60 Denmark Street
Kew 3101

30th September 1977

The Honorable J. A. Rafferty MP
Minister of Transport
570 Bourke Street
Melbourne 3000

Sir
In accordance with the requirements of Section 128 of the Country Roads Board 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, 1977.

The Board thanks you, Sir, for your 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

R. E. V. Donaldson
AASA (Senior), AIMA, FCIT, JP
Chairman

T. H. Russell
M.Eng.Sc., BCE, Dip.CE, CE, FIE Aust.
Deputy Chairman

W. S. Brake
BCE, CE, MIE Aust.
Member

N. L. Allanson
AASA (Senior), JP
Secretary

Some of the bridges completed by the CRB during the year: 1. Eastern Freeway — Chandler Highway Overpass. 2. Princes Highway East — Simpson's Creek Bridge. 3. Princes Freeway — Snowy River Bridge, Orbost. 4. Goulburn Valley Highway — Goulburn River bridge at Trawool, under construction. 5. Princes Freeway — Ashbys Gulch Bridge, Orbost.

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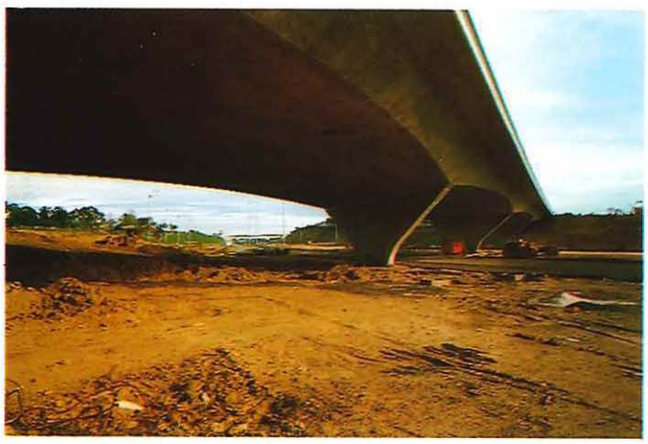

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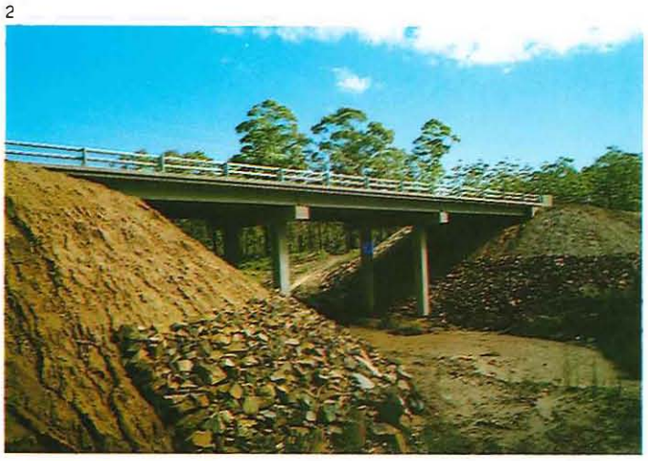

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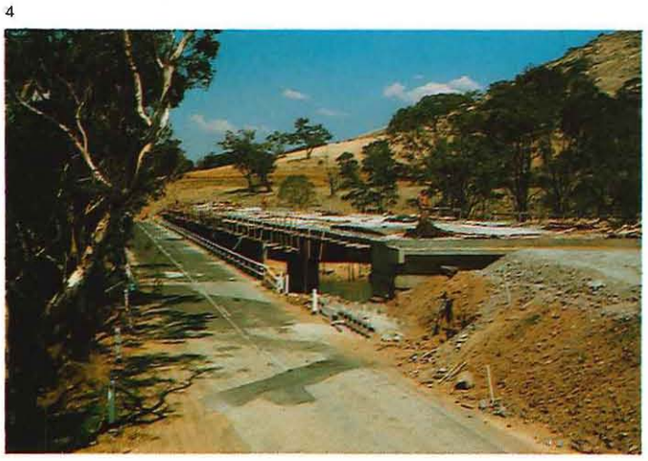

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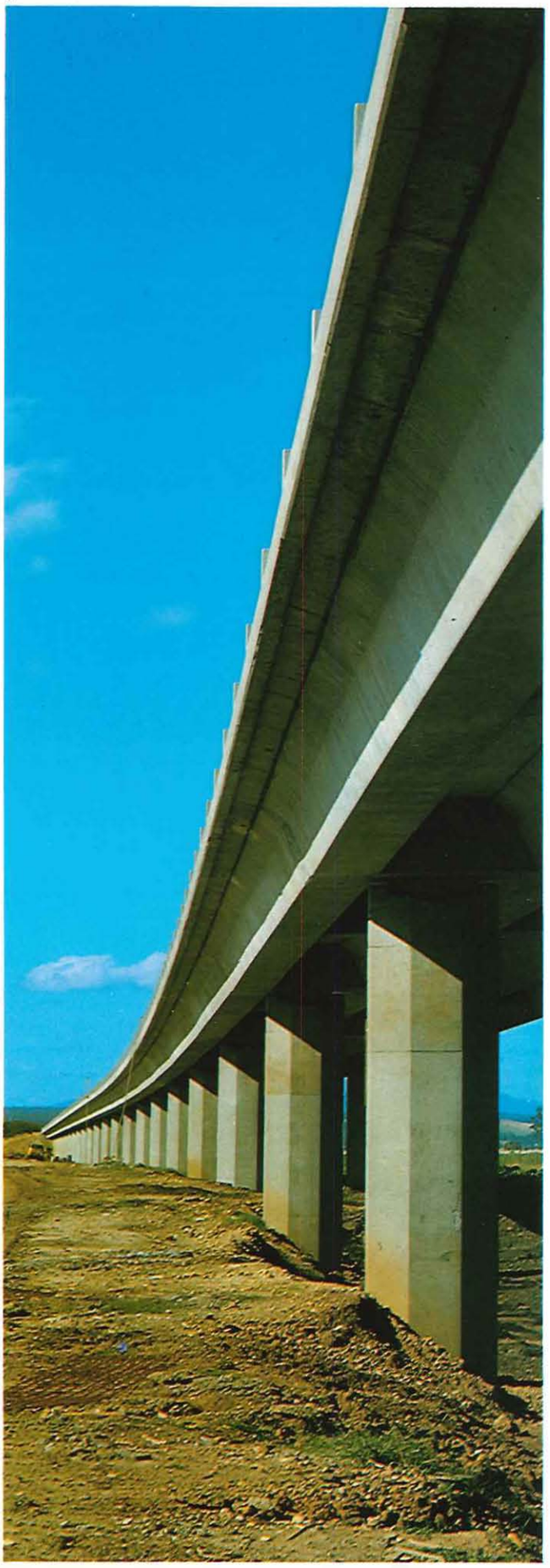

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Motor registration fees

An increase in the rates of motor registration fees by approximately 36% as from 1st January, 1977, resulted in additional revenue of approximately $14.5 million being paid into the Country Roads Board Fund and the Roads (Special Projects) Fund during the year. The additional revenue assisted in easing the financial crisis facing the Board.

As a result of the increased revenue, supplementary allocations of funds were made by the Board in January, 1977, to municipal councils for expenditure on main roads and unclassified roads. Additional funds were also provided for the Board's direct works programme.

The total gross revenue received from motor registration fees, including trailer registration fees, during the year amounted to $100.754 million, $69.162 million of which was paid into the Country Roads Board Fund and $31.592 million into the Roads (Special Projects) Fund.

Gross revenue received from motor registration fees represented approximately 49% of the Board's total funds available for expenditure on roads in the financial year. The level of registration fees is therefore a significant factor in the amount of funds available to satisfy the community's road needs.

Motor registration fee rates were previously increased in February, 1975, by approximately 35% and in March, 1968, by proportions ranging from 9% for private vehicles up to about 20% for commercial vehicles.

The amounts paid for registration of a Holden Kingswood sedan-type vehicle with 32 power units and 25 weight units as at 31st March, 1977, in the various States were approximately as follows:

Victoria	$65	South Australia	$61
New South Wales	$63	Western Australia	$56
Queensland	$54	Tasmania	$53

Commonwealth funds for roads

Funds made available by the Commonwealth for the three-year period from 1st July, 1974, were provided under the National Roads Act 1974, the Roads Grants Act 1974, and the Transport (Planning and Research) Act 1974, all of which expired on 30th June, 1977.

Although the Honorable P J Nixon MP, Commonwealth Minister for Transport, advised the States on 10th May 1977 of the principles which he would be proposing for the new Roads Assistance legislation, the only legislation passed by the Commonwealth prior to 30th June 1977 was interim legislation covering the three-month period from July 1977 to September 1977. The interim legislation entitled 'The States Grants (Roads Interim Assistance) Act 1977' is expected to be subsumed by later legislation covering a three-year period from 1st July 1977 to 30th June 1980.

The interim legislation provided for grants to be made to the States equal to one-quarter of each State's proposed total 1977/78 grants announced by the Honorable P J Nixon MP on 25th February 1977. The interim legislation did not provide funds for planning and research expenditure.

Although the principles outlined by the Honorable P J Nixon MP on 10th May 1977 regarding the proposed Roads Assistance legislation indicate that the new legislation will combine into one act the 1974 National Roads Act and Roads Grants Act, there is no indication that the serious shortcomings of the 1974 legislation will be avoided. The proposed legislation is expected to cover only a three-year period and to provide for eight separate categories with specific grants being made to each category. The three-year period is far too short for planning purposes and the retention of so many categories receiving specific grants continues the Commonwealth's intrusion into the development of Victoria's road system in respect of which the priorities and standards should be determined by Victoria. The administrative arrangements required to cope with so many categories is time-wasting and unnecessary.

Another disturbing feature of the proposed legislation is the indication that the level of grants for 1978/79 and 1979/80 are to be held, in real terms, at the level of 1977/78 grants. Although this is a form of indexation, the indexation is based on the amount of the proposed 1977/78 grant which is well below needs. The proposed 1977/78 grant of $98.9 million is inadequate, taking into account the following factors:

- $98.9 million is only 8.5% or $7.8 million greater than that made available by the Commonwealth in financial year 1976/77.
- To maintain in 1977/78 the 1976/77 level of road and bridge works financed from Commonwealth funds assuming an inflation rate of 16%, the Commonwealth allocation should be approximately $106 million.
- Assuming an inflation rate of 16% in 1977/78, the real work effort will fall in 1977/78 by approximately 7% compared with 1976/77. This could lead to reductions in workforces employed by the Board, Councils and Contractors.
- The Commonwealth Bureau of Roads "Report on Roads in Australia 1975" recommended an allocation to Victoria in 1977/78 of $135.5 million.

Another deficiency in the proposed new legislation is the serious departure from previous trends in the amounts made available for particular categories. The proposed 1977/78 distribution of funds announced by the Honorable P J Nixon MP drastically reduces the amounts made available for urban arterial roads, approximately 30% of the Commonwealth funds for urban arterial road construction is under municipal control, and increases the amounts proposed for urban local and rural arterial and rural local roads. The results of road needs surveys conducted by the Commonwealth Bureau of Roads and the States' Road Authorities and the recommendations of the Commonwealth Bureau of Roads have been disregarded by the Commonwealth Government. The situation is illustrated by the following table:

Note: In financial year 1976/77 approximately $200 million was paid to the Commonwealth by Victorian motorists in fuel taxes. In return grants made available to Victoria were only $91.1M.

In order to correct the deficiencies, the Honorable P J Nixon MP was requested by the Honorable J A Rafferty MP, Minister of Transport, Victoria, to increase the urban arterial roads grant by $21.2 million, or if this could not be arranged, to transfer $5.3 million from the proposed urban local roads grant to the urban arterial roads grant, and $1.4 million from the national commerce roads grant to the urban arterial roads grant.

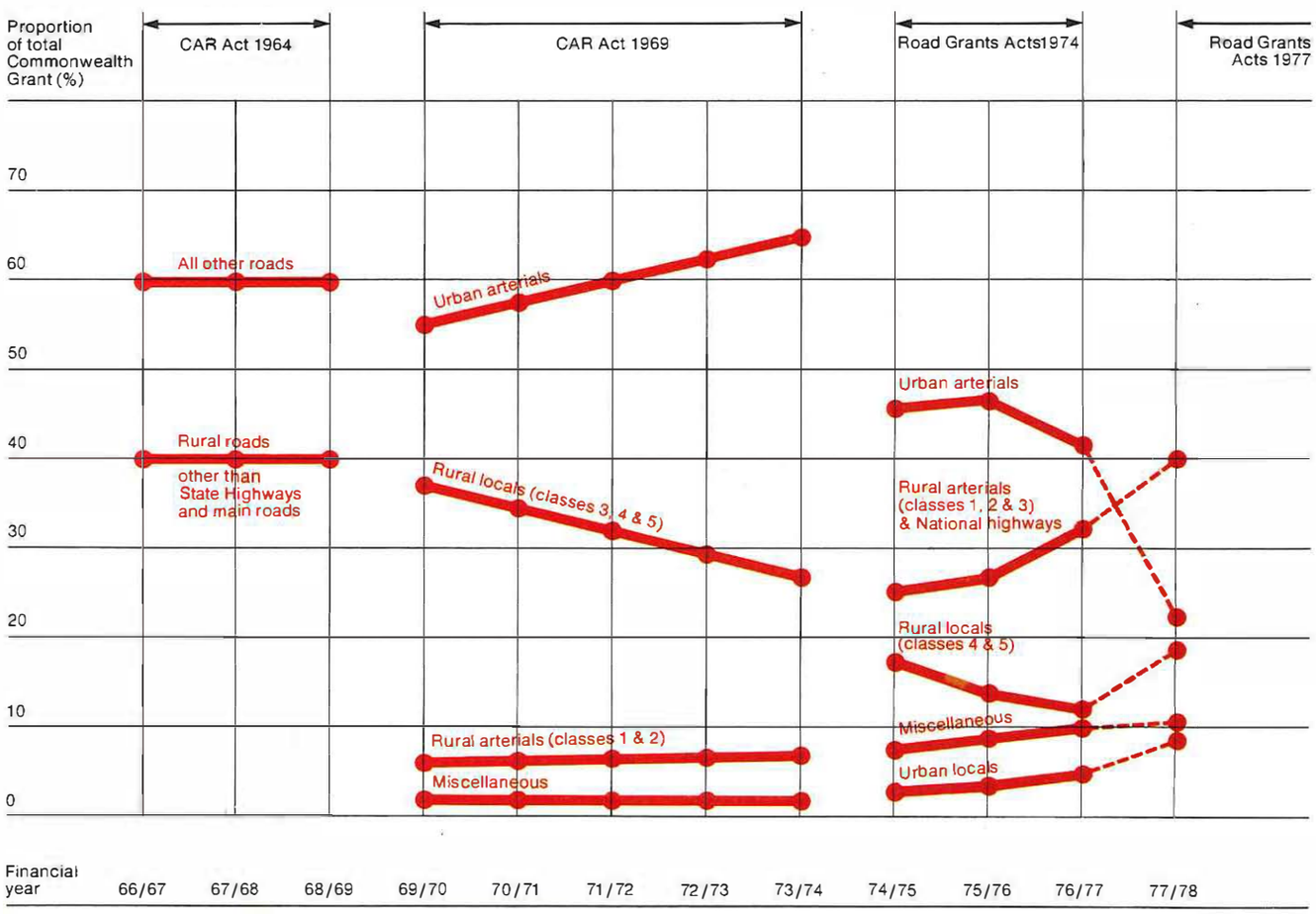
In summary, the Commonwealth's proposed distribution of funds over the eight categories ignores demonstrated road needs and indicates that the Commonwealth is adopting a role in relation to local government which properly belongs to the State. The lack of a coherent Commonwealth policy for roads seriously impairs the States' ability to predict likely financial resources and to plan and implement the necessary road programmes.

The following graph illustrates the confusing changes in the pattern of Commonwealth grants to Victoria since 1966/67.

Table Showing Comparison of:
1. Proposed Commonwealth road grants for 1977/78
2. Commonwealth grants 1976/77
3. Recommendations of Bureau of Roads for 1977/78

Category	Proposed C'wealth grants 1977/78	C'wealth grants 1976/77	Increase/Decrease proposed grants on 1976/77 grants		Bureau of roads rec. 1977/78 (current prices)	Increase/Decrease proposed grants on Bureau's rec. 1977/78	
	$'000	$'000	$'000	%	$'000	$'000	%
National Highway construction	26,000	23,450	+ 2,550	+ 11	36,400	− 10,400	− 29
National Highway maintenance	3,000	2,150	+ 1,850	+ 39	3,200	− 200	− 6
Major commerce roads	5,200	5,200	—	—	6,400	− 1,200	− 19
National roads	34,200	30,800	+ 3,400	+ 11	46,000	− 11,800	− 26
Rural arterial	11,100	4,300	+ 6,800	+ 158	5,700	+ 5,400	+ 95
Rural local	19,000	10,700	+ 8,300	+ 78	14,600	+ 4,400	+ 30
Urban arterial	22,200	39,600*	− 17,400	− 44	57,800	− 35,600	− 62
Urban local	8,900	3,100*	+ 5,800	+ 187	5,700	+ 3,200	+ 56
M.I.T.E.R.S.	3,500	2,600	+ 900	+ 35	5,700	− 2,200	− 39
Roads grants	64,700	60,300	+ 4,400	+ 7	89,500	− 24,800	− 28
Total:	98,900	91.1	7,800	8.5	135,500	− 36,600	− 27

*Includes approved transfer of $350,000 from National Highway construction to National Highway maintenance, and $1.5 million from urban local to urban arterial



1. South Gippsland Freeway, south from Princes Highway East. 2. Minister of Transport, Mr J A Rafferty, plants a tree to mark the opening of the Mulgrave Freeway, Blackburn Road to Forster Road Section. 3. Guests at the official opening of the Snowy River Bridge, Orbost.

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Allocations to municipal councils simplified procedures

In October 1976, the Board announced new simplified procedures relating to the allocation of funds to municipal councils for expenditure on unclassified, main and forest roads. The new procedures allow the councils greater flexibility in the expenditure of the allocations and substantially reduce the administrative work involved by municipal staff and the Board's staff.

The Board's 1977/78 allocations to municipal councils were made in April 1977 in accordance with the new procedures. The principal features of the new procedures are:

Unclassified roads

—Apart from large road and bridge projects MITERS projects and jointworks between two councils, one overall allocation will in future be made to each municipal council for an approved list of projects.

—The present system of seeking the Board's approval to transfers of funds will be eliminated. Councils will in future be able to spend the total allocation on any of the works in the approved programme provided that the total allocation is not exceeded.

—The revote and commitment system will be eliminated. Councils will in future be able to claim against the current year's allocation, expenditure incurred on uncompleted works approved in the previous year, but any unexpended funds at 30th June each year will lapse and will need to be included in the councils' ensuing year's applications for funds.

—The 'Application for funds' form requiring councils to submit an application for one job only on each form has been amended to allow for applications for several jobs to be made on each form.

—The submission of tenders for the Board's approval in future will only be necessary where plans and specifications are required to be submitted and approved by the Board, or the lowest tender is not proposed for acceptance, or the total amount of the tender exceeds $100,000 or the tender proposed for acceptance is not in accordance with the plans and specification.

—The amount of information required in claims submitted by councils for reimbursement of expenditure will be substantially reduced.

—Plans and specifications will only be required in future for particular projects where it is considered necessary to ensure that uniform standards are maintained. Such projects would include bridgeworks, urban construction works, large and complex rural works and works requiring the acquisition of land from permanent reserves.

—The Board's approval to the hire of private plant by municipal councils will not be required in the future.

Main roads

—Apart from the retention of the present system of requiring applications for individual jobs on main roads and the allocation of funds for individual jobs, procedures generally have been simplified on the lines outlined above for unclassified roads. Provided that the overall allocation to the council is not exceeded, councils will be permitted to incur expenditure in excess of individual allocations by up to 25% or $1,000 whichever is the greater. Expenditure in excess of these limits will require the approval of the Board's Divisional Engineer.

