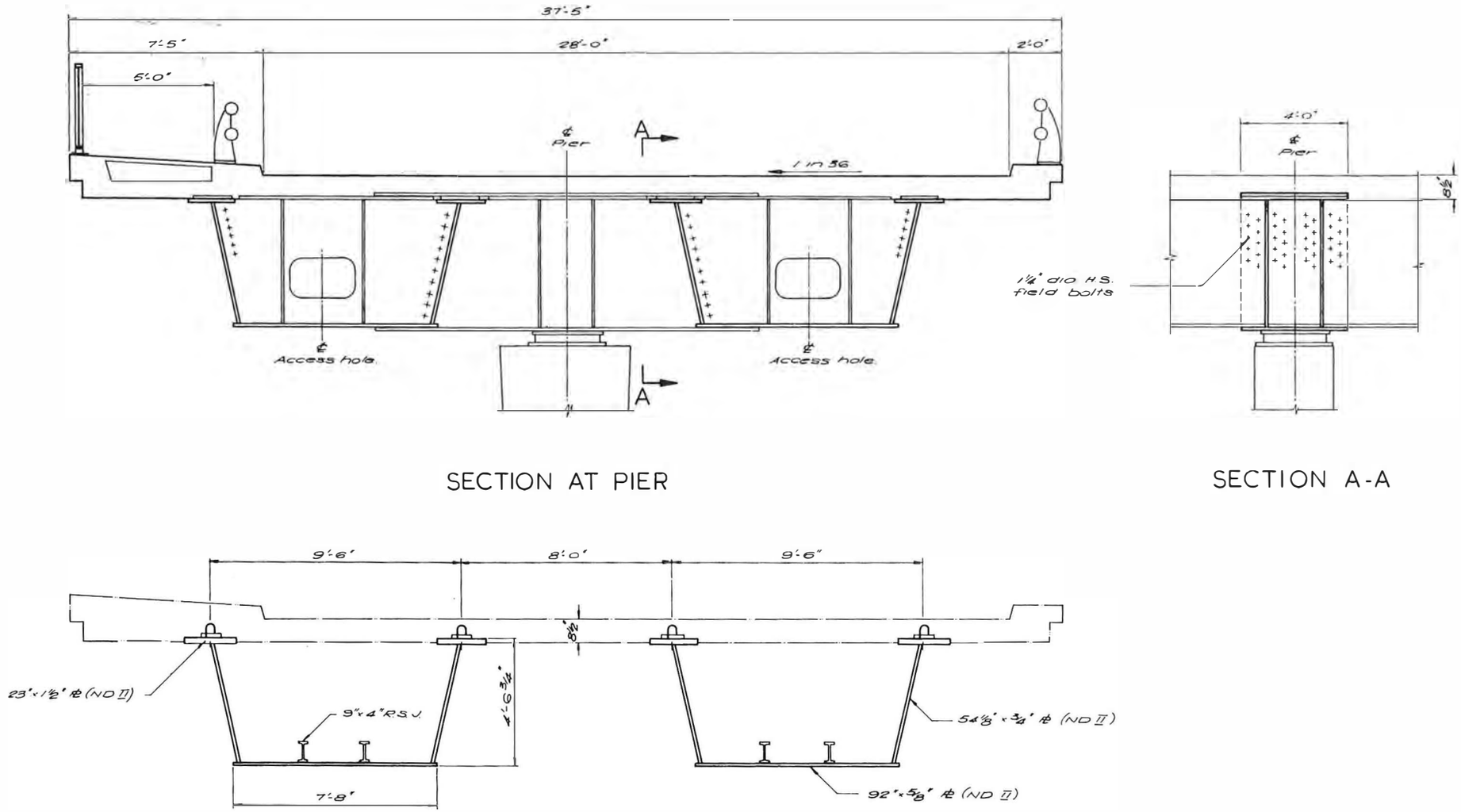


Figure 3 — Kororoit Creek Road Bridge. Details of Construction.

2. CONSTRUCTION

Phillip Island Bridge

The 1962/63 and 1963/64 Reports referred to details of the foundation investigations for this bridge, while the 1966/67 Report contained much of the detail of the bridge layout, design and initial construction work by Contractor John Holland & Co. Pty. Ltd.

The new bridge will consist of sixteen 100 feet approach spans, with a continuous 150 feet — 200 feet — 150 feet span arrangement at mid channel, providing 40 feet navigation clearance at high water in the central span. The bridge will be approximately 2,100 feet long with a 6 feet footway and carriageway 28 feet wide.

Construction of the foundations and substructure is now approximately two-thirds complete, although foundation conditions encountered during excavation have necessitated redesign of some of the pier foundations. As mentioned in the 1966/67 Report the belled footings at pier 8 had to be redesigned following a plate bearing test, to reduce the foundation bearing pressure to one half of the original design value.

Subsequently the remaining deep water piers 7, and 9 to 11, were redesigned using 9 feet outer diameter reinforced concrete cylinder foundations, sunk to a depth of from 38 feet to 52 feet below sea bed level. At the conclusion of sinking, the bottom 10 feet of each cylinder is sealed with tremie concrete placed under water, and voids remaining around the outside of the cylinder are pressure grouted with a sand-cement grout.

The central portion is then filled with lean mix concrete to 5 feet below sea bed level and the remainder of each cylinder completed in normal reinforced concrete to the design level at R.L. minus 3 feet.

Due to a 6 tons limit on the existing crossing, placing of the approach span 100 feet beams is proceeding from the San Remo end. Six approach spans of the 43.5 tons 100 feet long prestressed concrete beams manufactured in Melbourne have been placed and decks completed.

The precast concrete segments for the navigation span beams are being cast on site, on the respective approach on which they will be required. The design originally provided for 5 segments per beam weighing a maximum of 35 tons, but at the request of the contractor this was varied to 11 segments each weighing a maximum of 16 tons, to allow use of the lifting equipment permanently on site. Of the 10 segmental beams provided in the design 2 have now been placed and post-tensioned. The concrete in the joints between segments is required to attain a strength of 6,000 pounds per square inch before stressing. This is being achieved within 7 days by the use of high early strength cement together with an additive to improve workability.

Each beam has 4 post-tensioned tendons and each tendon consists of 18 x $\frac{1}{2}$ inch nominal diameter high tensile wire strands. Post-tensioning is being carried out using the V.S.L. system and the initial prestressing force required in each tendon is 534,000 pounds. To make allowance for friction losses between the cables and the ducts and for "draw in" at the wedges, an initial jacking force of 605,000 pounds is being applied to each tendon (equivalent to approximately 80% U.T.S. of the tendon). After anchoring, the load at any point in the tendon is estimated to be within 6% of that specified. The tendons are finally pressure grouted with cement grout using an 0.5 water/cement ratio together with an expansion additive.

Pykes Creek Reservoir Bridges Duplication

The construction of two bridges now proceeding over Pykes Creek Reservoir will complete 4 miles of duplication of the Western Highway in this area. The bridges will be 47 feet and 355 feet long respectively by 28 feet width between kerbs, with the longer bridge having four main spans of 85 feet. Abutments are skewed at 27° 50′ on the shorter bridge, with the Melbourne abutment of the longer bridge skewed at 35° and the remaining piers and Ballarat abutment square to the centreline. A small triangular shaped span is used at the Melbourne end to adjust for the skew.

The State Rivers and Water Supply Commission required the construction of a small approach bridge in preference to normal abutment filling otherwise needed, to relieve loading on the downstream side of the existing dam embankment. The Commission also required provision of 20 inch diameter bored piles to rock foundations below the dam. The foundation material is a Permian glacial tillite. The bored piles extending 2 feet into bedrock varied in length from 40 to 85 feet. Open ended steel shells 20 inch diameter by 5/16 inch thick in 30 feet lengths were driven to practical refusal. Material within the shells was then excavated to 2 feet into rock, 35 feet length reinforcing cages placed and the shells filled with concrete. Batters varied from vertical to 1 in 10.