Prior to their introduction the simplified proposals were discussed with representatives of the Municipal Association of Victoria and at meetings arranged with municipal officers in each of the Board's regional divisions.

Three major projects opened to traffic

Many significant roadworks and bridgeworks were completed and opened to traffic during the year. Three projects of major significance were: the Snowy River Bridge on the Princes Freeway at Orbost, the South Gippsland Freeway at Hampton Park and the Mulgrave Freeway between Springvale Road and Forster Road at Mount Waverley.

Snowy River Bridge, Princes Freeway, Orbost

A new bridge over the Snowy River on the Princes Freeway at Orbost was officially opened to traffic by the Honourable J A Rafferty, Minister of Transport on 25th November 1976. The bridge was built at a cost of $2.4 million and is the first of four bridges to be built as part of the 8.4 kilometre freeway bypass of Orbost.

The old timber bridge over the Snowy River had always been susceptible to flooding but the new bridge now provides motorists with a road level 3 metres above the record flood level of 1971.

The new bridge is 366.4 metres in length and is among the ten longest bridges in Victoria.

Construction of the freeway project started in 1974 and is scheduled for completion in November 1977. The total estimated cost of the whole project is $9 million. The work is the biggest single project undertaken by the Board in the far east of the State.

South Gippsland Freeway, Hampton Park

This South Gippsland Freeway project, when completed, will provide a freeway connection between the Mulgrave Freeway north of the Princes Highway at Dandenong and the junction of the South Gippsland Highway and Dandenong-Hastings Road at Hampton Park.

The dual carriageways of the freeway between the Princes Highway East and Pound Road including the Pound Road interchange were opened to traffic on 6th December 1976. At the same time the southbound carriageway of the ultimate dual carriageways between Pound Road and the Dandenong-Hastings Road was opened to traffic. The northbound carriageway on this section is expected to be complete late in 1977. The project is estimated to cost $12 million.

Mulgrave Freeway, Springvale Road to Forster Road, Mount Waverley

The Mulgrave Freeway between Springvale Road and Forster Road was opened to traffic in two sections during the financial year. The first section of 2 km from Springvale Road to Blackburn Road was opened on 15th December 1976. The second section of 1.6 km was opened on 5th April 1977 following an inspection and tree planting ceremony conducted by the Honourable J A Rafferty, Minister of Transport.

The two sections were completed at a total cost of $13 million.

As part of the project Forster Road was widened and traffic lights installed at its intersections with Waverley Road and Ferntree Gully Road.

Miss Kareen Wealands from the CRB's Estates Section explains compensation procedures to Nepean Highway residents.

Four new urban projects

The Board announced the commencement during the year of preliminary work on four new urgently required major urban projects.

The projects are:

—the construction of the F9 Freeway from Graham Street, Port Melbourne to Grant Street, South Melbourne

—the widening of the Nepean Highway between Cochrane Street, Elsternwick and South Road, Moorabbin

—the extension of the Eastern Freeway from Bulleen Road to Doncaster Road, North Balwyn

—the widening of Bell Street, Preston between James Street and O'Keefe Street.

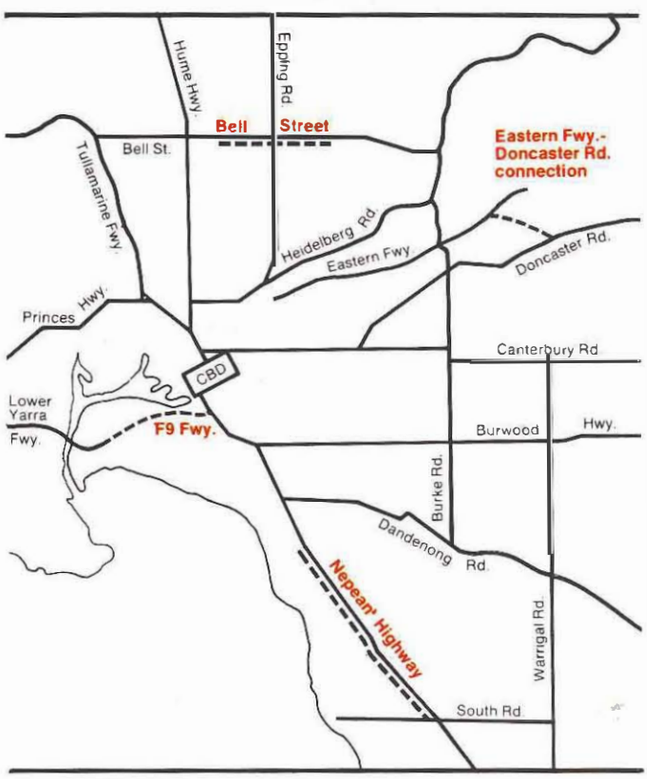
F9 Freeway

The F9 Freeway will extend from Graham Street, Port Melbourne to Grant Street, South Melbourne. The freeway is needed to cater for West Gate Bridge and Johnson Street Bridge traffic and will provide a southerly bypass of the City centre resulting in a vastly improved road connection between the western and south-eastern suburbs.

Eight traffic lanes at ground level will be provided from Graham Street to Johnson Street. From Johnson Street, the freeway will be elevated to east of Kingsway with a basic six-lane configuration. Beyond Kingsway an arterial road connection will be provided along Grant Street to St. Kilda Road. Interchanges will be provided at Graham Street Port Melbourne and at Johnson Street and Kingsway in South Melbourne. Connections to Sturt Street and Power Street will provide access to Alexandra Avenue.

In March 1977, the Honourable J A Rafferty, Minister of Transport announced the acceleration of the works programme to enable the completion of the freeway late in 1981. The completion of a link between the existing freeway at Graham Street and the Johnson Street Bridge should be achieved by late 1979.

The purchase of the necessary properties required for the project was accelerated during the year.



Nepean Highway widening

In February 1977, the Board served notices of acquisition on the owners of property required for the widening of the Nepean Highway between Cochrane Street, Elsternwick and Hampton Street in Brighton, a distance of 2.4 km. The whole project between Cochrane Street, Elsternwick and South Road, Moorabbin, a distance of 6.4 km, will be carried out in three sections over a six-year period at an estimated cost of $32 million in 1976 prices.

The first section on which construction will commence is between Cochrane Street and Hampton Street, followed by the sections between Hampton Street and Cummins Road and between Cummins Road and South Road. The widened highway will provide four lanes for traffic in each direction and a service road along the eastern side. The widening will take place along the western or bay side of the existing highway.

The widening is an urgently needed improvement to the road system servicing the eastern bayside suburbs and will improve traffic flow for the 28,000 vehicles which use this section of the highway each day.

Eastern Freeway extension

In March 1977 the Honourable J A Rafferty, Minister of Transport and the Honourable G P Hayes, Minister for Planning approved the extension of the Eastern Freeway from Bulleen Road to Doncaster, a distance of 2.7 km.

The extension will provide two lanes for traffic in each direction and allow for any future expansion on the southern side.

The freeway will be constructed substantially within the existing Melbourne Metropolitan Planning Scheme main road reservation. Some relocation of the Koonung Creek will be involved.

The work is estimated to cost $12 million in 1977 prices.

Bell Street, Preston widening

The purchase of land and demolition of buildings already owned by the Board was commenced by the Board during the year for the widening of Bell Street, Preston between James Street and O'Keefe Street.

This 2.5 km widening project is expected to be completed by 1981 and will provide three lanes for traffic in each direction with flared intersections at major crossroads. The estimated cost is $10 million in 1977 prices.

The plans for the project were developed by the Board in conjunction with the Preston City Council, to improve traffic flow for more than 20,000 vehicles using the road each day.

The construction work will be undertaken by the Preston City Council with funds provided by the Board.

The Council is expected to commence work on the first section of the project between Hotham Street near the Preston and Northcote Community Hospital and the railway line early in 1978.

Increased commercial vehicle weight and dimension limits

In November, 1976, the CRB began issuing special permits for commercial vehicles to exceed certain existing State limits in length, weight and height.

The new levels followed a comprehensive three year study into the economics of road vehicle limits by a Study Team set up by the National Association of Australian State Road Authorities. (NAASRA).

NAASRA felt that a study into the economics of road vehicle limits was warranted because of the differences and

inconsistencies that existed between State regulations. These differences and inconsistencies were of concern to the transport industry, particularly interstate operators.

In developing the organisation for the Study, a Steering Committee was formed to guide and administer the Study program. Mr T H Russell, the Board's Deputy Chairman, was Convenor of the Steering Committee. The Committee was made up of representatives of NAASRA, the Commonwealth Bureau of Roads, the Commonwealth Bureau of Transport Economics, the Australian Road Research Board, together with a representative from the Australian Road Transport Federation.

An independent Study Team was appointed, which, for the majority of the Study, consisted of six professional staff and four supporting administrative staff. Additional assistance and specialist advice from consultants was obtained where necessary.

Following the publication of the Study's findings and recommendations late in 1975, the recommendations were subjected to close scrutiny and review by State and Commonwealth government departments, the transport industry and other interested parties.

NAASRA approved the recommendations in principle in November, 1975 and in February, 1977, the Australian Transport Advisory Council endorsed new draft regulations incorporating the Study's recommendations.

The Victorian State Government agreed that the Board should issue special permits until the appropriate State legislation can be amended.

The new permits allow the overall length of articulated vehicles to be increased from 15.3 metres to 16 metres, and the height of long distance vehicles travelling on specified routes to be increased from 4 metres to 4.3 metres. Mass limits were increased to the levels recommended by the NAASRA Study as outlined below:

	New	(Old)
	tonnes	tonnes
Tyre loading		
Single tyre	2.7	(2.3)
Axle loading		
Single axle		
—single tyres	5.4	(4.6)
—dual tyres	8.5	(8.2)
Axle group loading		
Twin steer (comprising two axles 10 m-2.0 m apart)		
—with load equalization	10.0	—
—no effective load equalization	9.0	(9.2)
Tandem axle (comprising two axles 10 m-2.0 m apart)		
—all dual tyres		
NSW, Vic, Qld, Tas, ACT	15.0	(13.2)
SA, WA, NT	16.5	—
—all single tyres	10.0	(9.2)
—single and dual tyres	12.0	(11.2)
Triaxles (comprising a group of three axles 2.0 m-3.2 m apart)		
—all dual tyres		
all States and ACT	19.0	(16.32)
NT	20.0	—
—all single tyres or a combination of single and dual tyres	15.0	

Gross loading (except NT)

The maximum permitted gross mass of a vehicle or vehicle combination, used in general transport operations, should be the minimum of

—the manufacturer's rating.

—the sum of the permitted tyre or axle loadings.

—the gross mass M (in tonnes), as given by the axle spacing/mass schedule in which applies to the axle spacing L (in metres) only, based on the formula $M = 2L + 12$.

—36 tonnes for immediate application (this level to be reviewed within three years with a view to adopting a maximum of 38 tonnes subject to the introduction and enforcement of greater control on the safety and operational characteristics of heavy commercial vehicles).

Specific requirements

1. Tyres used for a given load should be in accordance with the rating standards of the Tyre and Rim Association. The maximum tyre pressures are — bias ply tyre — 700 kPa. radial tyre — 825 kPa.
2. The maximum permitted axle and axle group loading limits are dependent on the provision of an approved suspension system, capable of adequate equalization in the case of tandem and triaxle groups provided wholly by hydraulic or pneumatic or mechanical or other approved means.
3. Vehicles with a spread tandem configuration will not be registered after (date to be specified). Spread tandem axle configurations already in use will be permitted to operate to a maximum limit of 15 tonnes (the limit for the normal tandem).

The new permits only apply to commercial vehicles that meet particular safety and design criteria.

In addition to the many recommendations concerning length, weight and height the Study Team found that there were many inadequacies in the existing regulation and enforcement of controls on heavy vehicle operations in Australia.

Having regard to the safety of all road users and the need to overcome the present inadequacies, the following additional recommendations were made by the NAASRA Study:

—Inspection of the mechanical condition of commercial vehicles, on both a regular and random basis, should be given greater emphasis as vehicle defects are of significant concern in regard to the safety of all road users.

—Policing of gross mass should be improved to increase the safety and efficiency of traffic flow. The registered gross vehicle mass and gross combination mass should be clearly displayed on all vehicles.

—Modifications which affect basic operational characteristics of vehicles should be more strictly controlled.

—Action should be taken to ensure that the braking systems of trucks are of the highest standards attainable.

—Effective standards on the type, strength and location of semi-trailer and trailer couplings should be enforced.

—Controls in relation to noise levels, exhaust smoke and gaseous emission levels of heavy commercial vehicles should be adopted and enforced.

Roadworks speed limit signs

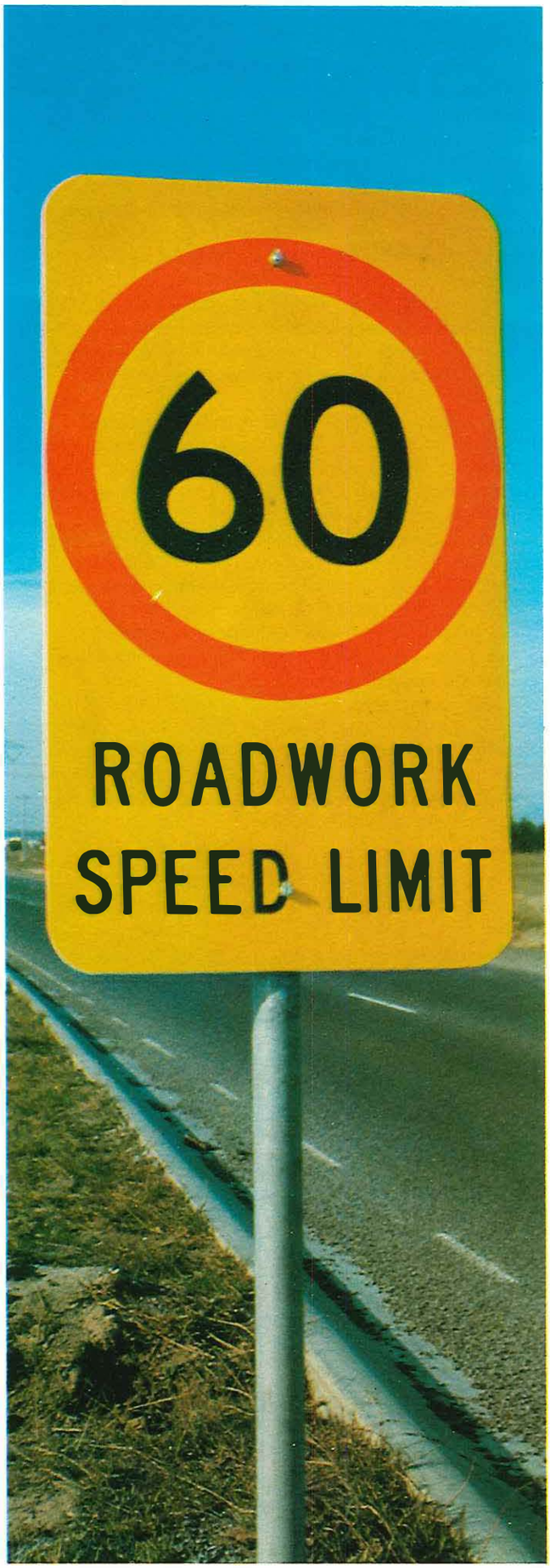
On 1st February 1977 the Board made a by-law to provide for the erection of speed limit signs to indicate the legal maximum speed at which a vehicle may be driven through the Board's construction sites. Motorists who exceed the speed limit may be prosecuted and subject to a maximum fine of $100.

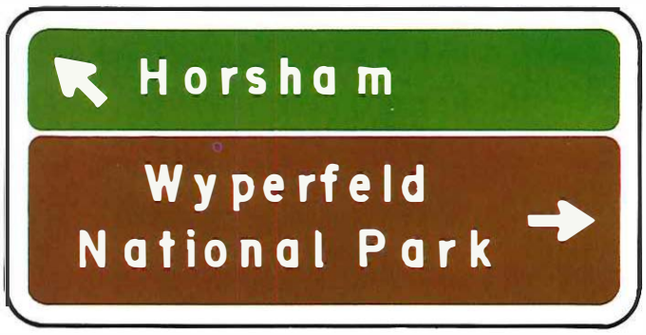
The need for a speed limit has been evident in recent years as an attempt to prevent motorists travelling too fast through construction areas thereby creating a danger to other motorists and the Board's construction personnel.

Local police will be advised when the signs are proposed to be erected at particular locations.

The signs are rectangular in shape and feature a red circle on a yellow background with the words 'Roadworks Speed Limit' underneath the circle. Enclosed in the red circle is the speed in kilometres per hour at which the motorist may travel.

The signs will be placed on both sides of the road in advance of construction sites together with other warning signs. Where necessary in an extended works area repeater speed limit signs will be erected.





Tourist and services signs

During the year the Board formulated and promulgated a series of detailed specifications for the erection of signs denoting:

1. tourist drives and features of tourist interest on declared or proclaimed State highways, main roads, tourists' roads and forest roads,
2. roadside services on declared or proclaimed State highways, main roads, tourists' roads and forest roads, and
3. services in the vicinity of rural freeways.

The specifications describe warrants and methods of signing.

The colour schemes adopted for the signs are
—white legend on brown background for tourist signs and
—white legend on blue background for services signs.

Signs erected denoting tourist facilities which are non-commercial and roadside facilities such as rest areas provided by the Board are generally provided at the Board's expense. Signs denoting certain types of commercial tourist or service establishments may be erected by the Board at the operator's expense.

On rural freeways emphasis will be given to providing signs indicating off-freeway services which offer a suitable standard of service within a reasonable distance of freeway interchanges.

Hume Freeway, Wallan-Broadford section

Following heavy rains in the Spring of 1976 some sections of the Hume Freeway between Wallan and Broadford required repair.

Some sections of pavement had rutted and cracked under the wheel paths of heavy trucks and had caused the bituminous surfacing to break up under wet weather conditions.

The distortions had resulted from the instability of the upper pavement layer of fine crushed rock. Some of the methods used to overcome harshness of the fine crushed rock during production and placement of the road pavement proved to be unsatisfactory and resulted in the instability of the pavement.

Remedial work was carried out after considerable investigation and testing.

Assistance at Creswick and Streatham bushfires

The Board provided assistance in the form of personnel and equipment during and after the bushfires which devastated the Creswick and Streatham areas on 12th February 1977.

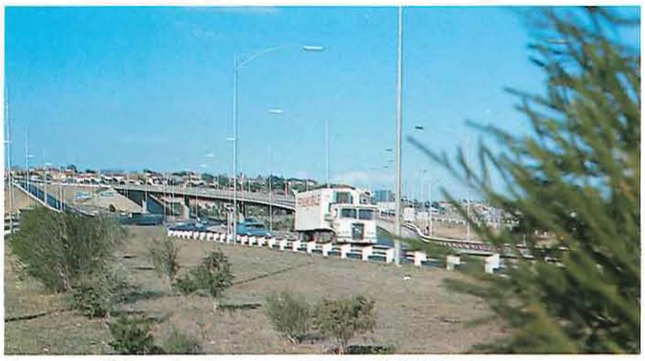
Three 680 litre (1500 gallon) water tankers, with drivers, were used in a supporting role in the suppression of the Creswick fire. The tankers transported water to the Country Fire Authority fire fighting units at the fire fronts.

At Streatham the Board provided three bulldozers, a heavy grader and a front end loader, plus drivers, to assist graziers to bury the thousands of dead stock which perished in the fire. A low loader float was used to transport the equipment.

In the week after the fire a water tanker was used to transport water to households for domestic use.

Two of the Board's typists from Head Office volunteered in assisting with general stenographic duties at Streatham after the fire.