The three main piers of the larger bridge consist each of two columns of 5 feet diameter founded at least 10 feet into rock where they are belled to 8 feet diameter by 3 feet deep.

Plate 7 — Pykes Creek Reservoir Bridges Duplication.
Outer Main Piers Under Construction.

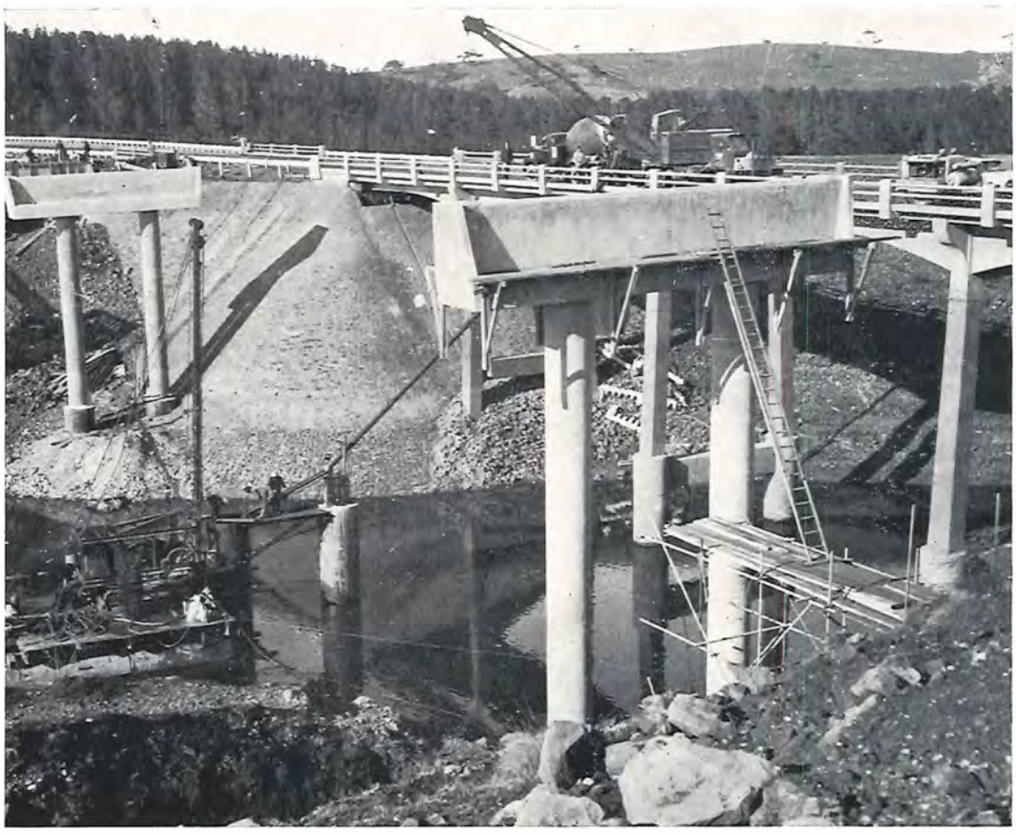


Plate 8 — Pykes Creek Reservoir Bridges Duplication.
Central Main Pier Under Construction.

These columns extend upwards a maximum of 60 feet to the average minimum water level of the reservoir, where they transition to 3 feet 2 inch diameter reinforced concrete columns used for the remaining 35 feet to the pier crossheads. The columns at the central pier are free standing for 100 feet to their support at the pier crosshead.

Due to the abnormally dry summer, construction of the two piers nearest the abutments was carried out in the "dry" (Plate 7), and the central main pier through 30 feet of water instead of the expected 60 feet depth (Plate 8). The cylinder holes for the pier in the water were excavated using a 5 feet diameter percussion drill from a floating pontoon, following which 60 feet of ½ inch thick steel caisson was driven into the rock. The caisson was then dewatered and the belled section in the rock excavated by hand. Reinforcement and concrete were then placed and the 3 feet 2 inch diameter column continued up to crosshead level.

Five lines of pretensioned prestressed concrete beams will be used for the four main 85 feet spans with a composite reinforced concrete deck cast in place. The 28 ton beams will be placed using a 120 feet span prefabricated launching truss.

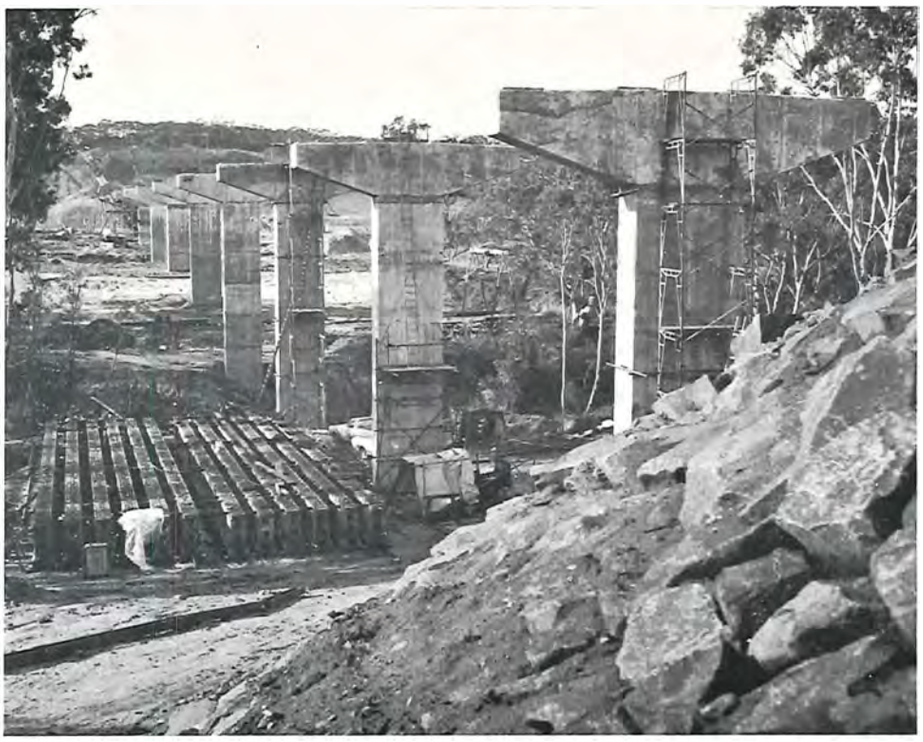


Plate 9 — Construction of the Glenelg River Bridge, Princes Highway West, Dartmoor.

Glenelg River Bridge, Princes Highway West, Dartmoor

Construction of the above bridge, 800 feet long by 28 feet between kerbs at a cost of approximately $430,000, is now well advanced with completion expected during the first half of 1969.

The bridge consists of 10—80 feet spans with four lines of 32 ton post-tensioned segmental prestressed concrete beams per span, and a 7½ inches thick composite reinforced concrete deck cast in situ.

The piers of single reinforced concrete column design of section 9 feet x 3 feet extend a maximum of 60 feet from pile cap to the top of the cantilever crosshead (Plate 9). Depending on the length of pile required, the pile caps are founded on reinforced concrete, prestressed concrete, or 16 inch diameter steel shell piles with a maximum length of 63 feet.

The beam segments are being manufactured by a sub-contractor at Hamilton and transported approximately 50 miles to the bridge site where they are assembled at ground level. The beams are made up of 5 segments per beam with 3 curved or draped ducts for 3 post-tensioning tendons per beam.

After assembly the 4—3 inch wide joints in each beam are filled with an 8 bags of cement per cubic yard, ¾ inch maximum size aggregate, concrete which generally reaches its 6,500 p.s.i. target strength at 6 days. The beams are then post-tensioned by the P.S.C. system, each tendon consisting of 7—0.7 inch Dyform cables. Each Dyform cable is both stress relieved and stabilized. To reduce losses each cable is being individually double end stressed to the required loading and elongation. At the conclusion of tensioning the ducts are washed with water, blown clean with oil-free air and grouted with an 0.5 water-cement ratio mixture incorporating an additive.

The general bridge concrete is being supplied by truck mixers from a concrete batching plant erected within the works site. All concrete delivered to the job from the plant has had high strengths — normally around 6,000 p.s.i. at 28 days from a 6 bag cement per cubic yard mix. Spring water used in the concrete, flowing from a limestone deposit, may be aiding the high results.

After placing the beams, the deck of each span will be formed up and cast, at a rate of one every 2-3 weeks, using 3 sets of formwork, until completion of the bridge.

ROAD DESIGN SUB-BRANCH

1. TRAFFIC ENGINEERING AND BY-PASS ROAD INVESTIGATIONS

Traffic Studies

The annual traffic census was conducted on Wednesday, 20th March, 1968. Twelve hour classification counts were taken at a total of 2182 stations, 786 of which were on State highways and by-pass roads, 1146 on other Board's declared roads, and 150 on unclassified roads.

The Highway Traffic Index (100 in the base year 1933) rose by 8 points to 927 in 1968, an increase of 0.9%. The rate of increase remains close to the 1959 prediction, as might be expected, since the data on which the Index is based were collected very largely from rural State highways. Augmented counts were conducted in Bendigo and Horsham Divisions this year, the number of stations counted being 616 and 323 respectively. The Board's electronic computer was used to produce the census results this year for the first time.

Linemarking

During 1967/68 the Board maintained traffic line and other pavement markings on a total of 6129 route miles of road, comprising 3994 miles of State highways and by-pass roads, 1778 miles of other declared roads and 357 miles of unclassified roads, the latter at the request and cost of municipalities.

The total length of equivalent standard stripe (i.e. 10 feet x 3 inch line, 30 feet gap) painted was 15,902 miles, an increase of 5.3% over the previous year.

An additional small linemarking unit consisting of an overseer and two plant operators, equipped with a Kelly-Creswell model B-4 linemarking machine, commenced operation in April of this year. These small units maintain a variety of intersection markings, mainly in the Melbourne metropolitan area. They also paint urgently required short lengths of line, and remove obsolete markings with chemical paint stripper.

The total cost of linemarking carried out by the Board this year was $239,682 including work to the value of $25,902 done by the Board's regional divisions. The average cost per mile of equivalent standard stripe painted by the main units was $12.89, compared with $12.28 in 1966/67.

By-Pass Roads Investigations

During 1967/68 progress was made in functional design of approved by-pass roads, and investigation of the need for by-pass roads.

Functional layouts were approved of the following works—

(a) Lower Yarra Crossing approaches

The eastern approaches, being the development of Graham Street, Ingles Street and Boundary Street among others, were approved. This work will include a grade separation from the Port Melbourne rail line at Graham Street. The western approach, a freeway nearly four miles in length to the Princes Highway West, was also approved. This will include full diamond interchanges at Williamstown Road and Millers Road, a half diamond interchange at Blackshaws Road, and a Y interchange at the Princes Highway West.

(b) Mornington Peninsula By-pass Road

Functional layouts were completed for the section of this route from the Dandenong-Frankston Road to Skye Road.

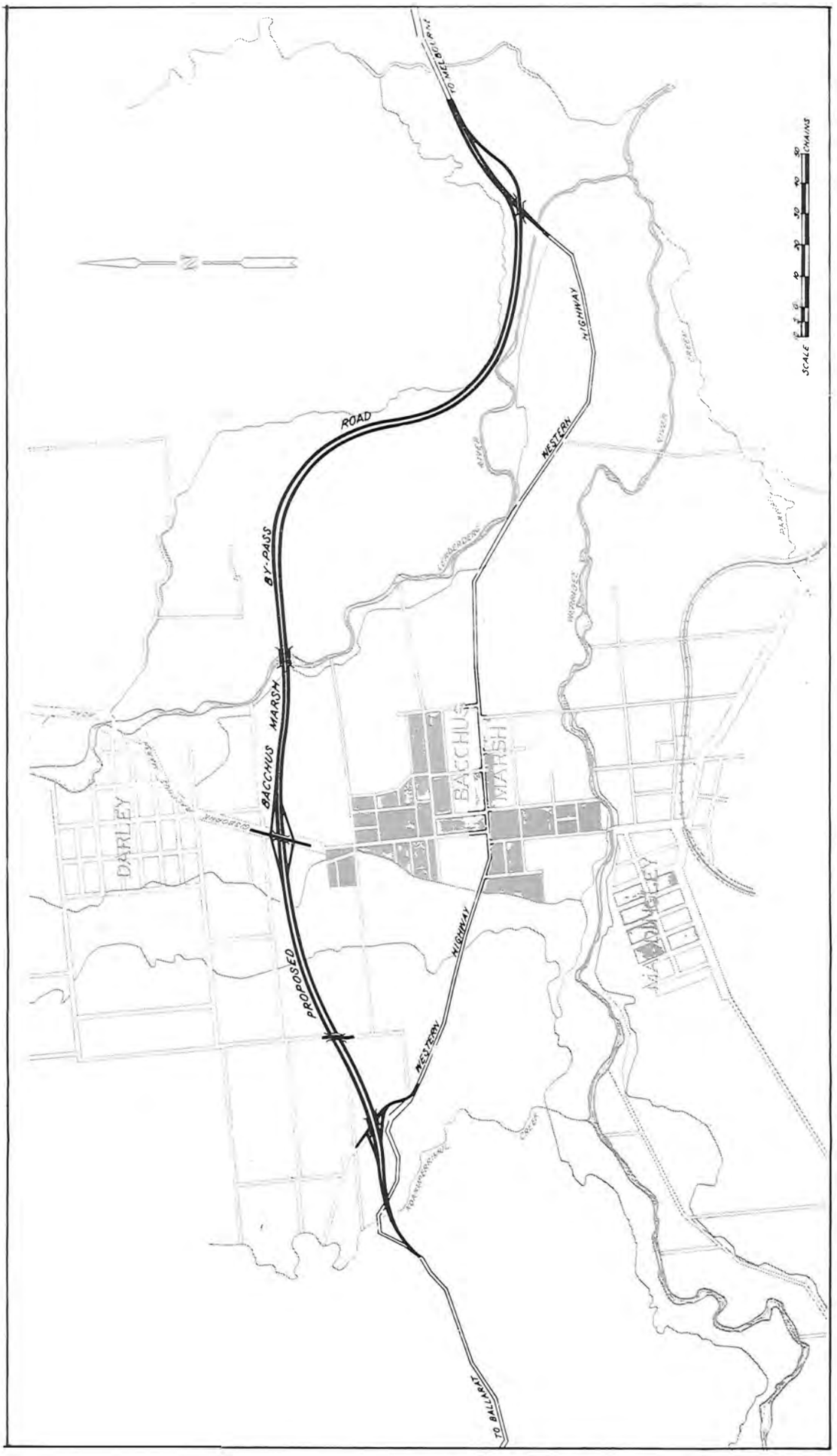


Figure 4 — Bacchus Marsh By-pass — Locality Plan.

The following investigations proceeded to the stage of preliminary layouts being approved by the Board —

(a) Melton By-pass

The existing Western Highway through Melton will require to be replaced by a freeway facility in the future. The Board has approved layouts for a 5 mile length of by-pass, with suitable interchanges, as a future development, being part of a freeway route from Melbourne to Ballarat. The Melton Shire Council has been requested to make provision for the by-pass in its Planning Scheme.

(b) Bacchus Marsh By-pass

Another section of the Melbourne-Ballarat freeway route approved by the Board is a by-pass of Bacchus Marsh. This will pass to the north of the town, with an interchange at each terminal of the by-pass, and full diamond interchange on the Bacchus Marsh-Gisborne Road (Figure 4). Care has been taken to co-ordinate the horizontal and vertical alignment, and to produce an aesthetically pleasing alignment, in view of the scenic nature of the country.

(c) Greensborough By-pass

This route, previously approved by the Board, was modified to include an interchange with the proposed Melbourne and Metropolitan Board of Works' Route 5. Amendment to the design of the section between Grimshaw Street and the Heidelberg-Kinglake Road was carried out as a consequence.