The declared road system



Freeways — Tullamarine Freeway — Bell Street interchange.

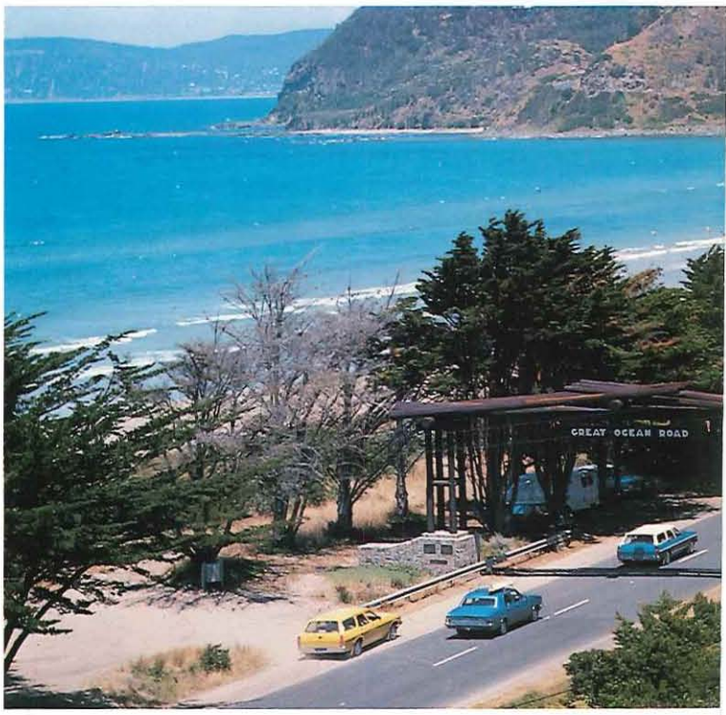
State Highways

State highways are the principal arteries forming interstate connections and links between the larger centres of population in the State. Some State highways in Victoria form part of the National Route system of highways with uniform route numbering throughout Australia. The Board bears the full cost of both construction and maintenance works required to meet the needs of through traffic. The total length of State highways was 7049 km.

The total expenditure of $36,408,900 on Victoria's 32 State highways during the year included an amount of $3,720,000 made available from the Roads (Special Projects) Fund.

Appendix 1 includes a list of State highways declared by the Board, and details of the more significant works completed during the year on State highways are given in Appendix 2.

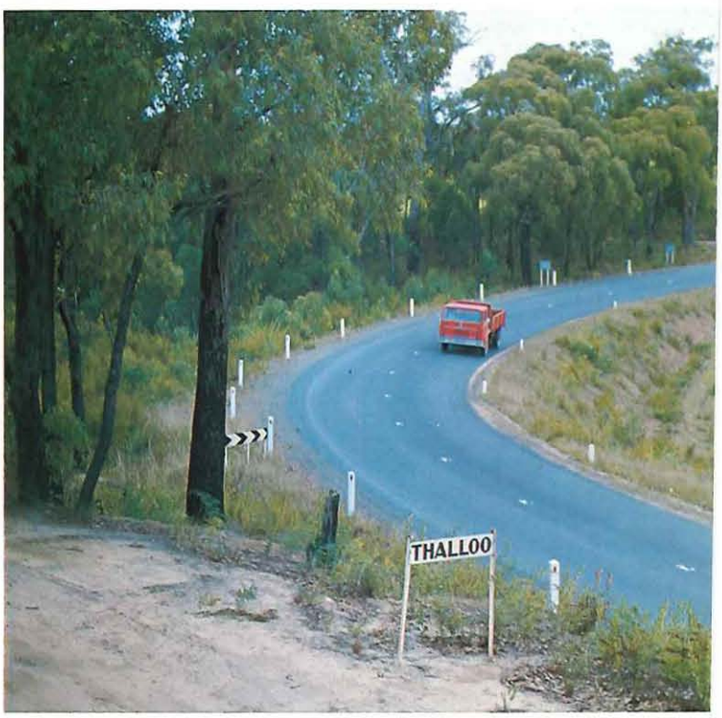
The Hume Highway/Freeway and the Western Highway/Freeway have been declared by the Commonwealth Minister for Transport as national highways under the provisions of the Commonwealth National Roads Act. These declarations permitted funds made available under the Commonwealth National Roads Act to be spent on the Hume Highway/Freeway and the Western Highway/Freeway. During the year $21,018,000 from Commonwealth sources and $861,000 from State sources was spent on these two State highways/freeways.



Freeways

A freeway is a road having dual carriageways with no direct access from adjoining properties and side roads. All crossings of a freeway are by means of overpass or underpass bridges, and traffic enters or leaves the freeway carriageway by means of carefully designed ramps. The Board bears the total cost of all work on freeways. The total expenditure of $55,747,000 on freeways during the year included an amount of $19,235,000 made available from the Roads (Special Projects) Fund.

The table in Appendix 1 lists the freeways constructed by the Board and opened to traffic. The significant works completed during the year are shown in Appendix 2.



Tourists' roads

Tourists' roads proclaimed under the provisions of the Country Roads Act provide access to places of special interest to tourists, both in summer and winter. The Board bears the full cost of works required to cater for the needs of through traffic. In general the works are carried out under the direct supervision of the Board's staff.

Details of the more significant works carried out on tourists' roads during the year are listed in Appendix 3. The table in Appendix 1 lists the tourists' roads proclaimed under the provisions of the Country Roads Act. The total length of roads declared or proclaimed in Victoria under the Country Roads Act was23,657 km as at 30th June, 1977.

'000s kms	0 2 4 6 8 10 12 14 16 18 20 22 24
State Highways	7049
Freeways	231
Tourists' Roads	797
Forest Roads	1032
Main Roads	14548
Total length of declared road system	23657

Main roads — Doncaster Road, East Doncaster.

Tourists' roads — Great Ocean Road.

Forest roads — Walhalla Forest Road.

Highways — Western Highway, near Dimboola

Forest roads

Forest roads proclaimed under the provisions of the Country Roads Act are situated within or adjacent to any State forest or in areas which are considered by the Board to be timbered, mountainous or undeveloped. The Board bears the full cost of works required to cater for the needs of through traffic, with approximately half the work carried out on these roads being undertaken by municipal councils on behalf of the Board.

The table in Appendix 1 lists the forest roads proclaimed under the provisions of the Country Roads Act.

Main roads

Main roads are roads linking centres of population with other centres or with areas of industry, commerce, or settlement. Generally main roads are constructed and maintained by municipal councils to the satisfaction of, and with financial assistance from, the Board. In some cases, at the request of the council and with the approval of the Minister, works are carried out under the direct supervision of the Board's staff.

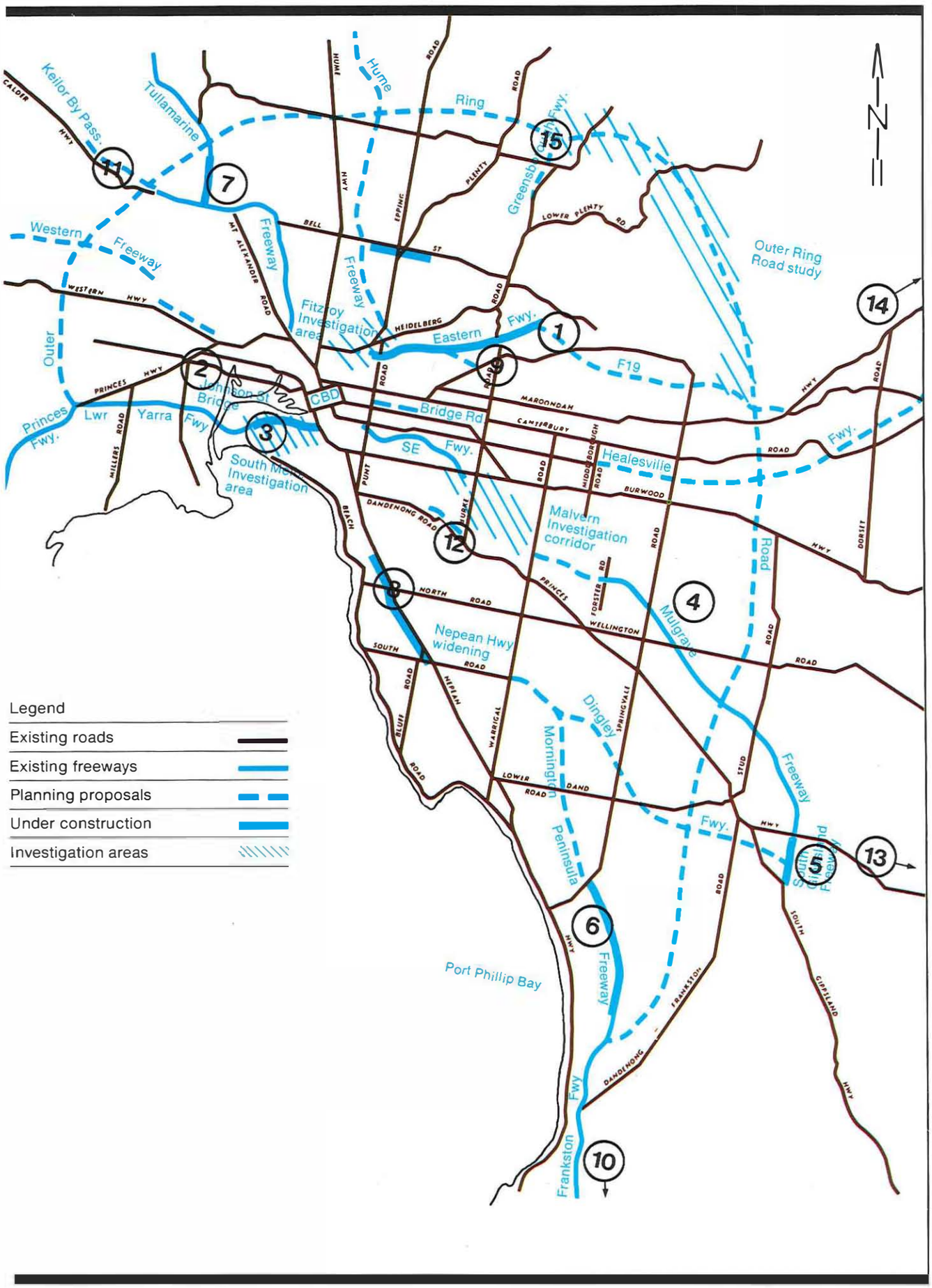
A summary of the more important works on main roads completed during the year is given in Appendix 4.

Unclassified roads

Roads which are not included in the Board's declared and proclaimed road system are referred to as unclassified roads. These roads are the responsibility of municipal councils, but each year the Board provides financial assistance towards the cost of construction and maintenance works, generally in accordance with priorities allotted by municipal councils.

Municipal contributions are determined at the time the allocation is made, and are based on many factors including the nature, extent, and location of the particular work and the financial position of the municipality concerned. A list of the more significant works on unclassified roads carried out during the year with financial assistance from the Board appears in Appendix 5.

Road construction programme



Road planning

Metropolitan road improvements

For the metropolitan area to function efficiently and for the existing quality of life of the community to be maintained and improved, it is essential for people and goods to be able to move, or to be moved, through, around and across the urban area of Melbourne with reasonable freedom and safety.

The Board fully realises the importance of public transport in providing for the movement of people but in a City of relatively low density development such as Melbourne there are many trips, especially those involving the movement of goods, which cannot take place on public transport. The progressive improvement of Melbourne's road system in such a way that significant economic, safety, environmental and social benefits result is an essential component of the overall transportation system.

Urban road development criteria

The Board has adopted the following criteria in the development of the urban road system of Melbourne:

—all works must, of course, comply strictly with Government policies;

—selected arterial roads be developed to provide reasonable continuity of high capacity movement on an integrated road system. This would include an outer ring road;

—other arterial roads be developed or provided to the maximum extent possible, generally within existing road reservations to provide adequate distribution and circulation of traffic through and around suburban centres and bypassing the Central Business District of Melbourne;

—more emphasis be placed on the application of traffic management techniques both along selected arterial roads and on an area-wide basis to optimise traffic flow on the arterial roads and to protect the environmental quality of local areas;

—consideration be given to the construction of freeways where other forms of road improvements are not capable of catering for high volume traffic flows to meet the demands of business and social needs in the transportation of goods and people. Community disruption and adverse environmental impacts to be avoided or minimized as far as possible.

Road construction programme

During the year the Board adopted a tentative construction programme for major works in the metropolitan area over the next decade from 1977/78 to 1986/87.

The programme was prepared within the criteria outlined above to assist the Board in planning the necessary pre-construction stages of various projects and to ensure as far as possible that the required construction and financial resources are available.

The preconstruction requirements, eg. right of way determination, detailed design, planning scheme amendments, alterations to services and land purchase are resource consuming tasks which apply to major metropolitan road projects.

The need for flexibility in the programme is a primary requirement. Revisions will be necessary from time to time especially in the second five-year period to cater for departures from the estimated availability of funds, inflation, changes in priorities and other demands on the Board's funds.

Projects already commenced and expected to be completed in the first five-year period to 1981/82 are:

	Project	Estimated expenditure 1977/78 to completion at 1977/78 costs	Year of completion
		($ million)	
1	Eastern Freeway, Hoddle Street to Doncaster Road	22.96	1979/80
2	Johnson Street Bridge and approaches	3.44	1977/78
3	Freeway F9	72.00	1981/82
4	Mulgrave Freeway, Warrigal Road to Forster Road	13.4	1980/81
5	South Gippsland Freeway	2.19	1977/78
6	Mornington Peninsula Freeway, Springvale Road to Eel Race Drain	8.43	1978/79
7	Tullamarine Freeway, Lancefield Road conversion	4.45	1979/80
8	Nepean Highway, widening between Elsternwick and Moorabbin	32.44	1981/82

Projects expected to be initiated during the first five-year period to 1981/82 are:

	Project	Estimated cost to complete at 1977/78 costs	Year of Completion
		($ million)	
9	Chandler Highway extension (Route E6), Eastern Freeway to Harp Road	12.0	1981/82
10	Mornington Peninsula Freeway, Moorooduc Road to Dromana (single carriageway)	9.92	1981/82
11	Calder Freeway, Keilor Section	19.21	1982/83
12	Princes Highway East, Hawthorn Road to Waverley Road	6.5	1982/83
13	Princes Freeway, Berwick bypass	10.6	1982/83
14	Maroondah Highway, Hull Road to Warburton Highway	3.54	1981/82
15	Greensborough Freeway — F5	24.7	1983/84

Each of the above projects either has been or will be the subject of extensive investigation and discussions with the municipal councils concerned and local communities.

The Hume challenge

The Board is facing one of the major challenges of its 63 years with the planning and construction of the 300 km Hume Highway/Freeway duplication and realignment between Melbourne and Wodonga.

Modern design techniques are being used to ensure that wherever possible the freeway will blend into the natural environment, making best use of the surrounding vistas and topography.

Background

The Hume is the most important inter-capital link on the Australian continent and one of Australia's most colourful highways.

Explorers, miners, settlers, bushrangers, convicts and troopers have all contributed to establishing the Hume as a major intercapital road.

Bullock wagons and coaches carried pioneers over approximately the route taken by the explorers, Hume and Hovell, to the loneliness of central Victoria and southern New South Wales, and to the Beechworth goldfields. These travellers fell easy prey to bushrangers such as Ned Kelly, whose memory still haunts the area just north of the newly constructed Wallan to Broadford freeway.

Sydney Road, as it had become known, was declared a Main Road by the Board in 1914, making councils eligible for some financial assistance from the limited funds then available to the Board. In 1925 the full financial responsibility for Sydney Road was passed to the Board. Sydney Road was then renamed the North-Eastern Highway and in 1928 changed to the Hume Highway — in both Victoria and New South Wales, in honour of Hamilton Hume who was the first explorer to enter what is now Victoria.

Since World War Two, practically the entire Victorian section of the Hume Highway has been reconstructed. In recent years the work has included the construction of dual carriageways, in many cases to freeway standard.

The Hume Freeway is being developed with the assistance of finance provided under the Commonwealth Government National Roads Act 1974.

The conversion of the Hume Highway to freeway standard, including the construction of bypasses of some centres of population, is being planned and constructed, and for convenience, the length has been divided into a number of Sections:

Section 1 Mahoney's Road to Craigieburn

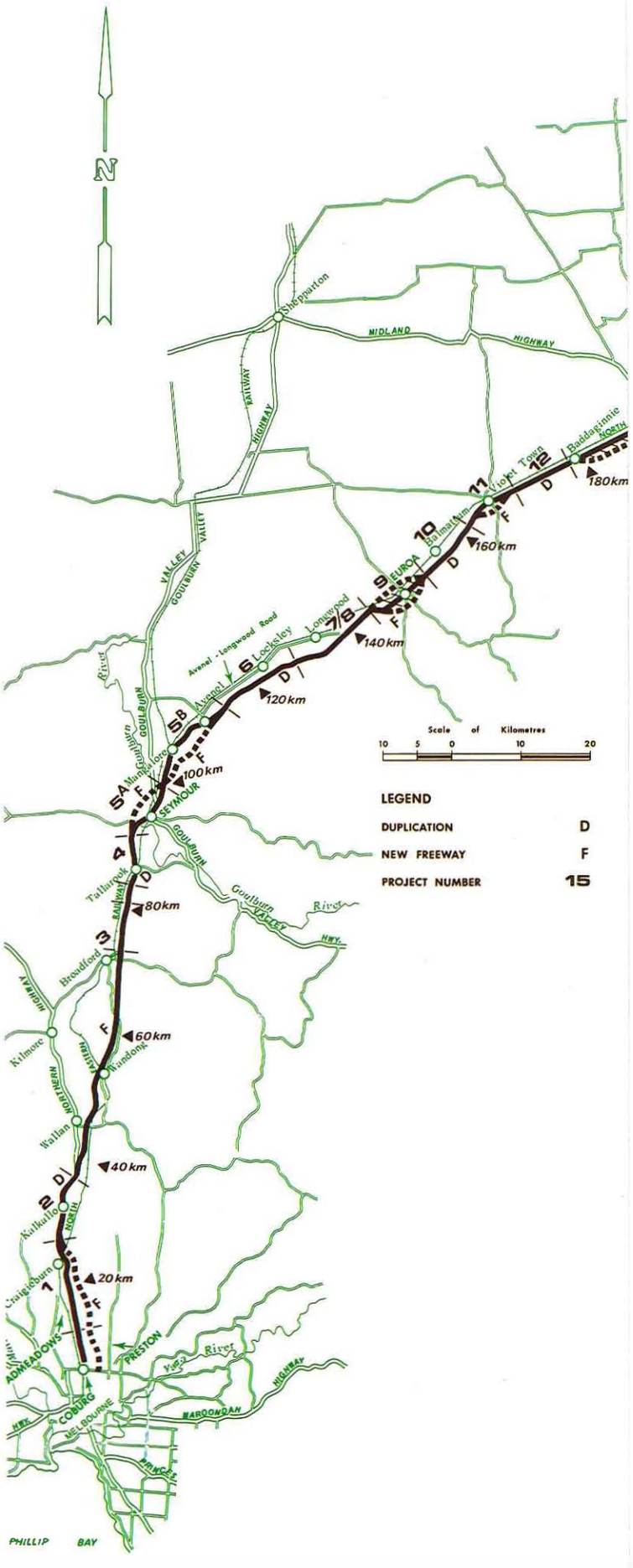
The existing Hume Highway passes through the northern suburbs of Melbourne along a narrow, highly developed corridor.

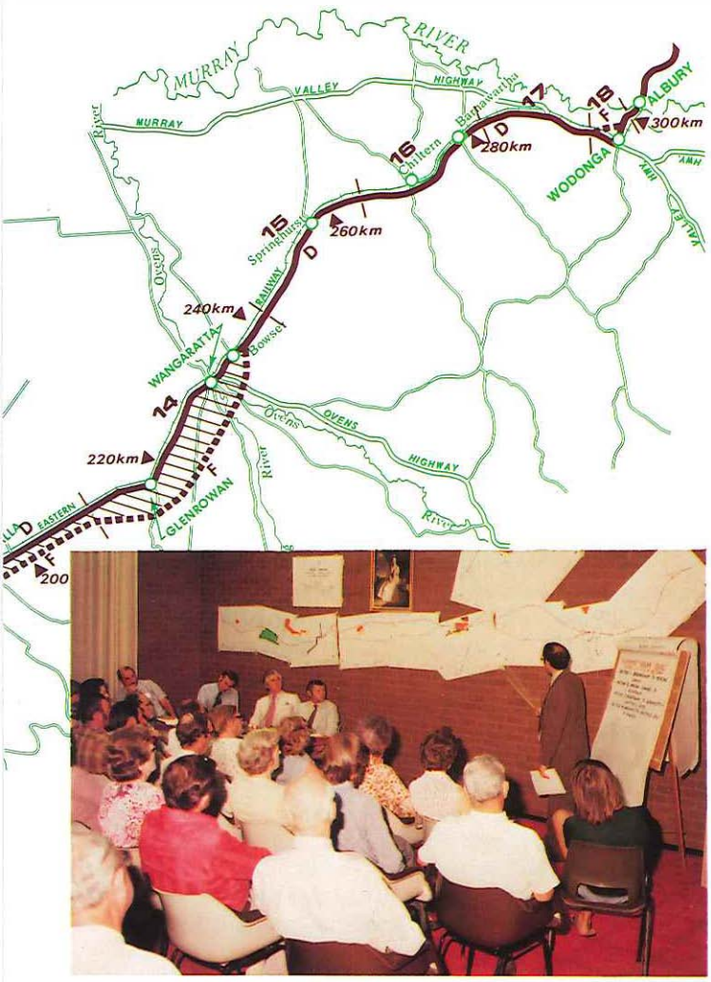
Traffic is unable to move freely, especially in peak hours. To alleviate this problem, an ultimate 8 lane urban freeway is planned and a reservation has been provided in the Melbourne Metropolitan Planning Scheme.

The 14 km Mahoneys Road to Craigieburn section of the Hume Freeway will provide a transition between the rural area north of Craigieburn and the proposed fully developed urban area south of Mahoneys Road. It will be the entrance of the major interstate route into the Melbourne Metropolitan Area.

This section passes through land zoned for general industrial use but almost rural in character at present.

Through traffic using the existing Hume Highway south of Craigieburn will be substantially reduced when this section of freeway is completed, improving access to industrial areas which have developed on both sides of the old highway route.





Public meetings were held in Benalla (pictured), Glenrowan and Wangaratta to discuss the Hume Freeway, Baddaginnie-Bowser Section.

Heavy interstate transports pass through Benalla and other towns day and night.

Section 2 Craigieburn to Beveridge

The terrain in this section transitions from the flat and gently undulating coastal plains to the foothills of the Great Dividing Range.

The existing divided highway was constructed in the late 1960s and carries more than 11,000 vehicles daily. In order to upgrade this section of highway to freeway standards, it will be necessary to close existing road and property connections, replacing them with access roads leading to freeway interchanges.

The settlement of Kal Kallo, which abuts the existing highway, includes accommodation and vehicle servicing facilities. Special consideration will be required at the freeway stage to provide access to these amenities.

Section 2a Wallan to Broadford

This project, the largest undertaken by the CRB to date, was opened on the 3rd May, 1976, by the Hon R J Hamer, ED, MP, Premier of Victoria. The opening heralded the beginning of a new era of rural freeways in Victoria where the planning and design include environmental, aesthetic, and engineering factors.

The alignment of this section of freeway had been fixed with both environmental and conservational aspects in mind. Existing stands of timber have been retained as much as possible, and in addition, over 40,000 native trees and shrubs have been planted along the roadside. In future years these will provide an ever changing vista to the motorist as they mature.

Safety is also of paramount importance. Generous clearance to roadside objects, large radius curves, and good visibility are noticeable features of the design.

The four-lane freeway is 34 km long, and includes 18 bridges. The total cost was $36.5 million.

Section 3 Broadford to Tallarook

The Broadford to Tallarook Section was largely a duplication of the existing Hume Highway. The bypass of Tallarook was completed in 1970, leading the way for the much longer Wallan to Broadford Section to complete full duplication from Melbourne to just south of Seymour.

Section 4 Tallarook to Seymour

A duplicated section using the former Hume Highway as one carriageway, this Tallarook to Seymour section also has a wide median preserving well established tree and shrub growth.

Section 5a Seymour Bypass

The bypass of the township of Seymour is a high priority project in the overall Hume Freeway programme, and construction is due to begin late in 1977.

A major interchange will be constructed at the Goulburn Valley Highway and this will provide free flowing connections for all major traffic movements. The importance of this interchange is highlighted by the fact that approximately 40% of the Hume Freeway traffic south of Seymour uses the Goulburn Valley Highway.

Section 5b Avenel Bypass

The Avenel Bypass will follow the 'Old Sydney Road' route from the North Eastern Railway overpass to Lambing Gully Road. Northward from Lambing Gully Road, the freeway passes to the east of Avenel after crossing Hughes Creek. The terrain is generally flat and swampy with the freeway placed on a low embankment. Access to Avenel will be provided by an interchange at Tarcombe Road.

Section 6 Avenel to Tubbs Hill
This 12 km section is under construction and consists of duplicating the existing Hume Highway on the northern side from the end of the Avenel Bypass to Pranjip Creek. The existing highway is flanked by established tree plantations, and wherever possible, these will be retained.
At the ultimate freeway stage, an interchange will be constructed at Alexanderson's Road, while an overpass will connect Oxenbury's Road to a deviation of Oak Valley Road.

Section 7 Tubbs Hill
A new carriageway will be constructed on the northern side of the existing Hume Highway, retaining the large stands of trees within a wide median. In the vicinity of Tubbs Hill, the proposed freeway bypasses the settlement of Old Longwood which has several old stone cottages. An interchange will be provided on a new alignment for the Longwood-Ruffy Road, a major local access across the Highway.

Section 8 Tubbs Hill to Euroa
The new carriageway for this section is to be constructed on the north side of the existing Hume Highway between the Old Longwood Bypass and Creighton's Creek. It then changes to the southern side for the rest of the section. This changeover avoids existing development, as well as the Telecom Melbourne to Sydney co-axial cable at a point where expensive relocation would be necessary. Again, wide medians are provided to retain the trees.

Section 9 Euroa Bypass
This section is currently under investigation. A 'Band of Interest' has been established, and covers alternatives both north and south of the Euroa Township.
The northern routes cross flood plains and low lying area. Problems associated with a northern route are in the areas of earthworks, landscaping and two crossings of the Melbourne-Sydney railway. Furthermore, access to Euroa from the northern routes is not as satisfactory as from the southern routes.
With the southern routes there are topographical and environmental problems, as well as difficult crossings of Seven Creek and Castle Creek. Considerable thought and effort has been and will be involved in the planning of this section to ensure that the route finally adopted gives the best overall solution

Section 10 Euroa to Violet Town
This section of the freeway is over flat ground, and special consideration will be given to landscaping in the form of tree planting to augment the existing growth alongside the present highway.
Several creeks which rise in the foothills of the Strathbogie Ranges to the south-east and spread across the plains to the north-west will need to be crossed. The flat terrain has led to extensive flooding of the existing highway, which will be regraded to provide a flood free route.

Section 11 Violet Town Bypass
This 6.5 km section is planned to bypass Violet Town to the south. Access to the township will be provided by an interchange at Harry's Creek Road. The bypass was favoured to duplication of the highway through Violet Town itself because of the development adjacent to the highway, and the restriction to the town development caused by the Melbourne-Sydney Railway.
Of particular interest will be the wide cross section adopted. Not only will the median be wide (about 25 m) but the clearance from the edge of the batters to the road boundaries will also be in the order of 20 m. This will allow extensive tree planting in all areas, especially desirable as there is little natural vegetation along the new route.

Section 12 Violet Town to Baddaginnie
Duplication is currently under way on the northern side of the existing highway carriageway. The new freeway reserve will extend to the railway reservation to enable generous landscaping during and after construction.

Section 13 & 14 Baddaginnie to Bowser
Proposals for this 67 km freeway section which includes bypasses of Benalla and Wangaratta to the east are being undertaken with a significant involvement in open planning and public participation.
The new freeway from Baddaginnie to Bowser will remove through traffic from Benalla and Wangaratta and extensive investigations are being carried out to ensure that the route selected will be compatible with local environmental considerations. As an essential part of these investigations, officers of the Board explained the various freeway alignment proposals at public meetings held during February, 1977, in Glenrowan, Benalla and Wangaratta.
The public meetings were arranged by Benalla and Wangaratta City Councils and Benalla, Oxley, Violet Town and Wangaratta Shire Councils. About 500 people attended the meetings. The input from the public meetings and individual discussions with people and councils will assist planners in providing interchanges at suitable points to meet the needs of the local communities and the travelling public.
The construction of this section of freeway, estimated to cost $110 million, will have a significant effect on the future development of Benalla, Winton, Glenrowan and Wangaratta. The community's and the motorists' needs are being carefully balanced. Investigations carried out by the Board have shown that of the 6000 vehicles that travel the highway daily, more than 95% can be classified as through traffic.
Signs on the freeway will indicate to the motorist services available in each of the towns. Glenrowan township, because of its historical significance, will remain easily accessible to tourists.
Between Benalla and Wangaratta, the freeway crosses the Warby Ranges and alternative routes under investigation make use of various 'Gaps' or saddles in the ranges.
The new freeway will need to cross a number of water courses, including the Ovens and King Rivers, Fifteen Mile Creek, and the Laceby Flood Plain. In general the freeway will be above 'the 100 year flood' level or the highest recorded level, whichever is the greater.

Section 15 Bowser to Chiltern
The topography consists of two distinct types over this section. For the 11 km between Bowser and Bentons Hill the existing highway crosses low lying plains. Then, from Bentons Hill to Chiltern, a distance of 14 km, there is generally lightly rolling terrain.
The first low part of the section will be upgraded by duplicating the existing carriageway on the east side. The existing carriageway, which is subject to flooding, will need to be raised extensively.
At Springhurst, a local deviation is proposed, and an interchange is to be provided. North-east of Springhurst, the duplicate carriageway is to be located on the southern side because of the location of both the Telecom Co-axial Cable and the Melbourne-Sydney Railway on the northern side.

Construction is underway on four projects on the Hume:

Section 16 Chiltern to Barnawartha
Planned as a divided highway some years ago, this section has recently been re-examined to ensure that sufficient land has been reserved for full freeway development. The freeway will pass through the Chiltern State Forest, which consists mainly of ironbark, along with grey, yellow and red box. Forests of these species are rare in the north-east of Victoria.

Section 17 Barnawartha to Wodonga
A new carriageway on this 12 km section will be constructed to the south of the existing carriageway, because of the proximity of the railway reserve to the north. A service road, to provide local access, is to be located on the south side over the entire length.

Section 18 Wodonga to Lincoln Causeway
The Wodonga Section of the Hume Freeway will bypass Wodonga on the northern side. The new route will leave the existing Hume Highway west of Wodonga at an interchange and cross the Melbourne-Sydney Railway line.
To the north of Wodonga, the route will pass through the outskirts of the town, running between the Donga Meat Works and the Sewerage Authority settling ponds. The route will rejoin the Hume Highway at an interchange located on the southern end of the Lincoln Causeway.

Road planning studies

The road planning function of the Board is an essential and highly sophisticated operation, involving all of the many diverse skills required to reach a compatible balance between the community's desire for mobility and its various other needs. The staff of the Board's Planning Sub-Branch brings together engineering, sociological, economic, environmental and town planning expertise in formulating and evaluating future road proposals. Specially trained officers in the Board's service, together with specialised equipment, are also able to provide technical advice on noise and air pollution, landscaping and general environmental matters.
Three significant planning studies in which the Board was involved were carried out during the year and are described below.

South Melbourne traffic and environmental study
A traffic and land use and environmental study of the South Melbourne and Port Melbourne area was completed and copies of the following reports were distributed to Councils and other interested organisations in June, 1977:
Volume 1: Land use and environmental survey
Volume 2: Traffic survey
Volume 3: Short term traffic management
Summary of short term improvements

The study was undertaken by the Country Roads Board with the co-operation of the South Melbourne and Port Melbourne Councils. The purposes of the study were:

—to gather and document information on traffic patterns in the area;
—establish predicted volumes of traffic in the area after the opening of West Gate and Johnson Street Bridges and before the F9 Freeway is completed;
—to identify any improvements to the road system which should be implemented prior to the completion of the F9 Freeway; and
—to allow an objective evaluation to be made of proposals to restrict truck movement on certain routes.
—to investigate the long term traffic management requirements and the development of the F9 corridor.

The following reports were substantially completed at the end of the financial year:
Volume 4: Long term traffic management
Volume 5: F9 Corridor development
Volume 6: F9 impacts

A series of short term improvements was suggested to cater for traffic in the period between the opening of the bridges and the opening of the F9 Freeway.
The study also analysed truck movements in the area and suggested that discussions should be held between the Board, the councils, truck operators and other parties to consider those recommendations which were aimed at minimising or restricting truck travel through residential areas.
The existing volumes of trucks crossing the Yarra River in the period 7 a.m. to 7 p.m. together with the predicted volumes after the opening of the new bridges, are shown below.

Bridge	Existing 12 hour truck volume	Predicted 12 hour truck volume on opening of bridge
West Gate Bridge	0	4,000
Johnson Street Bridge	0	5,800
Spencer Street Bridge	10,600	3,250
Kings Bridge (high level)	4,800	4,100
Kings Bridge (low level)	1,550	1,300
Queens Bridge	3,400	2,900
Princes Bridge	1,250	1,150

The land use and environmental survey carried out as part of the study involved the collection of land use data, presentation of existing traffic noise levels, review of previous environmental area studies, and an appraisal of other environmental and residential precincts generally in South Melbourne and Port Melbourne.

Gardiner's Creek valley study

In January, 1977, the Government set up this corridor study involving the Ministry of Planning, Ministry of Transport, Ministry for Conservation, Melbourne & Metropolitan Board of Works, Town & Country Planning Board, Malvern, Camberwell and Hawthorn Councils and the Country Roads Board to investigate and recommend a course of action on the future allocation of space in the Gardiners Creek valley for transport, drainage, recreation and other community uses. The study is progressing under the direction of a Steering Committee comprising representatives of the above bodies.
The investigation work is being carried out by six study teams from the participating authorities. The six study teams have been formed to study particular problems relating to Roads, Transport User, Drainage, Recreation, Waterway Environs and Community Effects. Overall co-ordination is being undertaken by a full time Study Manager who is also responsible for the public involvement programme. This programme includes the wide distribution of information in the form of bulletins, displays and a mobile information centre, and feedback of information and ideas from the community to the Study Manager.

Outer Ring Corridor study

The study into the Outer Ring Corridor continued during the year.
The purpose of the study is to examine the strategic significance of a new transport route around the main built up area of Melbourne. The terms of the study cover the possible effects on:

—the land use zoning system
—the transport (road and public transport) network and investments
—the social and economic situation.

The study is under the control of the Road Planning Liaison Committee, consisting of representatives of the Ministry of Transport, the Melbourne and Metropolitan Board of Works and the CRB. Consultants P G Pak Poy and Associates Pty Ltd, and a number of sub-consultants, have been retained for the study.
One question to be resolved is whether or not the option to build an Outer Ring road should be retained. In this context, preliminary cost estimates show that the cost of a freeway between Frankston and Laverton would be about $560 million at present day values. This is a large investment, but such a facility would be stage constructed over many years. Although the Melbourne Metropolitan Planning Scheme contains a Main Road Reservation around the outer suburbs except between Ringwood and Diamond Creek, further detailed investigations may be required over some sections if the Government decides to retain the option to build part or all the ring.
It is expected that the findings of this study will be reported to the Government early in the 1977/78 financial year.

Road construction and maintenance

Major project construction

During the year the Board continued construction on major projects throughout the State. Work completed on the construction of divided roads on freeways, State highways and main roads during the year increased the total length of divided roads to 706 km.

In addition to National Highways and the other major projects completed and referred to in the Review section of this annual Report, the more important projects in progress during the year were:

Urban

Eastern Freeway

The construction of the Eastern Freeway between Hoddle Street, Collingwood, and Bulleen Road, Bulleen, a distance of nine kilometres, continued during the year. This section of the freeway will be generally of eight lane capacity, with a ten lane capacity between the Merri Creek and the Chandler Highway interchange. The central median is designed to cater for a fixed rail public transport system to serve the East Doncaster area. The Boulevard, Chandler Highway, Columba Street and Bulleen Road overpasses were opened to traffic during the year and work on the remaining bridge structures and the freeway carriageways progressed satisfactorily. The freeway is expected to be opened to traffic late in 1977. The total cost for this first section of the Eastern Freeway is estimated to exceed $87 million.

In March, 1977, the CRB obtained the approval of the Minister of Transport to the construction of an easterly extension of the freeway, generally along the existing Melbourne Metropolitan Planning Scheme main road reservation to Doncaster Road, Balwyn North, and investigations and design for this extension are progressing.

South Gippsland Freeway

Work continued on the freeway interchange with the South Gippsland Highway and on the northbound freeway carriageway between the South Gippsland Highway and Pound Road. The project is scheduled for completion late in 1977 at an estimated cost of $10 million.

Mulgrave Freeway

Preliminary work commenced on the relocation of services east of Huntingdale Road on the proposed 3.7 kilometre extension of the Mulgrave Freeway from Forster Road to Warrigal Road. This extension to Warrigal Road is expected to be opened in two sections: to Huntingdale Road in late 1979, and to Warrigal Road in 1981. The extension is estimated to cost $12 million.

Tullamarine Freeway

Work continued during the year on the upgrading of Lancefield Road, adjacent to the Essendon Airport, to freeway standard. Construction of an interchange at English Street to provide access to the Essendon Airport began during the year. The upgrading of Lancefield Road is expected to be completed in late 1979 at an estimated cost of $6 million.

Greensborough Freeway

Lowering and duplication of the Melbourne-Hurstbridge railway line and the construction of road over rail overpasses at Watsonia Road and Grimshaw Street continued during the year. The project is scheduled for completion in early 1978 at an estimated cost of $5.7 million.

Mahoneys Road

The construction of a six lane, divided road in Mahoneys Road between the Hume Highway, Campbellfield and High Street, Thomastown, continued during the year. The construction of a new second carriageway was completed and upgrading of the existing carriageway was undertaken during the year. The total cost of the project is estimated to be $3.5 million.

Johnson Street Bridge

Work progressed on the Johnson Street Bridge over the Yarra River to link the proposed F9 Freeway with Footscray Road. Foundation work and work on the superstructure for the river span, and associated roadworks continued during the year. The project is expected to be completed in mid 1978 at an estimated cost of $32 million.

Mornington Peninsula Freeway

Construction continued on the 6.7 km section of the Mornington Peninsula Freeway between Springvale Road, Keysborough and Eel Race Drain, Seaford. The work involved earthworks in the vicinity of Thompson Road and the Patterson River. The section of freeway between Springvale Road and Eel Race Drain is estimated to cost $11 million and is scheduled for completion late in 1979.

In November, 1976, a two kilometre section of the freeway south from Eel Race Drain to the Frankston Freeway was opened to traffic. The cost of this freeway section was $1.1 million.

Rural

Western Highway, Horsham

During the year work on the duplication of the Western Highway southern approach to Horsham including the construction of a second bridge across the Wimmera River continued. The 1.7 km road and bridge project is scheduled for completion in December, 1977, at an estimated cost of $1 million.

Bellarine Highway

During the year work continued on the duplication of 2.7 km of the Bellarine Highway between Bawtree Road and Swan Bay Road. The work, including the construction of a large culvert at Fenwick Gully, is estimated to cost $708,000 and is scheduled for completion in August, 1977.