2. ENGINEERING PLANS AND SURVEY

Engineering Surveys

Head Office engineering survey parties completed a total of 214 miles of survey during the year, as follows:

State highways	46 miles
By-pass roads	42 miles
Other roads	64 miles
Photo control	62 miles

Divisional staff also completed a considerable mileage of engineering surveys for road and bridge works. Consultants completed a further 12 miles of survey on by-pass roads.

Plans for Road Construction

Comparative figures regarding final construction plans completed in Head Office during 1966/67 and 1967/68 are:

	1966/67	1967/68
Linear miles	87	86
Estimated cost of roadworks	$9,530,000	$8,410,000
Final plan sheets	1512	1404
Separate projects	51	61

The number of final plan sheets shown above does not include many hundreds of sheets of cross-sections which have been tabulated and plotted by machine as computer output.

Consultants have completed the design of one section of rural freeway 3 miles long with an estimated construction cost of $700,000. These, and other consultants, are proceeding with design of three sections of outer urban freeway of total length 10 miles and estimated cost $9 million.

The changing nature of the Head Office design task is illustrated by the following dissections of final plans produced:

	1960/61		1967/68	
	No. of Sheets	%	No. of Sheets	%
Undivided rural roads	764	63	540	39
Divided roads other than freeways	167	13	456	32
Freeways	43	3	212	15
Intersections, grade separations, etc.	265	21	196	14
Totals	1239		1404	

Some of the larger jobs for which plans were completed include the following:

Burwood Highway	Duplication from east of Stud Road to Ferntree Gully Road.	(2.3m)
Burwood Highway	Duplication from east of Dorset Road through Ferntree Gully to Mount Dandenong Road.	(2.0m)
Calder By-pass Road	Construction of service roads at Niddrie.	
Dynon Road	Hopetoun Bridge approaches.	
Goulburn Valley Highway	Reconstruction west of Molesworth.	(2.8m)
Hume By-pass Road (Tallarook)	Four-lane rural freeway (design by consultants).	(3.0m)
Licola-Jamieson Road	Connection past Mount Skene.	(9.3m)
Maroondah Highway	Deviation at Maxwell's Hill.	(1.8m)
Nepean Highway	Reconstruction Bay Road to Chesterville Road.	(0.8m)
Omeo Highway	Reconstruction Omeo to Black Camp Creek.	(3.4m)
Princes By-pass Road	Kororoit Creek Road interchange.	
Princes Highway East	Reconstruction Castlebar Road to Ferntree Gully Road, Oakleigh.	(1.2m)
Western Highway	Reconstruction, Albion to Kororoit Creek.	(1.7m)

Plans are well advanced for other jobs including:

Lower Yarra Crossing approach roads	Details are set out below.	
Mount Abrupt Road	New route northerly from Dunkeld.	(15m)
Calder Highway	Deviation with railway grade separation at Elphinstone.	(2m)

Specifications

Comparative information for supply and construction contracts for the last two years is as follows:

	1966/67	1967/68
Contracts for which specifications were prepared	136	134
Approximate total value of contracts	$5.0 million	$8.8 million
Specifications for construction contracts	18	20
Approximate total value of construction contracts	$1.8 million	$5.1 million

Of the twenty construction contracts, nine were for Special Projects with a contract value of $2.2 million. By far the largest contract among the other eleven was for the Strathmore By-pass Road.

Two of the twenty specifications were prepared in regional Divisions, the others in Head Office.

Lower Yarra Crossing Approach Roads

A major toll bridge over the lower reaches of the Yarra River is being constructed by the Lower Yarra Crossing Authority — a company which has been granted statutory powers for this purpose.

Outside the length for which the Authority is wholly or partly responsible, the Board is designing the necessary approach roads.

The main feature of the western approaches is the Lower Yarra Freeway which is designed to connect the Princes By-pass Road (formerly Princes Highway West) to the immediate approaches of the Lower Yarra Crossing. This 3.8 miles of four-lane and six-lane freeway involves 4 miles of ramps and connecting roads, two miles of adjacent roads and one mile of service roads for the restoration of local access. Figure 5 shows a plan of the locality. Plate 10 shows aspects of the project.

The eastern approach roads involve the reconstruction or up-grading of four miles of roadway in the Cities of Port Melbourne and South Melbourne to provide divided roadway conditions and improved rail crossing facilities. Plate 11 gives an impression of the grade separation being designed for the Graham Street railway level crossing.

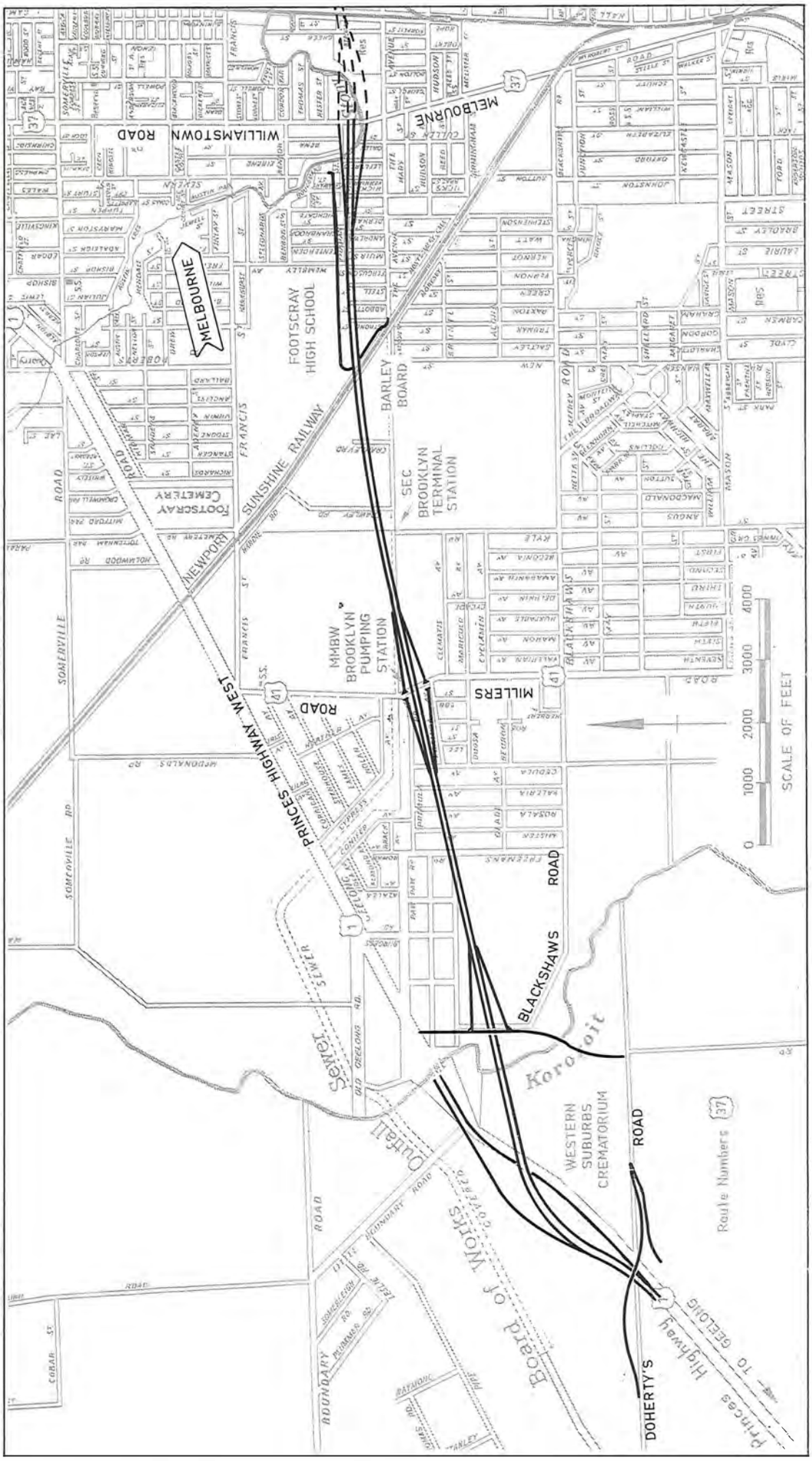


Figure 5 — Locality plan of Lower Yarra Freeway By-pass Road.

Plate 10 — Lower Yarra Freeway By-pass Road. Photo-mosaic incorporating Model of Project. View looking east towards Melbourne.

Plate 11 — Lower Yarra Crossing, Eastern Approaches.
Impression of Graham Street Rail Overpass.

3. TITLE SURVEYS AND PRINTING

Title Surveys

A total of 350 survey plans were completed in 1967/68. All the surveys for these were done by Board's surveyors except in 5 instances where outside surveyors were employed. Twenty-six of the survey plans related to by-pass roads or freeways. The I.B.M. 1620 computer processed 297,887 survey lines during the year.

Drafting Section

A total of 990 Gazettal Plans were drawn for the year, comprising 365 for Approving Orders in Council and 625 Declarations. Transfer Documents totalling 1,076 were prepared.

Plan and Offset Printing

The output of the Offset and Multilith machines totalled 4,211,735 runs during the year.

This type of production has increased by 314% over the last 5 years.

Two Engineering Manuals, and one handbook, viz.:—

Title Survey Manual
Engineering Survey Manual
Freeway Design Standards

were prepared and published. It is expected that the two Manuals will be issued during 1968/69.

Plans printed in 1967/68 totalled 148,000. There was a slight increase in Statfile reproduction and a 21% increase in production of negatives compared with 1966/67.

4. RIGHT OF WAY

Land Acquisition

As land acquisition cases have become more complex, the number taken to arbitration has increased. The Right of Way Section gives substantial engineering assistance to the Board's valuers and counsel on the cases where this is necessary.

Land Development

Property enquiries, and applications to develop land which could result in traffic generation affecting the Board's declared road system, are now being dealt with at the rate of about 70 per week.

Highway Record Survey Plans

Highway record survey plans were completed for the Princes Highway West — Sections 1 and 2 (Melbourne-Camperdown, 121 miles) and Hume Highway — Sections 2 and 3 (Seymour-Wodonga, 129 miles).

Strip maps were compiled from aerial photography on the following State highways:—

Murray Valley Highway — Sections 1, 2, 3 & 4 (Corryong-Hattah)	472 miles
Sturt Highway	71 miles
Calder Highway — Section 6 (Ouyen-Mildura)	76 miles
Midland Highway — Section 1 (Geelong-Ballarat)	52 miles
Total	671 miles

Odometer Surveys

These surveys were carried out for repositioning of mileposts on the Hume Highway — Sections 1, 2 and 3 (Melbourne-Wodonga) and the Western Highway — Sections 1 and 2 (Melbourne-Ararat).

MECHANICAL SUB-BRANCH

1. DESIGN AND DEVELOPMENT

The following engineering design and system development work has been completed or is proceeding:

(a) Aggregate belt spreader

The prototype referred to in previous Reports is now complete and will soon undergo field tests. The machine will be capable of laying an aggregate carpet up to twelve feet in width. A novel feature is an unpowered automatic belt centering device which is expected to reduce wear and tear on the belt.

(b) Bitumen storage tanks

The installation at Hamilton of the Board's second pair of 8,000 gallon capacity electrically heated bitumen storage tanks was completed. The construction of the third pair, for installation at Benalla, has commenced.

(c) Bitumen sprayer testing installation

This installation at Syndal is now almost complete. It is expected that test runs and calibration will commence shortly, and that testing of bitumen sprayers will start late in 1968.

(d) Linemarking machine

The construction of a medium size machine, which was described in some detail in the 1966/67 Report, is almost complete. It will be available for calibration in July 1968 and testing will commence in August.

(e) Electronic data processing of plant information

New types of Plant Working Returns were introduced in June 1968. Processing of plant field operating data from these Returns will commence in July 1968. It is expected that the information obtained will assist towards the more efficient utilization of the plant fleet.

(f) Pumping units for bitumen sprayers

Two pumping units of new designs have recently been constructed. Both use an infinitely variable ratio reversible hydrostatic drive to the bitumen pump in place of a mechanical drive. The mechanical drive was subject to considerable wear and required extensive maintenance.

In the first unit, the hydrostatic drive comes from the prime mover engine and the bitumen output is locked to the vehicle speed. All existing sprayer controls are retained except, of course, the control of pump speed. Early tests on this unit have been satisfactory.

In the second unit the hydrostatic drive comes from an auxiliary power unit. The speed of the pump can be varied by changing the setting of the hydraulic pump in the hydrostatic transmission. The sprayer controls are otherwise unchanged. This unit will be tested during the 1968/69 season.

(g) Paynesville Ferry

A propulsion unit and accessories have been designed for the new ferry which will operate between Paynesville and Raymond Island in the Board's Bairnsdale Division.

The propulsion unit, powered by a Perkins 4-270 D diesel engine will drive through a fully reversible, infinitely variable, hydrostatic transmission to a pocketed sheave which will engage a calibrated chain. A second chain which will not be powered will provide a safeguard against the ferry drifting if the propulsion chain fails. The crossing, which is about 400 feet wide, will be made at a speed of 1 knot.

2. NEW TYPES OF PLANT

The following major plant and machinery items of types not previously owned by the Board were acquired:

(a) Crawler Tractor — Class VI

Allis Chalmers model HD16DP torque converter power shift crawler tractor powered by a 6 cylinder 173 h.p. diesel engine. The tractor is equipped with a hydraulically operated bulldozer blade complete with hydraulic tilt cylinder, and a hydraulically operated swivel tyne rear ripper.

(b) Towing Tractors — Medium

(i) Case, model 1032, pneumatic tyred towing tractor powered by a 6 cylinder 107 h.p. diesel engine through an 8 speed conventional transmission.

(ii) International model 806D, pneumatic tyred towing tractor powered by a 6 cylinder 100 h.p. diesel engine, through an 8 speed conventional transmission. A power shift amplifier provides a 33% reduction in speed and corresponding torque increase in each gear ratio.

(c) Patrol Tractor

Fiat model 415 pneumatic tyred tractor powered by a 4 cylinder 42 h.p. diesel engine through a conventional six speed transmission, and fitted with a 10 cubic feet bucket capacity Superlift front-end loader.

(d) Front-end loader

Cranvel Loadstar hydraulically operated front-end loader with a one cubic yard bucket capacity fitted to a 60 h.p. Chamberlain Champion pneumatic tyred tractor. The tractor is fitted with torque converter and Borg Warner Velvet Drive three speed transmission.

(e) Backhoe — Front-end Loader

Ford model 752 side shift backhoe, and Ford model 740 front-end loader built on a Ford model 4500 pneumatic tyred tractor. The unit is powered by a 3 cylinder 56 h.p. diesel engine through a 4 speed conventional transmission.

(f) Self-propelled Multi-wheel Roller

Moore Ferguson model SP 1511 self-propelled multi-wheel roller powered by a 4 cylinder 64 h.p. Ford 5000 diesel engine through a torque converter power shift transmission. Maximum ballasted weight is 35,100 pounds providing tyre loads of 3,190 pounds on each of eleven wheels.

(g) Tandem Vibrating Roller

McDonald model "EC" tandem vibrating roller powered by a 3 cylinder Lister diesel engine through a hydrostatic infinitely variable transmission. The rolling width is 37 inches and the machine weight 3.7 tons unballasted and 4.3 tons ballasted.

(h) Extendible Tray Semi-trailer

Freighter model TF/35 extendible tray type semi-trailer coupled to an International model ACCO 1840 petrol engined prime mover. Maximum carrying capacity of the unit is 14 tons. The semi-trailer tray body length can be extended from 35 feet to 55 feet in increments of 5 feet and the unit is fitted with a sliding tandem rear axle assembly to give optimum load distribution for long loads of various lengths.