Princes Highway East

—Beaconsfield-Pakenham

Work continued on the construction of 14.2 km of divided highway between Beaconsfield and Pakenham. Work was completed between Beaconsfield and Pink Hill, and is scheduled for completion to Pakenham in late 1978. The estimated cost of the project is $5.2 million.

—Morwell-Traralgon

Construction of the 10 km of divided highway between Morwell and Traralgon continued during the year. Work on the last 2.5 km section is scheduled for completion in mid 1978 and the whole project is estimated to cost $2.5 million.

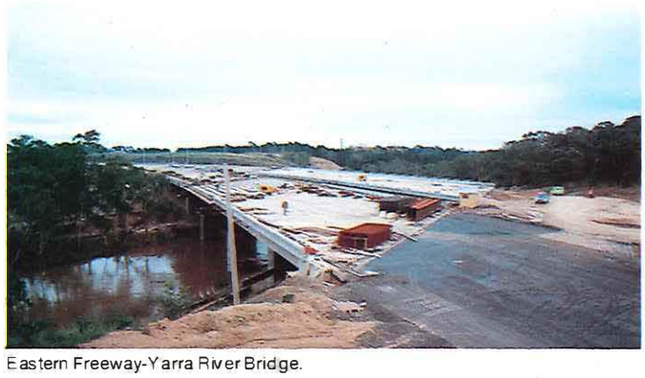
—Simpsons Creek

The reconstruction and realignment of 3.8 km of highway including construction of a three span concrete bridge was completed in June, 1977, at a cost of $650,000.

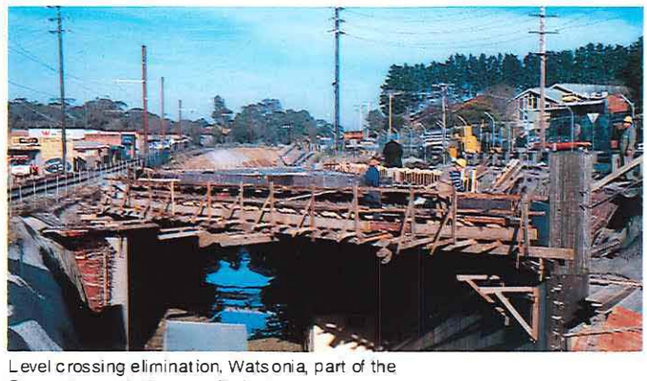
Urban projects.

Mornington Peninsula Freeway, adjacent to Wells Road.

Johnson Street Bridge, South Melbourne



Eastern Freeway-Yarra River Bridge.



Level crossing elimination, Watsonia, part of the Greensborough Freeway Project.

National highways

The Commonwealth National Roads Act 1974 provided funds for national roads, which include national highways, export roads and major commercial roads. A national highway is a road or proposed road that in the opinion of the Commonwealth Minister of Transport is or will be the

principal road linking:
—two or more State capitals;
—a State capital city and Canberra;
—a State capital city and Darwin;
—Brisbane and Cairns; or
—Hobart and Burnie,

or a road or proposed road that should in the opinion of the Commonwealth Minister of Transport be treated by reason of its national importance as a national highway.

In Victoria the Hume Highway from Campbellfield to the River Murray, and the Western Highway from Deer Park to the South Australian border, excluding the section through Ballaarat City, are declared as national highways.

The length of Victoria's national highways and the length of dual carriageways on the national highways as at 30th June 1977 were as follows:

Highway	Length (km) Dual carriageways	Total	Percentage of dual carriageways
Hume	94	285	33
Western	64	405	16
	158	690	23

The amount allocated to Victoria for national highways for the three year period was, as indicated below.

Year commencing	1 July 1974*		1 July 1975	1 July 1976*	Total
	Original	Supplementary			
	$	$	$	$	$
National Highways					
Construction	15,900,000	1,390,000	16,800,000	23,450,000	57,540,000
Maintenance	1,500,000	130,000	1,600,000	2,150,000	5,380,000
	$17,400,000	$1,520,000	$18,400,000	$25,600,000	62,920,000

*Including approved transfers.

Princes Freeway, Drouin to Warragul Section

Work continued on the construction of this section of the Princes Freeway, having a length of 15 km and which will bypass the townships of Drouin and Warragul. The construction of two kilometres of divided highway on the existing Princes Highway to form part of a freeway interchange two kilometres east of Drouin was commenced. The project is scheduled for completion in 1982.

Princes Freeway, Orbost

Work continued during the year to provide an 8.4 km flood free crossing of the Snowy River flood plain and a bypass of Orbost. In November, 1976, the bridge across the Snowy River was opened to traffic. Construction of roadworks to the east of the Snowy River have been completed and opened to traffic. The bridges at Ashbys Gulch and Watts Gulch were completed. The whole project is scheduled for completion in November, 1977, at an estimated cost of $9 million.

The total expenditure by the Board on the Hume Highway and the Western Highway during the year was $21,879,000, $21,018,000 of which was charged to Commonwealth funds.

Expenditure during the year on the Hume Highway was $13,733,000. Work estimated to cost $52 million at 1976 prices and extending over 55 km was under construction during the year north of Seymour on four freeway projects. These projects are:

—**Seymour Bypass and Avenel Bypass**
This project extends for 27 km bypassing the townships of Seymour and Avenel. The estimated cost of the project is $35 million and is expected to be completed in 1982.

—**Avenel to Tubbs Hill**
This project extends for a distance of 12 km and is estimated to cost $6.6 million with completion due in late 1978.

—**Violet Town Bypass**
This project is 6.2 km in length bypassing the township of Violet Town. The project is estimated to cost $5.5 million and is expected to be completed in mid-1979.

—**Violet Town to Baddaginnie**
This project is estimated to cost $4.5 million and is expected to be completed in late 1977.

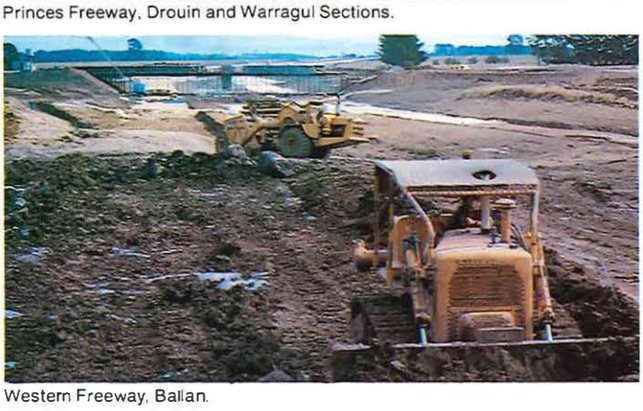
Details of other work proposed on the Hume Highway are contained in the article headed 'The Hume Challenge' on page 17.

Expenditure during the year on the Western Highway was $8,146,000. The major construction project involved was the 8.4 km freeway bypass of the township of Ballan. The project is estimated to cost $8.2 million and is expected to be completed in mid 1978.

Rural projects:

Duplication of the Western Highway, Horsham.

Princes Freeway, Drouin and Warragul Sections.



Western Freeway, Ballan.

Duplication east of Beaconsfield on the Princes Highway East.

Contracts

Contracts under the Board's direct supervision

Details of the types and numbers of contracts entered into showing respective values, together with a comparison with those of financial year 1975/76 are shown in the following table:

	1976/77		1975/76	
Type of contract	No. of contracts	Value $	No. of contracts	Value $
Road construction —				
1. Over $1M	3	3,985,130	—	—
2. $100,000 to $1M	2	422,411	3	590,390
3. Under $100,000	4	178,540	—	—
Supply of roadmaking materials	134	7,927,294	134	4,825,667
Bituminous treatment & supply of materials	85	10,944,708	62	10,024,524
Bridge construction —				
1. Over $1M	—	—	—	—
2. $100,000 to $1M	3	595,336	7	2,715,629
3. Under $100,000	12	614,817	5	325,689
Components & fabricated steel	28	1,742,112	22	1,169,859
Construction equipment	18	678,811	16	665,055
Divisional facilities	3	193,383	2	65,724
Stores	5	2,660,375	13	1,600,676
Miscellaneous services	46	1,398,313	28	1,131,060
Total	343	31,341,230	292	23,114,273

Contracts under the councils' supervision

During the year the Board approved the acceptance by municipal councils of 150 tenders for a total amount of $6,872,314 for road and bridge works for which the Board allocated funds in whole or in part. In financial year 1975/76 156 tenders were approved for a total amount of $7,525,247. The Board also approved the use of 50 municipal contracts for the supply of materials for works partly financed from funds provided by the Board compared with 63 last year.

Bituminous surfacing

The total length of bituminous surfacing, including both sprayed work and plant mix work, completed during the year amounted to 4,826 km at an approximate cost of $26,000,000.

The Board's 17 mobile bituminous surfacing units, together with plant owned by municipal councils and contractors, completed 4,285 km of sprayed work at a cost of approximately $15,200,000

Contractors operating from fixed asphalt plants completed 219 km of plant mix work on densely trafficked roads at a cost of approximately $10,700,000 using 436,850 tonnes of asphalt.

The lengths of the various types of work completed during the year were:

240 km of sealing widened pavements,

33 km of initial sealing on dual carriageways,

622 km of restoration of sealed coats on reconstruction sections,

475 km of final sealing on initial treatments,

2,551 km of maintenance retreatments,

322 km sealed on behalf of other State and municipal authorities, and

583 km of extensions to the bituminous sealed road system of the State including 32 km of roads declared or proclaimed under the Country Roads Act.

The following quantities of materials were used by the Board or by contractors during the year on bituminous surfacing works:

Material	Quantity
Bitumen for sprayed work	31,000 tonnes
Bitumen for asphalt	23,000 tonnes
Aggregate for sprayed work	261,000 cubic metres
Aggregate for asphalt	294,000 cubic metres
Other bituminous materials for sprayed work and maintenance	11,000 tonnes

The total length of sealed roads in the Board's declared or proclaimed road network is 21,811 km or 92% of the total length of declared or proclaimed roads.


CROYDON

Rolba R1500 Snowblower at Mt Hotham.

Use of reclaimed rubber

Over the years various blends of small amounts of natural and synthetic rubbers have been used in bitumen to give better initial adhesion of the bitumen and aggregate with varying degrees of success. A recent development has been the use of granulated reclaimed rubber. This enables much larger proportions of rubber to be economically added. The granules do not fully dissolve in the bitumen but act as a soft elastic aggregate, or cushion, between the larger stone particles. This gives a surfacing suitable for resurfacing cracked pavements and better able to withstand the effects of heavy traffic.

Granulated rubber is obtained from used motor vehicle tyres by shredding or by crushing after being made brittle by freezing in liquid nitrogen. The practical and economical use of discarded tyres is also attractive from the point of view of preservation of the environment.

Approximately 10 km of sprayed work was carried out during the year and two short sections of plant mix work were placed.

The use of reclaimed rubber is being developed in close co-operation with the Australian Road Research Board.

See full page photo montage on previous page.

Snow clearing

Snow clearing of roads to snow resorts was again carried out during the year on the Alpine Road (Mt Hotham), Mt Buffalo Road (Mt Buffalo), Mt Buller Road (Mt Buller) and Bogong High Plains Road (Falls Creek). Snowfalls were generally light during the 1976 winter with most of the snow falling in early August. Snow clearing operations started in early June and finished in Mid September.

At Mt Hotham the cost of the work performed by the Board on Friday and Saturday nights during the season was financed by a special Treasury Grant. The cost of clearing snow from car parks at all resorts was charged against the respective administering authorities or, in the case of Mt Buffalo, to a special CRB/National Parks Service grant.

Mechanical improvements to snow clearing plant, in particular the Rolba R1500 snow blowers, used on the Alpine Road at Mt Hotham, and the purchase of a Mercedes Benz U94 Unimog prime mover and Schmidt snow clearing attachments for use on the Bogong High Plains Road improved the efficiency of the snow clearing operations during the year.

The snow clearing operations were performed by four supervisors and nine plant operators, using twelve main items of plant:

—6 four wheel drive Aveling Austin Grader Snowploughs.
—3 Rolba R1500 snowblowers.
—2 Rolba R400 snowblowers.
—one U94 Unimog and Schmidt snow clearing attachments.

Linemarking

Implementation of METCON/STATCON

During the year the Board allocated a further $350,000 for expenditure on the continuing implementation of the METCON and STATCON signals, signs and markings for which it has responsibility. The allocation included $100,000 for the installation of METCON signals, enabling a further four sets of traffic signals to be installed on declared roads in the metropolitan area.

The remaining $250,000 was allocated for expenditure on signs and markings in rural areas of Victoria under STATCON. The necessary METCON signs and markings on the Board's declared roads in the Metropolitan area were completed during the year. STATCON signs and markings were also completed on the Board's declared roads in the Mornington Peninsula, some outer suburban areas to the east of Melbourne, and the urban areas of Geelong, Ballarat and Bendigo.

At the end of the financial year STATCON had been extended to all declared roads on the Bellarine Peninsula and in the urban areas of a total of 51 towns on State highways. Approximately 3800 Stop and Give Way signs, and 3500 pavement markings had been installed to the end of the year.

The whole of the Board's signs and markings programme should be substantially complete by the end of 1978, and the major part of the signals installation programme by 1981.

Raised pavement markers on rural highways

During the year the Board completed a programme of laying raised reflective pavement markers on a total of 1100 km of rural State highway. The lengths of highways treated in this manner were selected on the basis of accident frequency. A substantial length of most of the major State highways radiating from Melbourne were included in the programme.

The markers were laid at 24 m centres, ie. one marker in every second gap in the broken painted line. At double lines two markers were laid with one either side of the line at each location. A feature of this programme was the partial mechanization of the operation which enabled machine mixing of the epoxy adhesive used to lay the markers. Machine mixing in turn made possible the use of special fast setting adhesives enabling the laying process to proceed both in cold weather and under reasonably heavy traffic with minimal disturbance to the markers during setting. The initial loss rate of about 1 to 2% of the markers due to imperfect laying techniques is regarded as a significant improvement over earlier methods.

The markers provide substantial improvement in night driving conditions.

Use of reclaimed rubber in bituminous surfacing.
Background: Test section of bitumen reclaimed rubber seal on the Maroondah Highway at the intersection with Mount Dandenong Road, Ringwood.
Insert top: Discarded tyres — a disposal headache.
Insert below: Close up of rubberised asphalt.

Land purchase

The payment of compensation for property acquisition to those owners whose property is in the path of planned road widening projects or new road construction projects is a major aspect of road building in Victoria and accounts for millions of dollars each year.

With most major road projects property owners have been made aware of the proposals for many years. For example, in the case of the Board's largest current road widening project — the Nepean Highway widening from Elsternwick to Moorabbin — owners have been aware of the general proposals since 1954 when a main road reservation was included in the Melbourne Metropolitan Planning Scheme.

Under the provisions of the Country Roads Act the Board is required to make full compensation at current market values for the property acquired and all damages sustained.

The Board's objective is to place the owner in the same financial position after the property is sold to the Board as he or she was prior to the sale.

During the year the Board paid compensation and costs amounting to $20.97 million to 671 owners of land. The following table shows the road classifications on which the expenditure was incurred:

During the year the Lands Compensation (Amendment) Act 1976 was passed. Prior to the passing of this Act the Lands Compensation Act 1958 provided for the Board to grant an interest free loan to an owner where certain conditions apply. Two of these conditions were that the market value of the land being acquired did not exceed $35,000 and that the amount of the loan did not exceed the difference between the market value of the property being acquired by the Board, and $35,000. The Lands Compensation (Amendment) Act 1976 amended the figure of $35,000 to $75,000.

	Commonwealth road category						
CRB road classification	National highways	Urban arterial roads	Urban local roads	Rural arterial roads	Rural local roads	Export roads	Total
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
Freeways	2,455	11,864	—	236	—	—	14,555
State highways	28	3,326	—	406	—	—	3,760
Tourists' roads	—	1	—	3	1	—	5
Forest roads	—	—	—	—	1	—	1
Main roads	—	1,583	—	177	71	—	1,831
Unclassified roads	—	202	309	—	225	79	815
Totals	2,483	16,976	309	822	298	79	20,967

The table below shows the number of land purchase transactions completed and the amount of compensation and associated costs paid by the Board over the last five years.

	1972/73	1973/74	1974/75	1975/76	1976/77
Number of land purchase cases settled	865	864	923	661	671
Compensation and associated costs paid by the Board	$10.07m	$11.71m	$19.34m	$16.02m	$20.97m
Reimbursement to councils for the purchase of land for unclassified roads	$0.46m	$0.88m	$0.53m	$0.73m	$0.74m

Of the $20.97 million expended during the year $10.84 million was spent in purchasing properties from owners who demonstrated that they were incurring hardship due to the Board's future road proposals.

The Board received $1,478,214 from 707 rented residential or commercial properties and 176 separate areas of vacant land. During the year 41 separate areas of surplus land were sold for $1,705,341, 11 residential properties surplus to requirements were sold for $376,680 and 18 houses were sold for removal for $42,130.

Bridges

Construction of new bridges

A total of 111 new bridges estimated to cost $16,457,000 were commenced during 1976/77.

The following table gives a comparison between the number and estimated cost of bridge projects begun in 1976/77 and those for the preceding financial year:

Description	1975/76		1976/77	
	No.	Est. cost	No.	Est. Cost
New bridges commenced under the supervision of the Board's staff	37	$9,970,000	56	$12,670,000
New bridges commenced under municipal supervision with financial assistance from the Board	41	$1,695,000	55	$3,787,000
Total bridges commenced	78	$11,665,000	111	$16,457,000

Major bridges completed in rural areas

Some of the major bridges completed in rural areas during the year under the direct supervision of the Board's staff included:

—South Gippsland Freeway, Pound Road Overpass — a two span post-tensioned concrete box girder bridge 76.4 m long and 12.2 m between kerbs.

—Western Freeway, Ballan-Greendale Road Overpass — a two span post-tensioned concrete box girder bridge 89 m long and 9.8 m between kerbs.

—Princes Freeway, Orbost Section: Snowy River Bridge — a fifteen span prestressed and reinforced concrete bridge 370.9 m long and 10.0 m between kerbs. Watts Gulch Bridge — a ten span prestressed and reinforced concrete bridge 210.4 m long and 10.0 m between kerbs. Ashbys Gulch Bridge — a twenty eight span prestressed and reinforced concrete bridge 490.9 m long and 10.0 m between kerbs.

—Princes Highway East, Simpsons Creek Bridge — a three span prestressed and reinforced concrete bridge 37 m long and 9.8 m between kerbs.

—Princes Highway West, Darlots Creek Bridge — a four span reinforced concrete bridge 44.4 m long and 9.8 m between kerbs.

—Western Highway, Wimmera River Bridge at Horsham — a seven span reinforced concrete bridge 74 m long and 9.2 m between kerbs.

—Goulburn Valley Highway, Goulburn River Bridge at Trawool — a five span steel girder and reinforced concrete bridge 147.5 m long and 9.8 m between kerbs.

—Swanpool Main Road, Broken River Bridge — a three span prestressed and reinforced concrete bridge 55.6 m long and 8.6 m between kerbs.

Some of the larger bridges completed during the year under municipal supervision with financial assistance from the Board were:

—Oxley Shire: Bright Main Road, over Pelican Creek, five span reinforced concrete bridge 31.1 m long and 6.7 m between kerbs.

—Bacchus Marsh: Geelong-Bacchus Marsh Main Road, over Parwan Creek, three span reinforced concrete bridge 27.4 m long and 8.6 m between kerbs.

—Otway Shire: Birregurra-Forrest Road, over the Barwon River, three span reinforced concrete bridge 28.8 m long and 9.8 m between kerbs.