(i) Tray Truck

A E C Marshall model TGM 6 RME truck chassis and cab fitted with an Evans tray body 24 feet long by 8 feet wide. The truck is a tandem drive vehicle powered by a 6 cylinder 154 h.p. diesel engine through a conventional gear box.

(j) Crane

V-Kart model VK30 self-propelled straddle crane with a maximum lifting capacity of 3 tons. The crane is powered by a single cylinder 10 h.p. petrol engine through an 8 speed manual transmission. The crane boom extension is hydraulically controlled and an additional 5 feet boom attachment is supplied.

(k) Forklift Truck

Hyster Ransomes model L40A battery electric forklift truck with a lifting capacity of 4,000 pounds at 24 inches fork length. An electronic control system, which provides infinitely variable speed control with minimal power loss over the lower and mid speed ranges, is fitted. The unit has controlled electrical braking. The batteries are charged overnight by an automatic device which regulates charging current in accordance with battery condition.

(l) Concrete Mixer

Bedford model KR12 tilting drum concrete mixer with a wet mix capacity of 3½ cubic feet and powered by a Villiers 12/2 petrol engine.

(m) Vibro-rammer

Heinepak model 70 vibro-rammer powered by a 2¼ h.p. two stroke petrol engine. The unit has a nett weight of 138 pounds and a compaction force of 1,650 pounds at 600 impacts per minute.

3. SYNDAL WORKSHOP ACQUISITIONS

(a) A Junkers dynamometer has been obtained. This dynamometer, which consists of a combined water wheel and prony-brake, will permit the efficient testing of small engines from 3 to 30 horsepower.

(b) A Schroeder hydraulic test bench, capable of testing a wide range of components including hydraulic pumps, valves, rams and motors, has been acquired. This machine can also be used to check the operation of hydraulically actuated automatic transmissions which are now an accepted part of heavy earth moving machines.

4. APPRENTICE CENTRE

The Apprentice Centre is now an established part of the Mechanical Sub-branch. Satisfactory results are being achieved in both practical and theoretical training and apprentices passing through the centre continue to reach a high standard of technical competence.

ADVANCE PLANNING

Pavement Serviceability

The 1965/66 Report referred to use of the Board's roughometer in determining the Pavement Serviceability Index. The Report mentioned the proposed installation of automatic recording equipment. Electronic equipment has since been fitted by the Board's Materials Research Division, and this enables a record of roughness to be printed on tape at each quarter mile interval. As a result, it was possible to examine some 4,300 miles of highways in the first half of 1968.

GLENELG HIGHWAY, OUTER WHEEL PATHS, ROAD NO. 2671 PAGE 5
BPR ROUGHOMETER, OPTICAL UNITS INTEGRATOR, SURVEY DATE...17-19FEB68

ROUGHNESS READINGS (INCH/QUARTER MILE) TWO-WAY HIGHWAY..... HAMILTON BOUND LANES L1	ROUGHNESS READINGS (INCH/QUARTER MILE) TWO-WAY HIGHWAY..... HAMILTON BOUND LANES L2	ROUGHNESS READINGS (INCH/QUARTER MILE) TWO-WAY HIGHWAY..... BALLARAT BOUND LANES L1	ROUGHNESS READINGS (INCH/QUARTER MILE) TWO-WAY HIGHWAY..... BALLARAT BOUND LANES L2	TEXTURE (.01 INS.)	ROUGHNESS (INCH/MILE) ACTUAL	ROUGHNESS (INCH/MILE) CORRECTED	P.S.I.	MILE-POST	P.S.I. = PRESENT SERVICEABILITY INDEX 0 1 2 3 4 5
27		28		12	110	86	3.8		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXXX
28		24		11	104	82	3.9	115	'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX
29		25		12	108	84	3.9		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX
31		31		11	124	102	3.4		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXX
38		42		11	160	138	2.7		'XXXXXXXXX'XXXXXXXXX'XXXXXXX
34		34		11	136	114	3.2	116	'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XX
30		35		11	130	108	3.3		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXX
34		36		11	140	118	3.1		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'X
35		37		11	144	122	3.0		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'
28		37		11	130	108	3.3	117	'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXX
31		37		11	136	114	3.2		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XX
28		33		11	122	100	3.5		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXX
40		34		11	148	126	2.9		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX
49		49		12	196	172	2.2	118	'XXXXXXXXX'XXXXXXXXX'XX
42		40		12	164	140	2.7		'XXXXXXXXX'XXXXXXXXX'XXXXXXX
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45		51		10	192	172	2.2		'XXXXXXXXX'XXXXXXXXX'XX
34		31		11	130	108	3.3		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXX
39		40		14	158	130	2.9	120	'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX
35		33		14	136	108	3.3		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXX
23		24		14	94	66	4.4		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXX
25		26		14	102	74	4.2		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XX
24		26		14	100	72	4.2	121	'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XX
22		24		14	92	64	4.5		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXX
20		26		14	92	64	4.5		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXX
23		23		11	92	70	4.3		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXX
29		30		11	118	96	3.6	122	'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXX
27		26		11	106	84	3.9		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX
26		24		11	100	78	4.0		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'
25		31		11	112	90	3.7		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXX
24		30		11	108	86	3.8	123	'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXXXXX
29		33		12	124	100	3.5		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'XXXXX
34		40		12	148	124	3.0		'XXXXXXXXX'XXXXXXXXX'XXXXXXXXX'
45		43		12	176	152	2.5		'XXXXXXXXX'XXXXXXXXX'XXXXX

Explanatory notes:—

(*i*) *"Roughness readings" are those recorded by the roughometer.*

(*ii*) *"Texture" refers to average surface texture depth — readings obtained by use of the Board's "texturemeter" (referred to in the* 1965/66 *Report).*

(*iii*) *"Actual roughness" = mean of roughness readings per quarter mile converted to roughness per mile.*

(*iv*) *"Corrected roughness"* R_c *= actual roughness minus twice the texture reading.*

Figure 6. Typical Computer Print-out of Roughometer Data and Present Serviceability Index.

The tape record is transferred to the Board's I.B.M. 1620 computer, which calculates the Present Serviceability Index and prints out the Index and the original data (Figure 6). The concept of the Present Serviceability Index was dealt with in some detail in the 1965/66 Report (pages 28-29). Briefly, the Index is based on a correlation established between present serviceability of certain pavement sections, as noted by a panel of experienced engineers, and the roughness of these sections as determined by the roughometer. Present Serviceability Index is calculated from the expression:

$$P.S.I. = 14.184 - 2.327 \log_e R_c$$

where R_c = corrected roughness in inches per mile.

The roughometer is checked for repeatability of results, by repeating runs over the same stretches of pavement, keeping to the same wheelpaths as far as possible. Satisfactory repeatability for three pavements is indicated in Figure 7.