Metropolitan bridges and overpasses

Amongst the larger bridges in the metropolitan area completed during the year under the direct supervision of the Board's staff were:

—Eastern Freeway: Columba Street Overpass — City of Camberwell — a two span post-tensioned concrete box girder 116.7 m long and 5.4 m between kerbs. Boulevard Overpass — City of Kew — a single span post-tensioned portal frame concrete bridge 132 m long and 12.1 m between kerbs. Chandler Highway Overpass — City of Kew — a five span post-tensioned concrete box girder bridge 175.5 m long and 20.4 m wide. Chandler Highway Ramp Bridge — City of Kew — a three span post-tensioned concrete box girder bridge 61.5 m long and 20.4 m between kerbs. Bulleen Road Overpass — City of Camberwell — a two span post-tensioned multi-cell concrete bridge 93 m long and 20.4 m between kerbs.

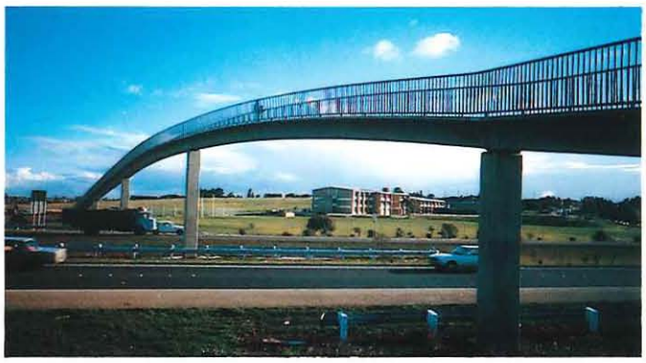
—Mulgrave Freeway: Ferntree Gully Road On Ramp Bridge — City of Waverley — a four span post-tensioned concrete box girder bridge 143.7 m long and 10.1 m between kerbs. Ferntree Gully Road East-bound Bridge — City of Waverley — a four span prestressed and reinforced concrete bridge 83.2 m long and 15.9 m between kerbs. Ferntree Gully Road West-bound Bridge — City of Waverley — a four span prestressed and reinforced concrete bridge 88.7 m long and 21.2 m between kerbs. Forster Road Bridges — City of Waverley — twin three span post-tensioned concrete slab bridges each 50.6 m long and 10.7 m between kerbs.

Grade separated pedestrian crossings

The Board is involved in the construction of grade separated pedestrian crossings as outlined below:

1. the construction of pedestrian overpasses over freeways or other important arterial roads to improve pedestrian access to areas on either side of the road;
2. the replacement of at-grade school crossings on heavily trafficked roads with pedestrian overpasses or underpasses under the scheme introduced by the Victorian Government in 1965. The scheme provides for:
   —applications for subsidies to be submitted to the Board by municipal councils;
   —priorities to be decided by the Board and the Road Safety and Traffic Authority in conjunction, taking into account traffic volume, average speed, number and age range of children crossing, and the type of road;
   —the total costs of approved crossings to be shared equally between the State Government (Treasury), the Transport Fund and the municipal council;
3. assistance to municipal councils on request in the preparation of plans and specifications and supervision of construction in cases where the Council pays the whole cost of construction.

Other projects and activities



Pedestrian overpass across the Mulgrave Freeway.

The following crossings were constructed by the Board during the year:

Restoration of pedestrian access

—Kernot Avenue over the Mulgrave Freeway: A five span prestressed and reinforced concrete beam overpass 175 m long and 1.8 m wide.

Grade-separated crossings to serve schools

Nineteen structures have now been constructed under a Victorian Government scheme.

Overpasses completed during the year under the scheme were:

—Warrigal Road at Euston Street, City of Oakleigh: A single span prestressed and reinforced concrete structure 32.8 m long and 1.8 m wide.

Elimination of railway level crossings

In 1954 the State Government established the Level Crossings Fund with a view to providing finance to assist with the elimination of dangerous railway level crossings. Contributions were made by the Board and the Victorian Railways towards the cost of projects. Since then 62 road overpasses, or underpasses, at a cost of more than $36 million have been constructed to eliminate dangerous railway level crossings.

Since 1st July, 1974 the total cost of this work has been charged to the Transport Fund.

Between 1970 and 1976, 740 motor vehicle accidents occurred at railway level crossings in Victoria and as a consequence 164 persons were killed.

The following project was substantially completed by the CRB during the year:

—road-over-rail overpass to carry Grimshaw Street over the Melbourne/Hurstbridge railway line at Watsonia. More than 17,000 vehicles travel along Grimshaw Street daily.

A road-over-rail overpass at Watsonia Road is scheduled for completion early in the 1977/78 financial year. The realignment of the railway line under both the Grimshaw Street and Watso
finish the project.

Work was commenced on the following project during the year:

—A road-over-rail overpass at Weerite, 185 kilometres to the west of Melbourne to carry the Princes Highway over the Melbourne/Port Fairy railway line. The project is estimated to cost $700,000 and is scheduled for completion in early 1978.

Construction is well advanced on a major level crossing elimination project at Camp Road, Broadmeadows.

National Parks roads

The State Government again provided loan funds amounting to $100,000 repayable by the Board for expenditure on roads and associated purposes in or near National Parks.

Allocations were made by the Board after consultation with the National Parks Service for maintenance and for other works in or near:

—Brisbane Ranges National Park in Bannockburn Shire
—Bulga National Park in Alberton Shire
—Cape Schanck National Park in Flinders Shire
—Captain James Cook National Park in Orbost Shire
—Ferntree Gully National Park in Sherbrooke Shire
—Fraser National Park in Alexandra Shire
—Glenaladale National Park in Bairnsdale Shire
—Hattah Lakes National Park in Mildura Shire
—Kinglake National Park in Eltham and Whittlesea Shires
—Lind National Park in Orbost Shire
—Little Desert National Park in Dimboola Shire
—Melba Gully National Park in Otway Shire
—Morwell National Park in Morwell Shire
—Mt Buffalo National Park in Bright Shire
—Mt Burrowa-Pine National Park in Minhamite Shire
—Organ Pipes National Park in Keilor City and Bulla Shire
—Port Campbell National Park in Heytesbury Shire
—Tarra Valley National Park in Alberton Shire
—The Lakes National Park in Rosedale Shire
—Warby Ranges National Park in Wangaratta Shire
—Warrandyte National Park in Doncaster & Templestowe City
—Westerfolds National Park in Doncaster & Templestowe City
—Wingan Inlet National Park in Orbost Shire
—Wilson's Promontory National Park in South Gippsland Shire
—Wyperfeld National Park in Karkarooc Shire

The works consisted of the construction and sealing of access roads to National Parks and roads and parking areas within National Parks, together with the maintenance of roads and parking areas already constructed. The works were carried out either by the Board, the local municipal council concerned, or the National Parks Service. The Government has made loan funds totalling $1,397,000 available for these purposes since 1st July, 1963.

Roads of tourist interest

The State Government again provided loan funds totalling $225,000 for expenditure on roads of a tourist nature other than roads proclaimed as tourists' roads under the provisions of the Country Roads Act. The loan funds are repayable by the Board.

Allocations for particular projects were again made by the Board after consultation with the Ministry of Tourism. The total amount made available by the Government since 1960 is $3,444,000. Applications for financial assistance from these funds far exceed the amount available for expenditure.

The Board is required to make an annual payment into the Tourist Fund amounting to two per cent of the amount credited to the Country Roads Board Fund in the previous year from receipts under the Motor Car Act. An amount of $1,016, 537 was paid during the year. The Tourist Fund is administered by the Ministry of Tourism.

Municipalities Forest Roads Improvement Fund

The Municipalities Forest Roads Improvement Fund was established in the State Treasury in 1955 for the purpose of assisting municipal councils in the improvement and protection of roads adjacent to State Forest areas to facilitate the extraction of forest produce. An amount of $125,000 was authorized to be paid into the Fund by the State Government during the year increasing the authorized contributions to $860,000 since the inception of the Fund.
Once again the Board's Divisional Engineers combined with the appropriate Forests Commission officers to determine the priorities of eligible works. Allocations for particular works were made by the Board with the agreement of the Forests Commission.
The limited funds available from the Fund only enable grants to be made for the most urgent works. Unsatisfied applications for funds totalled approximately $335,000.

Control of over-dimensional and overweight vehicles

To provide safer conditions for road users and to protect road surfaces, 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 the authority responsible for issuing permits for the movement of vehicles and loads exceeding the legal weight, height, length and width on:

- roads declared or proclaimed under the provisions of the Country Roads Act; and
- a journey which includes unclassified roads in two or more greater metropolitan municipalities as defined in the Motor Car Act.

The number and types of permits issued during the year compared with those issued during financial year 1975/76 are shown below:

	1975/76	1976/77
Single trip permits	22,959	20,075
Annual permits	4,040	3,526
NAASRA permits	—	11,150*
Total number of permits issued	26,999	34,751

*This figure represents the number of permits issued in accordance with the NAASRA recommendations, referred to in the Review Section of this Report. The permits will be effective until such time as they are made redundant by new legislation.

The number of offence reports submitted was 7,929, of which 6,793 or 85.6% were successfully prosecuted. Total fines and costs resulting from the above cases amounted to $882,565 which was paid into Consolidated Revenue.

Thirty-third conference of municipal engineers

The thirty-third conference of municipal engineers, convened by the Board in conjunction with the Local Government Engineers of Australia, was held at the Board's Head Office on 21st and 22nd March 1977, with a technical tour on 25th March.
The Conference was officially opened by the Chairman, Mr R E V Donaldson, on behalf of the Minister of Transport.

The theme of the Conference was the various aspects of management related to engineering. For the first time the opening paper was a Keynote Address by a distinguished speaker, Sir John Holland, Kt, BCE, FIE Aust, FAIB, whose topic was 'Management from a Civil Engineering Viewpoint'. Sir John's address was well received by conference participants and set the pattern for a highly informative and successful conference.
Approximately 270 engineers, including representatives of many Victorian municipalities, some State Government Instrumentalities and Departments and interstate bodies, and the Board attended the Conference to hear and discuss a number of papers on the general themes of Planning, Organisation and Resources, and Direction and Control.
Another innovation was the introduction of a split programme whereby papers on different subjects were given concurrently in the Head Office theatrette and in the Materials Research Division laboratory building. This change offered a selection of interest to participants and allowed a large number of papers to be presented over the two Conference days.

On the theme of Planning, Mr P S Parkinson, Shire Engineer, Flinders, spoke on Tourism — The role of Local Government. Mr N H Cottman, Shire Engineer, Stawell, convened a panel discussion on rural residential subdivisions, development and controls. The Board's Chief Planning Engineer, Mr R T Underwood, spoke on Urban Transportation Corridor Studies and discussion on this was followed by papers given by Mr S J Pike, City Engineer, Melbourne, and Mr B J Negus of the Board's Traffic Engineering Division on Inner Urban Traffic Management.
Mr W P Dunk of the Ministry of Conservation, Mr R E Saunders, Leader of the Board's Environmental Studies Section and Mr E C Madsen, Shire Engineer, Mornington, spoke on Environmental Issues, Legislation and Practice.

On the theme of Organisation and Resources, Mr P M Jeffreys, the Board's Chief Mechanical Engineer jointly with Mr N J Schofield, Shire Engineer, Hampden, presented a paper on New Plant and Equipment.
Mr M J Pawsey, City Engineer, Berwick, spoke on Street Works Co-ordination. There were a number of papers on bridge topics — by Mr D G Thompson of the Dandenong Valley Authority jointly with Mr R J Ladd, Deputy City Engineer, Knox, by Mr J W Sterkenberg, Shire Engineer, Avon, and by Mr D C Gillett, BHP Co. Ltd. The Board's Personnel Manager, Mr G C Rogers spoke on Flexible Working Hours, the Industrial Relations Officer,

NAASRA members attended the annual conference in Melbourne in November, 1976. Seated around the table are (from left): Mr W S Brake, Board Member CRB, Mr T H Russell, Deputy Chairman CRB, Mr D H Aitken ISO, Commissioner Main Roads Department WA, Mr G E C McKercher, Director Main Roads Department Tasmania, Mr J R M MacBride, Engineer Secretary (Elect) NAASRA, Mr R E V Donaldson, Chairman CRB and NAASRA, Mr D J Black, Engineer Secretary NAASRA.

Mr R C S Howard, spoke on Industrial Relations and the Board's Divisional Engineer, Ballarat, Mr E T Oppy, spoke on Delegation and Participation.
The third segment on the theme Direction and Control, included papers by Mr J C Sherring, City Engineer, Sandringham, who presented a paper on Maintenance and Servicing Functions, by Mr A M Noble, the Board's Assistant Chief Road Design Engineer, on Traffic Management Schemes, and by Mr H E Kilminster, City Engineer, Wangaratta, on External Controls. Mr D G Dean, Shire Engineer, Grenville, spoke on Retreatment of Bituminous Sealed Surfaces; and Mr D S MacLeod, Shire Engineer, Chiltern, on Quarrying Methods and Product Control. The Conference concluded on the subject of Financial Programme Management and Legislation with a paper by Mr A Thomson, City Engineer, Mildura, and a joint paper by Mr R G Cooper, the Board's Chief Accountant and Mr N S Guerin, the Board's Deputy Engineer in Chief.
On 25th March, interested engineers were taken on a tour of inspection of the preliminary rail lowering and grade separation works for the Greensborough Freeway.
The Board extends its thanks and appreciation to the Local Government Engineers Association of Victoria for assistance in planning the Conference and to Sir John Holland and all engineers, particularly those who presented papers, for contributing to the success of the Conference.

Visits to municipalities

Each year the Board Members make official visits to a number of municipalities throughout the State. This has been the practice since 1913 when the first Board toured the State to decide which roads should be main roads. Most municipalities in Victoria are visited at approximately six yearly intervals. These visits include a tour of the municipality's roads, in company with Councillors and council officers, and discussions on local road problems. These visits provide the Board Members with important information about road conditions and developments.
During the year the Board made official visits to thirty-six municipalities: the Shires of Alberton, Avoca, Ballan, Beechworth, Birchip, Chiltern, Colac, Donald, Gisborne, Karkarooc, Leigh, Metcalfe, Mornington, Morwell, Mount Rouse, Phillip Island, Pyalong, Traralgon, Upper Murray, Waranga, Warracknabeal, Wimmera, The Cities of Broadmeadows, Colac, Croydon, Dandenong, Essendon, Knox, Nunawading, Ringwood, Sale, Springvale, Sunshine, Traralgon, the Rural City of Wodonga and the Borough of Wonthaggi.
The Board places on record its appreciation of the assistance given by all Councillors and municipal officers during these visits.

Deputations

The Board is always prepared to discuss matters of common interest with representatives of Councils or other official bodies. These discussions provide a useful channel of communication between the Board and local administration. During the year the Board received deputations from the Footscray, Kew, Essendon, Moe and Ballaarat City Councils and the Whittlesea and Diamond Valley Shire Councils. The main topics raised were the general inadequacy of road grants to meet the State's road needs, the allocation of road funds to municipal councils by the Board, freeway planning and road construction.

National Association of Australian State Road Authorities

The National Association of Australian State Road Authorities (NAASRA) is an organisation consisting of the Heads of the road authorities of the six States and the Commonwealth Department of Construction which is the road constructing authority for the territories administered by the Commonwealth Government. The aims of NAASRA may be briefly stated as providing uniformity of practice in road and bridge design construction and operation, improved road construction methods and the production and updating of technical manuals to establish standard practices throughout Australia.
The Association also collects and disseminates statistical information relating to traffic, the types and standards of roads and road finance. The information collected is used in the formulation of national road policies.

NAASRA's views on Commonwealth controls on road finance, and Commonwealth participation in works programming, road design and construction standards are presented to the Australian Transport Advisory Council Road Advisers Group of which the Board's Chairman, Mr R E V Donaldson, is a member. This Group advises ATAC, a meeting of Ministers of Transport which determines policy.
The following NAASRA meetings were held during the year
—55th (Special Meeting) Perth, 26/8/76 attended by Mr R E V Donaldson, Chairman.
—56th (Annual Meeting) Melbourne, 1-3/11/76 attended by Mr R E V Donaldson, Chairman, Mr T H Russell, Deputy Chairman and Mr W S Brake, Member.
—56th (Intermediate Meeting) Melbourne, 17/5/77 attended by Mr R E V Donaldson, Chairman, Mr T H Russell, Deputy Chairman and Mr W S Brake, Member.
At the 56th Annual Meeting of NAASRA, Mr R E V Donaldson, Chairman, was appointed Chairman of the Association for 1976/77. Matters which were considered at this meeting included National Highway Identification Signs, Uniform Longitudinal Linemarking on Road Pavements in Australia, the Implementation of Recommendations

Mr A F Schmidt, Commissioner Department of Main Roads NSW, Mr W Hansen, Commissioner Main Roads Department Queensland, Mr A K Johinke, Commissioner Highways Department SA, Mr G H Warwick Smith CBE, Secretary Department of Construction (Commonwealth), Mr N A Waslin, 1st Assistant Secretary (Roads) Department of Transport (Commonwealth), Mr H T Loxton, Chairman Commonwealth Bureau of Roads.

of the Economics of Road Vehicle Limits Study, NAASRA Data Bank System Study, a Road Maintenance Study, a Guide Policy for Road Noise Control and Guidelines for Environmental Study Groups.
Before the Annual Meeting, NAASRA members toured the north-east of Victoria, visiting Tallangatta, Bright, Mt. Buffalo, Beechworth and Benalla. The tour concluded with an inspection of the Hume Highway.
The Principal Technical Committee of NAASRA plans and organises the technical work of the Association with the assistance of eight specialist committees. The Board is represented on the PTC by the Engineer in Chief, Dr K G Moody.
The financial and administrative functions of the State Road Authorities are covered by the Secretarial and Accounts committee of NAASRA and the Board is represented on this Committee by Mr N L Al
Mr R G Cooper, Chief Accountant.

The Board is also represented on the Specialist engineering Committees of NAASRA by the officers named below.
Mr K N Opie, Chief Bridge Engineer (Bridge Engineering Committee); Mr R A Northrope, Acting Officer-in-Charge, Computer Section (Computer Committee); Mr A M Noble, Assistant Chief Road Design Engineer (Geometric Road Design Committee); Mr P W Lowe, Materials Research Engineer (Materials Engineering Committee);
Mr P M Jeffreys, Chief Mechanical Engineer (Plant and Equipment Committee); Mr A M MacPherson, Traffic Engine
Works (Administration) Engineer (Construction and Maintenance Practice Committee); Mr J H Pittard, Advance Planning Engineer (Advance Planning Committee).
The joint work of the State Road Authorities through these Committees ensures co-ordination of effort, uniformity of approach and a pooling of experience in road and bridge planning, design, construction and maintenance.