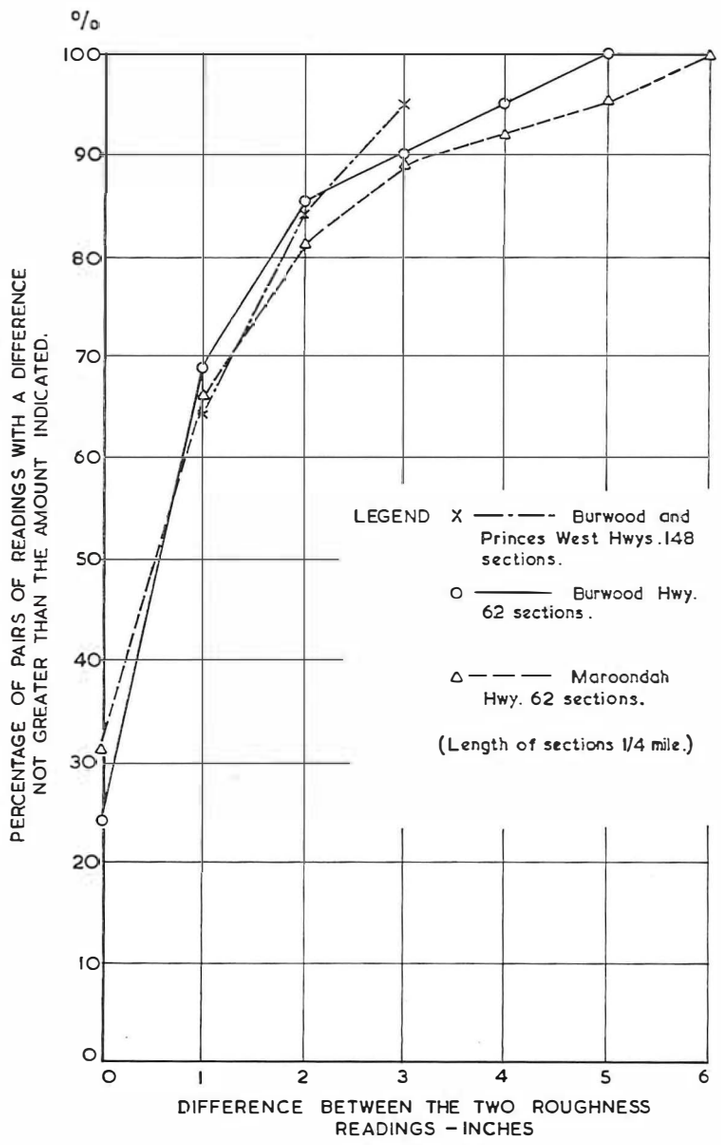

Figure 7. Roughometer Results Repeatability Tests.

Road Needs Survey

During the year, a considerable engineering effort was made in Victoria, in collecting information and assessing roads and bridges for the 1969-1979 Australia wide road needs survey. Items of particular interest in this survey were the introduction of a functional classification of roads, and the assessment of sections against a series of tolerable limits.

Grouping roads by function overcomes the difficulties experienced when only legal classifications are considered, and enables comparison of roads performing similar functions in the different States. Rating sections of roads against a series of tolerable standards determines whether a need now exists or will arise during the survey period, having regard to the anticipated growth in traffic, the structural condition and traffic serviceability.

Assessment of needs for roads in rural areas and in provincial urban areas was carried out in accordance with a specification prepared by a sub-committee of the Advance Planning Committee of the National Association of Australian State Road Authorities, after reaching agreement on basic assumptions and premises with the Commonwealth Bureau of Roads.

For the survey in the Melbourne metropolitan area and in major provincial urban areas, use was made of instructions prepared by the Commonwealth Bureau of Roads, viz. "Guide-lines for Data Collection" and "Guide-lines for Estimating Costs".

Results of the survey are now being collated and will be available for consideration when the Commonwealth Government is formulating a new Commonwealth Aid Roads Act to operate after the present Act expires at the end of June, 1969.

ENGINEERING COMPUTER SECTION

Use of the Board's Computer During 1967/68

(a) Use by Board's staff

A summary of the total computer time used during 1967/68 by the Board's own staff is shown in Table 9 and additional details of the work processed and the programming work undertaken are contained elsewhere in this Report.

TABLE 9—IBM 1620 COMPUTER USAGE BY BOARD'S STAFF

User	Productive Hours	Developmental Hours	Total Hours
Bridge Sub-Branch	682	164	846
Plans and Survey Section	308	47	355
Title Survey Section	147	—	147
Traffic & Location Section	226	98	324
Advance Planning Division	121	24	145
Computer Section	*223	103	326
Materials Research Division	125	51	176
Asphalt Division	6	—	6
Dandenong Division	22	—	22
Metropolitan Division	6	—	6
Accountant's Branch	14	1	15
Secretary's Branch	155	78	233
Totals for 1967/68	2035	566	2601

*Denotes work processed by the Engineering Computer Section for other sections.

(b) Use by Other Bodies

Machine time was also made available to other Government departments and bodies, viz.

Department of Lands and Survey
Department of Army (Survey)
Australian Road Research Board
Australian Photogrammetric Society
Shire of Whittlesea
Melbourne Metropolitan Transportation Study

Two firms of consulting engineers engaged by public authorities also made limited use of the Board's computer equipment. The total computer time utilised by other bodies was 227 hours during 1967/68, a decrease of 36% in comparison with the previous year.

(c) Trends in Computer Usage

Although there was little change in the volume of developmental work, the productive usage of the Board's computer for the processing of design problems and other directly useful work increased markedly during 1967/68. In comparison with 1966/67 an additional 808 hours of computer time were required, representing an increase of 66%.

Including developmental time (for writing and testing new computer programmes) the overall increase for the twelve month period was 44%.

The introduction of full two-shift operation was necessary in February 1968. In the last two months of the financial year, the workload had further increased to the stage where the computer was being operated for 15 hours per working day.

COMPUTER PROGRAMMING

In addition to providing advice and assistance to other members of the staff engaged in computer work, the Section co-operated with other Sections in the development of new computer programmes.

The Section programmed new systems for summarizing and reporting the annual traffic census figures, accident statistics, travel time study information obtained as part of the Road Needs Survey, and concrete test results.

The Road Design Sub-branch were also assisted by the programming of the geometric computations necessary for the design of curvilinear alignments, and the development of a new plotting programme to prepare drawings of road cross-sections in foolscap format.

SAFETY

Injuries to Board's staff at work decreased by 13.5 per cent. from 1966/67 to 1967/68. Details of the injuries are set out in Table 10.

TABLE 10—INJURIES TO BOARD'S EMPLOYEES

Type of Injury	1967/68	1966/67	Changes From 1966/67 to 1967/68	
			Decrease	Increase
Back strains	48	84	36	—
Burns and scalds	16	20	4	—
Burns to eyes	23	40	17	—
Fatal injuries	2	—	—	2
Foreign bodies in eyes	39	50	11	—
Fractures	9	18	9	—
Head injuries	10	14	4	—
Lacerations and wounds	44	40	—	4
Miscellaneous	120	99	—	21
Multiple injuries	5	7	2	—
Occupational diseases	48	43	—	5
Sprains and strains	21	30	9	—
Totals	385	445	Nett decrease = 60	

It is considered that the reduction in back strains is due at least partly to adoption of kinetic lifting methods, whilst the reductions in burns to eyes, and foreign bodies in eyes, result from gradual improvements in the supply and use of protective equipment.

The relative frequency and severity of accidents were as set out below, for 1967/68 and portion of 1966/67:—

	1/7/67-30/6/68 (Twelve month period)	1/1/67-30/6/67(a) (Six month period)
Total manhours worked	8,420,000	4,093,000
Lost time accidents	385	235(b)
Accident frequency rate per million manhours	46	57(b)
Days lost (c)	14,328	1,575(b)
Days lost per million manhours (c)	1,714	385(b)

Note:

(a) Detailed statistics are not available for the first half of 1966/67.

(b) Amended from the figures included in the 1966/67 Report, after further investigation.

(c) "Days lost" are based on Australian Standard CZ6—1966, "Recording and Measuring Work Injury Experience". The large increase in 1967/68 was due to arbitrary assessment of two fatalities as being equivalent to 12,000 days lost.

During 1967/68 activities regarding safety were carried out as set out below.

Inspections and Investigations

Regular visits of 5 days' duration were made to Board's Divisions and the Syndal Depot. In the course of these visits, general safety inspections were carried out, at depots, workshops, pre-cast yards and in the field. The inspections concerned existing and potential unsafe practices and conditions. Following each inspection, proposed safety measures were discussed with the Board's Divisional Engineer concerned.

Investigations were made into the causes of a number of accidents that occurred to employees in the course of their employment. In several instances, it was possible to devise methods of preventing repetitions of the accidents.

Training in Safe Practice

Safety talks, including the screening of films, were given during the inspections mentioned above. Safety induction sessions for cadet engineers and other staff were held at the Board's Head Office.

Lectures and practical demonstrations on kinetic lifting methods were given to staff during inspection visits.

Training was given to operators of cranes and forklifts at Syndal, to improve safety in material handling.