Australian Road Research Board

The Australian Road Research Board was established in 1960. The Board of Directors includes the Heads of the State Road Authorities, the Secretary of the Commonwealth Department of Construction, the Secretary of the Commonwealth Department of Transport and the Executive Director of ARRB. The Chairmanship of ARRB rotates annually amongst the Directors.
Up to 10% of the ARRB's annual expenditure is borne by the Commonwealth Department of Construction and the remainder is shared by the six State Road Authorities on the percentage basis adopted by the Commonwealth Government in making grants to the States under the Commonwealth Roads Grants Act 1974.
The major objective of the Board is to co-ordinate, encourage and arrange continuing research into problems associated with roads and traffic in Australia.
The members of the Australian Road Research Board meet twice a year to consider management and policy matters and to review the progress of research projects.
Mr R E V Donaldson, who is Deputy Chairman of ARRB attended the intermediate meeting at the Road Research Centre, Vermont on 4th November, '76 and also the Annual Meeting held there on 18-19th May 1977.
Technical conferences for the wider dissemination of the results of research and the exchange of knowledge are held biennially. The 8th Biennial Conference was held in Perth 23-27th August 1976 and was attended by
Mr R E V Donaldson, Deputy Chairman, ARRB, Mr T H Russell (Deputy Chairman, CRB), who was co-author of a paper on the NAASRA Economics of Road Vehicle Limits Study, and several CRB engineers.
ARRB Directors have decided to present an annual prize for the paper which best translates research into practice. The first award was presented at the August Conference in Perth to CRB engineer, Mr B L Phillips for his paper on 'Synthetic Aggregates for road surfacings'.
Several CRB engineers are members of ARRB technical or specialist committees.
There was co-operation between the Country Roads Board and ARRB during the year in several areas of practical road research, for example:

—Field evaluation of a durability test for bitumen at four field sites at Elmore, Violet Town, Epping and Vermont.
—Development of an asphalt mix for residential streets.
—Evaluation of asphalts which incorporate granular scrap rubber.
—Evaluation of granular rubber-bitumen binders for sprayed seal work.
—Field evaluation of the CRB Pavement Design Method.
—Preliminary investigations to determine the effectiveness of 'rumble-strips' as a warning device.
—Delineation of roads by means of reflective lines and other devices.
—Investigations into freeway lighting.

er (Traffic

Co-operation with Army Reserve

The CRB continued its sponsorship of Australian Army Reserve (SR) units of the Royal Australian Engineers. The units are the Headquarters 22 Construction Regiment and the 107 Plant Squadron (Heavy).
The 1976 annual training camp was held at Benalla and about 120 CRB personnel attended. Training at the camp was concerned principally with Bailey bridging, improvised bridging and watermanship, as well as recruit training for new members.

As at 30th June, 1977, fifteen members of the Board's staff were officers of the regiment, including the Commanding Officer, Lt Col G R Hunt ED, the Board's Project Engineer for the Eastern Freeway, and the Commanding Officer of the plant squadron, Major P M Hosking ED, the Board's Property Officer.

Public relations

In recent years the Board has accepted the need to employ specialist staff in order to inform the public of its functions and works.

This public information function is carried out through the preparation of news releases, media conferences, displays, films and the production of journals and brochures.

Publications

During the year, the Board issued the following publications:

CRB News, Nos 33, 34, 35
Urban Freeways
The Hume Challenge — a freeway from Melbourne to Wodonga
The Princes Freeway, Orbost Section
The Calder Freeway, Keilor Section
Converting Lancefield Road to Freeway
'Your Property . . . Your Roads'
Widening of Nepean Highway (revised)
Snow Driving . . . It's An Art
Financial Facts, February, 1977
The Hume Freeway, Baddaginnie to Bowser Section
The Replacement of the Murray River Bridge — Mildura
South Gippsland Freeway Extension, Hampton Park

Displays

The Board purchased a Mobile Information Centre to assist in the dissemination of information on its various projects and planning proposals. The Centre has provision for the display of literature, plans and photographs and includes video equipment. As well as its use at the Royal Melbourne Show and at country shows, the Centre was utilised prior to the opening of the Snowy River Bridge at Orbost, and at public meetings held at Benalla, Glenrowan and Wangaratta to discuss the proposed Hume Freeway in these areas.

In all the Board participated in 17 displays and exhibitions during the year, including Environment '76, the State Government Garden State exhibit at Garden Week, and Civinex '77.

Films

During the year five films were produced for public exhibition.

—Landscaping the Eastern Freeway
—The Great Ocean Road
—Bridging the Snowy — a freeway bypass for Orbost
—The Gardiners Creek Study
—The Hume Challenge.

Motorists' services and driver education

The Motoring Bulletin service to the media and emergency services was continued, after its introduction in early 1976. In all, 69 bulletins were issued covering roadwork locations that could cause delays to traffic. In addition, snow and flood reports were issued as required.

The Board's driver education brochure, 'Snow Driving . . . It's an Art' was reprinted after requests for 20,000 copies were received from interested authorities and individuals.

Personnel

The Board's personnel numbers as at the 30th June 1977, were as follows:

Technological staff (professional)	609
Technical staff	509
Administrative staff	738
Supervisory staff — Field	172
— Depot	71
Clerks of works	86
Construction and maintenance personnel	2224
Workshop and depot personnel	619
Total	5028

As in the last financial year replacements of personnel who left the Board's service were not made unless the need could be clearly justified. There was no recruitment of additional technological staff during the year and again no cadetships were granted. Salaried staff numbers reduced by 77 during the year.

Although recruitment activities were generally at a low level, officers of the Board continued to attend Careers functions throughout the State in an endeavour to assist students in determining their career objectives.

In the latter part of 1976 a scheme of Flexible Working Hours, somewhat similar to that in operation in many areas of the State Public Service, was introduced for staff located at Head Office. The results to date indicate that the scheme is operating successfully to the advantage of both the Board and the staff. Consideration is being given to the extension of the scheme to other areas of the organisation.

Apprenticeships

In order to assist with apprentice training generally the Board engaged as many apprentices as funds and training facilities would allow. Twenty-four apprentices were engaged during the year in the trades of motor mechanics (18), fitting and machining (1), structural steel fabrication (1), painting and decorating (1), lithographic printing (1), instrument making and repairing (1) and gardening (1).

One new apprenticeship offered by the Board this year was in the trade of instrument making and repairing. This apprentice has been employed in the Materials Research Division where he will be trained in the production of electronic and mechanical components for testing equipment.

The Mobile Information Centre was used successfully at the Snowy River Bridge opening ceremony at Orbost, and at rural shows in the eastern regions.

The total number of apprentices in training at the 30th June 1977 was:

Motor mechanics	58
Structural steel fabrication	3
Carpentry and joinery	3
Painting and decorating	3
Electrical mechanics	3
Cooking	2
Automotive electrics	2
Gardening	1
Lithographic printing	1
Instrument making and repairing	1
Fitting and machining	1
	78

Industrial relations

The rate of inflation reflected in wage and price increases during the year continued to be of concern in reducing the Board's capacity to carry out its programmes.

Industrial disputes such as the concrete batching plant dispute in March/April 1977 impeded the Board's work on some projects. The strike of petrol tanker drivers in April 1977 ended before it seriously hindered the work of the Board. Apart from the national stoppage on the Medibank issue the year was free of strikes.

The Board accepts the importance of consultation and participation with staff associations and trade unions as an important factor in good industrial relations. After extensive consultation with the staff associations the Board agreed to establish a Classifications Committee instead of acceding to a claim for a Board of Reference. The Classifications committee includes staff association representation. The role of the Committee is to consider:

1. requests for the reclassification of positions occupied by salaried staff provided that no request shall be considered which would result in a reclassification exceeding the level of Class 5 in the Administrative Division or Class 5 in the Technical Division or Class 4 in the Professional Division;
2. appeals from members of the salaried staff against the level of, or non-payment of higher duties allowances.

The Committee has no power of final decision and is required to make recommendations to the Board.

During the year the Board participated in several important cases before the Conciliation and Arbitration Commission. These included building industry and construction industry awards covering the employment of builders labourers, carpenters and construction workers. The Board also participated in an extensive case concerning the salaries of Class 1 professional engineers required to supervise the work of personnel receiving higher rates of pay. This case arose from a claim made by the Association of Professional Engineers, Australia, on the Metropolitan Water Sewerage and Drainage Board, NSW which could have had repercussions on the Board.

Details of awards by the Conciliation and Arbitration Commission to which the Board is a respondent party and the number of its personnel covered by these awards are as follows:

Award	No. personnel
Australian Workers Union Construction and Maintenance	1780
Building Construction Employees and Builders Labourers	80
Carpenters and Joiners	20
Engine Drivers and Firemen	5
National Building Trades Construction	77
Metal Trades Award	294
Transport Workers (General)	310
Municipal Officers (Country Roads Board)	1760
Municipal Officers (Country Roads Board) Senior Officers	19
Professional Engineers (Country Roads Board, Victoria)	522
Professional Engineers (Country Roads Board, Victoria) Senior Engineers	20

The remaining employees are covered by Victorian Wages Board Determinations.

Training and development

Once again the Board's comprehensive training and development programme provided training courses based on the needs of each work area. Engineering training courses covered a wide range of technical subjects such as road and bridge design, project management, materials testing, traffic engineering and computer methods.

Management skills were developed by conducting internal residential management courses for selected officers at middle and senior management level.

Appropriate external training courses, lectures and conferences were attended by selected staff, so that the latest trends in particular disciplines are available to the Board.

Over two hundred members of the staff used the Board's study leave scheme to undertake a wide variety of courses at tertiary institutions, thereby improving their promotional opportunities and gaining special skills and knowledge important to the Board's work.

Medical officer

During the year the Board engaged the services of a Medical Officer on a part-time basis with a view to providing certain occupational Health services.

As a result of this appointment important changes have been made in occupational health generally and in accident reporting and investigation and workers' compensation administration.

Retirements
During the year the following personnel retired after substantial service with the Board:

			Years of service
*Mintern-Lane, T	Superintendent of Works	Bridge	43
Jacka, A	Divisional Engineer	Traralgon	42
Ryan, J C	Engineering Assistant Class 4	Dandenong	42
Williams, C E	Roadmaster Grade A	Bendigo	41
Cambridge, A J	Roadmaster 'A'	Geelong	40
Pike, R S	Patrolman Grade 2	Dandenong	37
Sullivan, J P	Roadmaster A	Ballarat	37
Neville, W F	Assistant Chief Works Engineer	Engineer in Chief's Branch	36
*Aldridge, C S	Storeman Grade 3	Bendigo	35
Combridge, H R	Patrolman Grade 1	Dandenong	34
Stevens, N M	Compensation Investigating Officer	Estates Section	32
Easton, F R	Patrolman Grade 2	Traralgon	30
Leitch, E D	Plant Operator	Bairnsdale	30
Roberts, R	Divisional Engineer's Clerk	Warrnambool	30
Smooker, S J	Patrolman Grade 2	Bairnsdale	30
Bruhn, L G	Clerk of Works Grade A	Metropolitan	29
Darcy, E J	Senior Gardener	Geelong	29
Duffy, W C	Depot Foreman	Warrnambool	29
Knox, G W	Engineer Class 2	Materials Research Division	29
Farish, J J	Divisional Accountant	Benalla	28
Gavin, S K	Cost Accountant	Chief Accountant's Branch	28
Molnar, J	Assistant Chief Mechanical Engineer	Mechanical Sub-Branch	28
Moncrieff, E J	Principal Traffic Officer	Secretary's Branch	28
Dale, S W E	Float Driver	Syndal	26
*Jason, C E	Painter	Bendigo	26
Keddie, W	Carpenter	Ballarat	26
Medwell, W C	Owner Truck Driver	Ballarat	26
Beecher, L F	Administrative Officer Class 3	Bridge	25
Nolan, D F	Owner Driver	Ballarat	25
Radic, M	Bitumen Worker	Benalla	25
Stomm, M L	Scientific Officer Class 2	Materials Research Division	25
Thorne, F W	Fitter	Benalla	25
Keily, G	Patrolman Grade 1	Ballarat	24
McEvoy, J F	Patrol Assistant	Benalla	24
Alksnis, (Mrs) E J	Senior Machine Operator Grade 1	Chief Accountant's Branch	22
*Dunstan, C B	Patrolman Grade 1	Benalla	22
Goudie, H S	Patrolman Grade 1	Bairnsdale	22
*Krisans, B	Truck Driver	Mechanical Sub-Branch	22
Whitefield, L D	Truck Driver 7-8 tonne	Ballarat	22
Busk, L N	Patrolman Grade 1	Traralgon	21
Ollis, B D	Plant Serviceman Grade 1	Geelong	21
Pattie, J	Overseer Grade C	Traralgon	21
Speechley, R J	Overseer Grade B	Bendigo	21
Taylor, E T	Overseer Grade C	Bairnsdale	21
Walter, B	C.M.W.2	Dandenong	21
White, R W	C.M.W.3	Bendigo	21
Adams, R	Administration Engineer	Engineer in Chief's Branch	20
Douglas, T	Grader Driver	Warrnambool	20
Manly, E W	Patrolman Grade 3	Dandenong	20

*Deceased

Finance

Receipts

The Board's receipts were obtained from the following main sources:

After deducting the cost of collecting revenue received under the Motor Car Act, the total funds available to the Board during the year, including the allocation from the Roads (Special Projects) Fund, was $204 312 788. The funds were derived from:

State sources	104 958 848
Commonwealth sources	91 191 634
Balance brought forward from year 1975/76	8 162 306
	204 312 788

State sources:

—Motor registration fees:
Fees payable on the registration and re-registration of motor vehicles and trailers less the costs of collecting the fees (excluding metropolitan omnibus registration fees and the specified proportion of registration fees paid to the Roads (Special Projects) Fund.

—Registration number plate fees:
Fees payable or the provision and/or replacement of number plates less the costs of providing the plates and collecting the fees.

—Examiners' licence fees:
Fees payable by persons licensed to conduct motor car road-worthiness examinations, less cost of collection of the fees.

—Authorized log book fees:
Fees payable for the purchase of log books less the cost of providing the books and collecting the fees.

—Learner driver permit fees:
Seven-eighths of the permit fee and the permit extension fee payable by applicants for and/or holders of learner driver permits less seven-eighths of the cost of collection of the fees (one-eighth less one-eighth cost of collection is paid to the Drivers' Licence Suspense Account).

—Drivers' licence testing fees:
Seven-eighths of $4 of the fee payable for the test of proficiency of candidates for motor car drivers' licences less seven-eighths of the cost of conducting the test and collecting the fee (one-eighth of $4 less one-eighth cost of collection is paid to the Drivers' Licence Suspense Account) and the amount of each fee above $4 is paid to the Consolidated Fund.

—Motor car drivers' licence fees and tractor drivers' licence fees:
One-eighth of the fees payable for the issue of drivers' licences less one-eighth of the cost of collecting the fees (one-half, less one-half cost of collection, is paid to the Consolidated Fund; one-quarter, less one-quarter cost of collection, is paid to the Municipalities Assistance Fund; one-eighth, less one-eighth cost of collection, is paid to the Drivers' Licence Suspense Account).

—Motor driving instructors' appointment and testing fees:
Fees payable by candidates for motor driving instructors' licences, less cost of collection of the fees.

—Motor driving instructors' licence fees:
One-quarter of the fees payable for the issue of motor driving instructors' licences less one-quarter of the costs of collection of the fees (one-half, less one-half cost of collection, is paid to the Consolidated Fund; one-quarter, less one-quarter cost of collection, is paid to the Municipalities Assistance Fund).

—Unregistered vehicle permit fee:
A fee for the issue of a permit to use an unregistered motor car or trailer on a highway for a period of not more than 7 days, less the costs of collection of the fee.

—Proprietorship notification fee:
A fee payable with notification by a proprietor of a motor car or trailer of repossession of the item under a hire purchase agreement, bill of sale or like instrument, less the costs of collection of the fee.

—Fines imposed under the provisions of the Country Roads Act.

—All moneys received under Part II of the Commercial Goods Vehicles Act (tonne kilometre tax).

—Municipal payments on account of main road works.

—Special moneys appropriated by Parliament.

—Loan money.

—Allocation from Roads (Special Projects) Fund.

Commonwealth sources:
—Receipts under the National Roads Act 1974, Roads Grants Act 1974, and Transport (Planning and Research) Act 1974.
—Grant towards Traffic Engineering and Road Safety Improvements.

The following table shows the funds available to the Board for the construction and maintenance of roads in 1976/77 compared with 1975/76

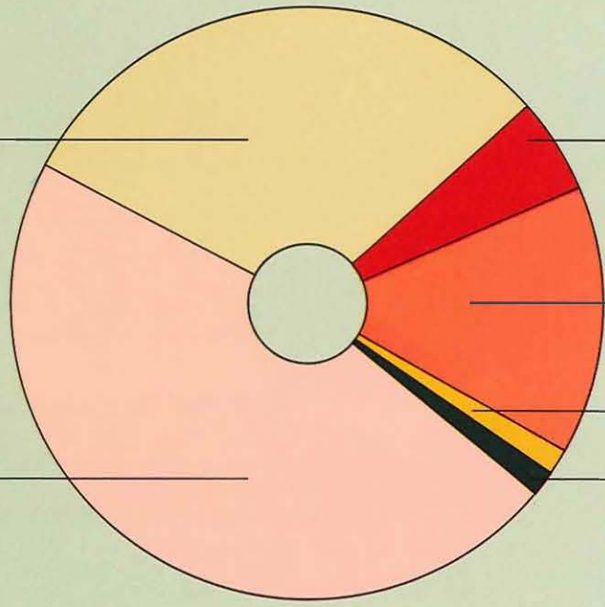
Item	1975/76		1976/77	
	$	$	$	$
Receipts from State sources				
Fees under the Motor Car Act less cost of collection		50,826,830		60,801,371
Commercial Goods Vehicle Act		10,132,146		9,967,856
Municipalities contributions		2,232,860		2,517,696
Loan funds		325,000		325,000
Special grant from State treasury		427,000		638,000
General receipts		1,524,877		1,745,537
Allocation from Roads (Special Projects) Fund		30,192,191		28,963,388
		95,660,904		104,958,848
Balance brought forward at 1st July		616,605		3,175,871
		96,277,509		108,134,719
Receipts under Commonwealth grants				
Regional employment development scheme		701,864		—
Traffic engineering and road safety		129,616		146,572
General employment purposes		1,500,000		—
		2,331,480		146,572
Receipts under National Roads Act 1974				
National Highways		18,400,000		25,600,000
Export and major commercial roads		4,800,000		5,200,000
		23,200,000		30,800,000
Receipts under Roads Grants Act 1974				
Urban arterial roads		42,590,000		39,600,000
Urban local roads		3,200,000		3,100,000
Rural arterial roads		5,660,000		4,300,000
Rural local roads		11,750,000		10,700,000
Minor traffic engineering and road safety improvements		1,610,000		1,045,000
		64,810,000		58,745,000
Balance brought forward at 1st July		15,000		4,986,435
		64,825,000		63,731,435
Receipts under Transport (Planning & Research) Act 1974		1,790,910		1,500,062
Balance brought forward at 1st July		25,623		—
		1,816,533		1,500,062
Total funds available for expenditure by the Country Roads Board		188,450,522		204,312,788

Matching Commonwealth Grants for roads

The Commonwealth Roads Grants Act fixes for each year a 'quota' of expenditure to be made on roads by each State from its own resources. The achievement of the quota over the three year period ending 30th June 1977 is necessary for each State to qualify in full for the total amounts of the Commonwealth grants to be made under the National Roads Act, the Roads Grants Act and the Transport (Planning and Research) Act. Failure to expend an amount at least equal to the overall quota would require a State to pay to the Commonwealth the amount of any shortfall against the quota or such lesser sum as the Commonwealth Treasurer determines.

The three year quota for Victoria was $307.3m

Receipts 1976-77



Registration fees, drivers' licence fees etc.
31% $60,801,000

Tonne kilometre tax
5.08% $9,968,000

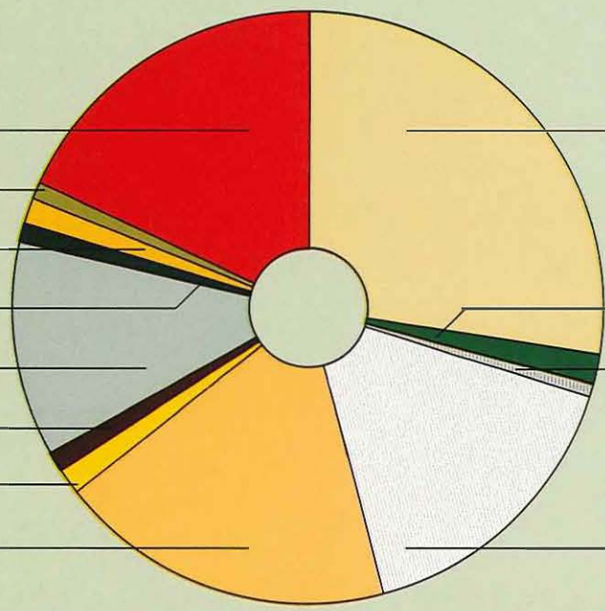
Allocation from Roads (Special Projects) Fund
14.77% $28,963,000

Municipal repayments
1.28% $2,518,000

Other
1.38% $2,709,000

Commonwealth Grants
46.49% $91,192,000

Payments 1976-77



State highways
17.89% $36,409,000

Freeways
27.39% $55,747,000

Other
.82% $1,675,000

Planning and research
1.40% $2,844,000

Capital
1.03% $2,092,000

Tourist roads
1.51% $3,066,000

Management and operating
11.81% $24,041,000

Forest roads
.73% $1,480,000

Statutory payments
1.05% $2,133,000

Interest and sinking fund
1.44% $2,934,000

Unclassified roads
18.83% $38,328,000

Main roads
16.10% $32,771,000

Expenditure

Expenditure in the form of cash payments during the financial year amounted to $203,519,868 leaving a balance of $792,920 to be carried forward into financial year 1977/78.