Accident Reporting

A revised type of accident-investigation report form was introduced in July, 1967. It now includes on the front, means of describing the accident that caused the injury. On the back are check lists for indicating the possible causes of the accident and for suggesting possible ways of preventing similar accidents in the future. This revised form is proving to be very useful in recording accident data.

MANUALS

Preparation of Manuals for use by the Board's Engineering Staff is continuing.

During the year new General Conditions of Contract and new Standard Specifications for Roadworks were introduced, and a Manual, "Notes on the Standard Specifications for Roadworks" was issued.

A total of 46 Standard Specification Drawings were issued for use in conjunction with the new Roadworks Specifications. These drawings, together with design tables and drawings related to the Road Design Manual and the Road Drafting Manual, will be included in a Manual of Design Tables and Standard Drawings to be issued shortly.

STAFF TRAINING

Selected members of the Chief Engineer's Branch attended the following training courses and conferences during 1967/68:

External Courses

New Zealand Roading Symposium—Victoria University, Wellington.

Special Lectures in Transport—University of Melbourne.

Third International Road Federation Pacific Regional Conference—Sydney.

Annual Engineering Conference at Brisbane—Institution of Engineers, Australia.

Permanent International Association Road Congress—Tokyo.

Seminar, Australian Transport in the Next Decade—Institute of Transport.

Symposium, Cost Benefit Analysis—Commonwealth Bureau of Roads.

Symposium, Economics of Roads and Road Transport—Commonwealth Bureau of Roads.

Seminar, Effect of Containerisation on Road Transport—Institute of Road Transport Engineers.

Traffic Planning and Control Course—University of New South Wales.

Seminars, Traffic Engineering—University of Melbourne.

Seventh Civil Engineering Construction Management Course—University of New South Wales.

Eleventh Survey Congress—Institution of Surveyors, Australia.

Apprenticeship Training for Civil Construction Workers—Barnard Bros. Pty. Ltd.

Seminar, Earth Moving—William Adams Tractors Pty. Ltd.

Short Course on Conservation—National Resources Conservation League.

Explosives Courses—State Electricity Commission of Victoria.

Scaffolding Lecture Series—Royal Melbourne Institute of Technology.

Concrete Technology and Practice Course—Royal Melbourne Institute of Technology.

Symposium, Noise in Industry—South Australian Department of Public Health.

Automatic Transmissions—Lecture Series—Society of Automotive Engineers, Australasia.

Workshop Management—Lecture Series—Society of Automotive Engineers, Australasia.

Development, Operation and Maintenance of Medium Speed and High Speed Diesel Engines —Society of Automotive Engineers, Australasia.

Automobile Braking—Society of Automotive Engineers, Australasia.

Service Training—Cummins Diesel Australia.

Symposium, Non-Destructive Testing—Non-Destructive Testing Association of Australia.

Twenty-first Annual Conference, at Newcastle—Australian Institute of Metals.

Seminar, Technical Computing—Institution of Engineers, Melbourne Division.

Data Processing and Machine Computation—Fortran Course—I.B.M. Australia Pty. Ltd.

Advanced Course—Australian Administrative Staff College.

Seminar, Effective Top Management—Dr. H. Koontz—Beckingsale and Company.

Seminar, Utilizing Human Resources—Commonwealth Department of Labour and National Service.

Methods of Instruction Course—Commonwealth Department of Labour and National Service.

Superintendents of Works' Conference—Local Government Engineers' Association of Victoria.

Work Simplification Course—Australian Institute of Management.

Industrial Engineering Appreciation Conference—Postmaster General's Department.

Internal Courses

Divisional Patrolmen's Training Course, Bendigo Division.

Bituminous Concrete Surfacing Course.

Training in Communications.

Course in Procedures of the Board's Traffic and Location Section.

Supervising Engineers' Conferences.

Computer Appreciation Courses for Engineers.

PUBLICATIONS

The following papers were presented during 1967/68, in connection with the Board's engineering work:

Paper	Author
Traffic Accident Reduction by Highway Improvement Presented at the Third International Road Federation Pacific Regional Conference, Sydney, January 1968.	N. S. Guerin, B.C.E., C.E., Cert. H.T.(Yale), A.M.I.E.Aust., A.M.I.T.E.
Railway Level Crossing Investigations Presented to The Highways and Traffic Engineering Branch of the Melbourne Division, The Institution of Engineers, Australia, July 1967.	N. D. McFadyen, B.C.E., Cert.T.P.&C.(N.S.W.), C.E., A.M.I.E.Aust.
Determination of Economic Thickness of Insulation Presented at The Institution of Engineers, Australia, Conference, Brisbane, April 1968.	J. Molnar, Dipl.Ing. (Hungary), M.I.E.Aust., M.I.A.A.E. J.B. Armitage, Dip.Mech. Eng., Dip.Elec.Eng.
Geological Factors Affecting Quality of Crushed Stone Presented to The Highways and Traffic Engineering Branch of the Melbourne Division, The Institution of Engineers, Australia, October 1967.	E. Nyoeger, F.R.M.I.T., R.M.A. (Budapest), J.M.(Aust.)I.M.M.
Petrographic Analysis Related to Quality of Basic Igneous Rocks as Roadmaking Aggregates Presented to the Australian National Society of Soil Mechanics and Foundation Engineering, Melbourne Branch, October 1967.	E.Nyoeger, F.R.M.I.T., R.M.A. (Budapest), J.M.(Aust.)I.M.M.
Design of Phillip Island Bridge Presented at a General Meeting of the Civil and Municipal Engineering Branch of the Melbourne Division, The Institution of Engineers, Australia, August 1967.	K. N. Opie, E.D., B.C.E., Dip.T.R.P., A.M.I.E.Aust.
Development of the Roadside, and Aesthetics in Road Design Presented at The Institution of Engineers, Australia, Conference, Brisbane, April 1968.	J. R. Joyce. A. J. Pryor, B.C.E., C.E., A.M.I.E.Aust.
Strathmore By-pass Road: Some Aspects of the Survey and Design Published in the Journal "Australian Road Research", Vol. 3 No. 4 December 1967	R. T. Underwood, M.E., Dip. T.&R.P., C.H.T.(Yale), C.E., A.M.I.E.Aust., M.A.P.I., A.M.I.T.E. R. N. Morison, B.Sc., C.Eng., C.E., A.M.I.C.E., A.M.I.E.Aust.
The Development of Divided Facilities in Rural Areas Presented at the Third International Road Federation Pacific Regional Conference Sydney, January 1968.	R. T. Underwood, M.E., Dip. T.&R.P., C.H.T.(Yale), C.E., A.M.I.E.Aust., M.A.P.I., A.M.I.T.E.
The Use of Local Materials in the Development of the Rural Road System in N.W. Victoria Presented at the Third International Road Federation Pacific Regional Conference, Sydney, January 1968.	L. Upton, C.E., A.M.I.E.Aust.

The following issues of "Engineering Notes" were published:

85. Use of Explosives for Breaking Back Piles
86. Repair and Renovation of Traffic Signs
87. Lime Content for Stabilization
88. Manual Lifting of Guide Posts

One Technical Bulletin, No. 27, was published, entitled "Compaction with Heavy Self-propelled Pneumatic Tyred Rollers".

Two issues of "Construction News" were published, containing fourteen items on various topics.

STAFF

Total staff of the Chief Engineer's Branch was 943 at 30th June, 1968.

Total work performed direct by the Board on its own behalf and for other authorities, and by municipalities from funds made available by the Board, cost $67,140,000 during 1967/68.

The work of the branch continues to increase in volume and in complexity. I wish to thank the staff for the important contribution made to the Board's work over the financial year.

Mr. D. T. Hewson, a most valuable senior engineering officer, lost his life in an accident during the year.

In another tragic accident, the Board suffered another severe loss when Messrs. J. Symons, R. C. Watt and C. J. Glare were killed.

Mr. N. G. Roeszler, who was the Board's first Metropolitan Divisional Engineer, retired during the year. He played a major part in the successful organising of this division.

H. S. Gibbs,
Chief Engineer.

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