The following table shows expenditure incurred by the Board, including that from the Roads (Special Projects) Fund, in the years 1975/76 and 1976/77.

Item	1975/76	1976/77
	$	$
Construction and maintenance of roads and bridges	147,120,207	169,475,841
Capital expenditure (plant, workshops, offices, etc.)	1,547,473	2,092,381
Planning and research	3,662,713	2,843,525
Salaries, operating accounts and other administrative expenditure	22,931,701	24,041,489
Statutory payments to Traffic Authority Fund, Transport Regulation Fund and Tourist Fund etc.	2,233,242	2,132,733
Interest and Sinking Fund payments	2,792,880	2,933,899
Total	180,288,216	203,519,868

Sharing the costs of roadworks

The Country Roads Act provides that no more than one-half of the amount expended from loan funds 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 either 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 1976 expenditure on the normal program of main roads works in financial year 1975/76 was apportioned in accordance with the Country Roads Act, resulting in the following distribution of expenditure other than Loan Fund expenditure:

Expenditure from Country Roads Board Fund	$14,296,069
Expenditure from Commonwealth funds	6,257,117
Expenditure from proceeds of ton/mile tax (Commercial Goods Vehicles Act)	5,147,059
	$25,700,245

Amount of Country Roads Board Fund expenditure apportioned to councils	$2,310,404

Within the limit 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 1976/77 compared with 1975/76 was as follows:

	1975/76		1976/77	
	CRB	Council Contribution	CRB	Council Contribution
	$	$	$	$
Patrol maintenance	2,195,180	974,530	2,391,553	1,046,240
Construction, reconstruction and other maintenance	22,035,733	5,475,677	31,909,877	7,952,078
Total	24,230,913	6,450,207	34,301,430	8,998,318

Municipal councils were not required to contribute towards the cost of works involving an expenditure during the year of $96,702,000 on State highways, freeways, tourists' roads and forest roads (including expenditure from the Roads (Special Projects) Fund).

Appendix 1

Lengths of State Highways, Freeways, Forest roads and Tourists' roads

As at 30th June, 1977

State Highways

Name	Route	Length (kilometres)
Bass	Lang Lang-Inverloch	60.6
Bellarine	Geelong-Queenscliff	31.6
Bonang	Orbost-NSW border near Delegate	113.1
Borung	Dimboola-Charlton	123.3
Burwood	Burwood-Ferntree Gully	20.4
Calder	Melbourne-Mildura	560.1
Cann Valley	Cann River-NSW border	44.9
Glenelg	Ballarat-SA border near Mt Gambier	282.2
Goulburn Valley	Eildon-Strathmerton	225.4
Hamilton	Geelong-Hamilton	231.0
Henty	Portland-Lascelles	346.1
Hume	Melbourne-NSW border near Albury	246.6
Kiewa Valley	Bandiana-Mt Beauty	78.7
Loddon Valley	Bendigo-Kerang	123.7
Maroondah	Melbourne-Mansfield	184.6
McIvor	Heathcote-Bendigo	44.2
Midland	Geelong-Ballarat	
	Bendigo-Shepparton	
	Benalla-Mansfield	416.0
	Morwell-Port Welshpool	78.9
Murray Valley	Corryong-Hattah	738.5
Nepean	Melbourne-Portsea	91.1
Northern	Kilmore-Echuca	142.5
Omeo	Bairnsdale-Tallangatta	282.2
Ouyen	Ouyen-SA border near Pinnaroo	130.7
Ovens	Wangaratta-Bright	76.2
Princes (East)	Melbourne-NSW border near Genoa	485.7
Princes (West)	Melbourne-SA border near Mt Gambier	401.9
Pyrenees	Elphinstone-Ararat	147.5
South Gippsland	Dandenong-Yarram-Sale	254.4
Sturt	Mildura-SA border near Renmark	113.6
Sunraysia	Ballarat-Calder Highway	340.0
Warburton	Lilydale-Warburton	34.6
Western	Melbourne-Serviceton	376.4
Wimmera	Apsley-St Arnaud	222.2

Freeways

Name	Section	Length (Kilometres)
Calder	Keilor	2.8
	Elphinstone	2.7
Frankston	Eel Race Drain to Beach Street	7.0
Hume	Craigieburn to Kalkallo	8.3
	Beveridge	3.2
	Wallan-Broadford	34.8
	Broadford to Tallarook	15.5
	Chiltern	21.3
Lower Yarra	Bertie Street to Graham Street	0.3
	Williamstown Road to Princes F'way	5.1
Midland	Yinnar	9.6
Mornington Peninsula	Dromana to Rosebud	8.4
Princes	Mulgrave	15.7
	Moe to Haunted Hills	16.2
	Laverton	12.8
	Lara	24.4
	Maltby	10.2
	Dartmoor	3.0
South Eastern	Anderson Street to Tooronga Road	6.8
South Gippsland	Whitelaw	3.8
	Princes Freeway to Princes Highway	1.4
	Princes Highway to Pound Road	2.5
Tullamarine	Flemington Bridge to Melbourne Airport	20.9
Western	Deer Park to Melton	13.3
	Bacchus Marsh	8.7
	Pentland Hills	11.0
	Pykes Creek	5.7
	Gordon	10.8

Forest roads

Name	Municipalities	Length (kilometres)
Bairnsdale-Dargo	Avon and Bairnsdale Shires	20.8
Bealiba-Moliagul	Bet Bet Shire	9.0
Beech Forest-Mt. Sabine	Otway Shire	12.6
Benambra-Corryong	Omeo, Tallangatta and Upper Murray Shires	76.5
Benambra-Limestone	Omeo Shire	14.3
Bendoc-Orbost	Orbost Shire	20.9
Brookville	Omeo Shire	15.9
Bruthen-Buchan	Tambo Shire	36.5
Buchan-Ensay	Tambo Shire	19.8
Bullumwaal-Tabberabbera	Bairnsdale Shire	30.2
Carrajung-Woodside	Alberton Shire	17.7
Dargo	Avon Shire	74.8
Deans Marsh-Lorne	Winchelsea Shire	22.9
Drummond-Vaughan	Daylesford and Glenlyon and Newstead Shires	20.9
Epsom-Fosterville	Huntly Shire	21.2
Forrest-Apollo Bay	Otway Shire	19.7
Greendale-Trentham	Ballan and Kyneton Shires	23.8
Heyfield-Jamieson	Mansfield and Maffra Shires	145.5
Inglewood-Rheola	Korong Shire	17.3
Kimbolton	Strathfieldsaye Shire	13.5
Lavers Hill-Cobden	Heytesbury and Otway Shires	43.5
Meredith-Steiglitz-Maude	Bannockburn Shire	20.7
Murrungower	Orbost Shire	21.3
Portland-Nelson	Portland Shire	38.6
Red Knob	Tambo Shire	7.2
Tatong-Tolmie	Benalla Shire	36.3
Walhalla	Narracan, Mansfield and Upper Yarra Shires	110.7
Warburton-Woods Point	Healesville, Upper Yarra and Mansfield Shires	103.4
Warrowitue	McIvor Shire	16.5

Appendix 2

State Highways and Freeways

Significant works completed during financial year 1976/77

Tourists' roads

Name	Municipalities	Length (kilometres)
Acheron Way	Healesville and Upper Yarra Shires	35.4
Alpine	Bright and Omeo Shires	83.0
Arthur's Seat	Flinders Shire	8.1
Bogong High Plains	Bright and Omeo Shires	66.7
Cameron Drive	Gisborne and Newham and Woodend Shires	4.3
Donna Buang	Healesville and Upper Yarra Shires	34.0
Gipsy Point	Orbost Shire	2.4
Grampians	Ararat, Dundas and Stawell Shires and Stawell Town	69.5
Great Ocean Road	Barrabool, Winchelsea, Otway, Heytesbury and Warrnambool Shires	207.2
Mallacoota	Orbost Shire	22.5
Mount Abrupt	Ararat and Mount Rouse Shires	24.8
Mount Buffalo	Bright Shire	39.0
Mount Buller	Mansfield Shire	27.0
Mount Dandenong	Sherbrooke and Lillydale Shires	21.8
Mount Victory	Arapiles, Stawell and Wimmera Shires	30.7
Marysville-Woods Point	Healesville Shire	18.9
Otway Lighthouse	Otway Shire	12.9
Phillip Island	Bass and Phillip Island Shires	23.4
Silverband	Stawell Shire	9.1
Sydenham Inlet	Orbost Shire	21.6
Wartook	Wimmera Shire	3.5
Wilson's Promontory	South Gippsland Shire	31.0

Bass Highway
—Cranbourne Shire
Widening 2.5 km between South Gippsland Highway and Lang Lang Jetty Road.

—Wonthaggi Borough
Regrading and widening railway crossing in Wonthaggi.

Burwood Highway
—Knox City
Reconstruction of the intersection with Stud Road.

Calder Highway
—Metcalfe Shire
Reconstruction at the Midland Highway junction.

Goulburn Valley Highway
—Numurkah Shire
Reconstruction and widening of 5.2 km between Wunghnu and Numurkah.

—Seymour Shire
Construction of a 5 span bridge on a new alignment over the Goulburn River at Trawool and construction of 1.7 km of highway.

Hume Highway
—Wodonga City
Duplication of 0.5 km of highway between South and Wodonga Streets.

Maroondah Highway
—Alexandra Shire
Reconstruction of 3.1 km of highway south of Taggerty.

—Box Hill City
Reconstruction of intersections with Elgar Road and Nelson Street.

—Nunawading City
Reconstruction of westbound carriageway at Frankcom Street.

Midland Highway
—Benalla Shire
Reconstruction and widening of 3 km of highway south of Swanpool.

—Bendigo City
Replacement of the old roundabout at the 'Fountain'.
Reconstruction of intersections with Weeroona Avenue.

—Huntly Shire
Reconstruction and widening of 1.5 km south of Goornong.

—Waranga Shire
Placement of asphalt on 3 floodways, east of Corop.

Mornington Peninsula Freeway
—Frankston City and Springvale City
Construction of 2 km between Armstrongs Road and Eel Race Drain.

Mulgrave Freeway
—Waverley City
Construction of 3.6 km between Springvale Road and Forster Road.

Murray Valley Highway
—Cobram Shire
Reconstruction of intersection with Benalla-Tocumwal Road.

—Upper Murray Shire
Reconstruction and widening of 4 km between Jerimal Creek and Towong.

Nepean Highway
—Frankston City and Chelsea City
Reconstruction of intersection at Eel Race Road level crossing.

—Frankston City
Reconstruction and installation of traffic signals at Davey Street.

Northern Highway
—McIvor Shire
Replacement of timber bridge north of Tooborac over Hayes Creek with a 3 cell 2.4 m x 2.4 m box culvert.

Ovens Highway
—Wangaratta Shire
Reconstruction and widening of 2 km between Tarrawingee and Everton.

Princes Highway East
—Bairnsdale Shire
Realignment of highway at Broadlands railway level crossing.

—Cranbourne Shire and Dandenong City
Reconstruction and signalisation of intersection with South Gippsland Highway.

—Orbost Shire
Reconstruction of 2.5 km at Manorina.
Construction of new bridge over Simpsons Creek, and reconstruction and realignment of 3.8 km.

—Pakenham Shire
Duplication of 3.6 km between Pink Hill and Starling Road, Officer.

Princes Highway West
—Belfast Shire
Reconstruction and realignment of 5.8 km east of Codrington.

—Corio Shire
Channelisation of intersection with Cox Road.

—Port Fairy Borough
Construction of new bridge and 2.4 km of highway at Rosebrook.

—Portland Shire
Reconstruction of 4.3 km at Lyons.

—Warrnambool
Duplication of 1.9 km in Warrnambool.

Princes Freeway (Laverton)
—Werribee Shire
Channelisation of Leakes Road-Fitzgeralds Road intersection.

South Gippsland Freeway
—Cranbourne Shire and Berwick City
Construction of 4 km between Princes Highway and Pound Road.

Sunraysia Highway
—Donald Shire
Resheeting and widening of 8 km between Donald and Litchfield.

—Lexton Shire
Reconstruction and minor realignment of 1.8 km north of Lexton.

Western Highway
—Ararat and Ripon Shires
Reconstruction and resheeting of 5.5 km between Eurambeen and Middle Creek.

—Ballaarat City
Reconstruction to provide for full channelisation of Sturt and Pleasant Streets.

—Ballaarat City
Construction of 0.5 km of divided highway.

—Horsham City
Duplication of southern approach to Horsham including construction of duplicate bridge over the Wimmera River.

—Stawell Shire
Reconstruction of intersection with Ararat-Stawell Road.

Western Freeway
—Bacchus Marsh Shire
Widening of Coimadai Creek bridge and approaches to freeway standard.

Wimmera Highway
—Arapiles Shire
Reconstruction and realignment of 5 km at Tooan and through Salt Lakes.

Appendix 3

Tourists' roads

Significant works completed during financial year 1976/77:

Tourists' roads
Alpine Road
—Bright Shire
Reconstruction of 1.6 km between Hotham Heights and Davenport.

Bogong High Plains Road
—Bright Shire
Reconstruction and widening of 3.1 km between Clover Dam and Dynamite Creek.

Appendix 4

Main roads

Significant works completed during financial year 1976/77:

—Alexandra Shire
Buxton-Marysville Road — Reconstruction and realignment of 1.7 km.

—Ballaarat City
Colac-Ballarat Road — Retreatment with asphalt between Darling and Rubicon Street.

—Beechworth Shire
Beechworth-Wodonga Road — Reconstruction and realignment of 1.6 km, north of Beechworth.

—Benalla Shire
Swanpool Road — Construction of a 3 span bridge over the Broken River.

—Cranbourne Shire
Cranbourne-Frankston Road — Duplication and reconstruction of 0.2 km between South Gippsland Highway and Scott Street.

—Croydon City
Canterbury Road — Reconstruction of intersection with Dorset Road.

—Dandenong City
Stud Road — Reconstruction of 0.8 km from Clow Street to David Street.

—Doncaster and Templestowe City
Doncaster Road — Duplication and reconstruction of 1.8 km Elizabeth Street to Pine Way.

—Dunmunkle Shire
Murtoa-Minyip Road — Reconstruction and sealing of 4.4 km west of Minyip.

—Eltham Shire
Heidelberg-Kinglake Road — Reconstruction between Kangaroo Ground-Wattle Glen Road and Hurstbridge, 2.9 km.

—Glenelg Shire
Casterton-Edenhope Road — Reconstruction of 2.2 km.

—Kilmore Shire
Kilmore-Kilmore East Road — Construction of multi-cell culvert at Kilmore Creek.

—Knox City
Wellington Road — Reconstruction of 3.1 km between Stud Road and Summit Road.

—Korumburra Shire
Nyorya-Poowong Road — Reconstruction and realignment of 3.2 km.

—Mirboo Shire
Mirboo North-Thorpdale Road — Reconstruction and realignment of 2.7 km.

—Newham and Woodend Shire
Lancefield-Woodend Road — Reconstruction of 2.8 km at Woodend.

—Oxley Shire
Bright Road — Construction of a 3 span bridge, known as 'Pelican Bridge'.

—Romsey Shire
Melbourne-Lancefield Road — Reconstruction of 3.5 km south of Bolinda.

—Springvale City
Cheltenham Road — Widening of 2 km between Springvale Road and Howard Road.: Widening of 1.7 km between Chandler Road and Corrigan Road.

—Stawell Shire
Stawell-Warracknabeal Road — Construction of a 10 span bridge over the Wimmera River at Glenorchy.

—Swan Hill Shire
Nyah-Ouyen Road — Reconstruction of 6.8 km.

—Tallangatta Shire
Yabba Road — Reconstruction and realignment of 0.9 km.

—Traralgon City
Tyers Road — Reconstruction of 1.2 km.

—Upper Murray Shire
Tallangatta-Corryong Road — Reconstruction and realignment of 2 km, near Beetoomba.

—Warrigal Shire
Brandy Creek Road — Reconstruction and widening of 1.2 km.

—Waverley City
Springvale Road — Widening of 1.6 km of the western carriageway between Ferntree Gully Road and Waverley Road.

—Williamstown City
Douglas Parade — Intersection and channelisation treatment between Hyde Street and Simcock Avenue.

—Wodonga City
Beechworth-Wodonga Road (Main and Unclassified Rd) — Duplication of 1.6 km between Murray Valley Highway and Pearce Street.

—Worrayl Shire
Leongatha-Yarragon Road — Reconstruction and widening of 1 km.

—Yea Shire
King Parrot Creek Road — Reconstruction and realignment of 4 km.
Yarra Glen-Yea Road — Reconstruction and realignment of 2 km at Glenburn.

Appendix 5

Unclassified roads

Significant works completed during financial year 1976/77:

—Ballaarat City
Drummond Street — Reconstruction of 0.4 km between Sturt and Webster Streets.

—Benalla City
Ackerby Street — Construction of a 3 span bridge over the Broken River, and approaches.

—Bendigo City
Nolan Street — Reconstruction between Midland Highway and Bridge Street.
Kennedy Street — Reconstruction between McIvor Highway and Phillips Street.
Patrick Street — Reconstruction between McIvor Highway and Lansell Street.

—Doncaster & Templestowe City
Thompsons Road — Reconstruction of existing pavement, from Manningham Road to Koonung Creek.

—East Loddon Shire
Pyramid-Yarraberb Road — Reconstruction between Dingee Road and Tandara-Serpentine Road.
Rothacker's Road — Reconstruction over 14.5 km.

—Eltham Shire
Bolton Street — Construction between Brougham Street and Eltham-Greensborough Road.

—Flinders Shire
Charles Street — Reconstruction of existing pavement between Solander Street and William Street, Dromana.
Latrobe Parade — Reconstruction of existing pavement between Foote Street and Park Grove, Dromana.
Mary Street — Reconstruction of existing pavement between Elizabeth Avenue and Boundary Road, Dromana.
Weerona Street — Construction between Field Road and Willow Road, Rye.

—Hastings Shire
Myers Road — Reconstruction of existing pavement between Coolart Road and Stumpy Gully Road.
Stanleys Road — Reconstruction of existing pavement at Tar Barrel Corner.

—Heidelberg City
Cape Street — Reconstruction between Darebin Street and St James Road.

—Knox City
Francis Crescent — Reconstruction between Station Street and Dorset Road.
Olivebank Road — Construction between Forest Road and Mont Albert Road.

—Korumburra Shire
Korumburra South Road — Reconstruction and widening of 4 km.

—Kowree Shire
Mitre Road — Construction and sealing of 4 km.

—Lillydale Shire
Birmingham Road — Construction between Edinburgh Road and Carronvale Road.
Killara Road — Construction between Boundary Road and Gruyer Road.

—Lowan Shire
Nhill-Murrayville Road — Construction and sealing of 9.8 km on the southern end of the Big Desert.

—Moe City
Old Sale Road — Reconstruction of bridge over Narracan Creek.

—Mornington Shire
Oakbank Road — Reconstruction west of Baldock Road.

—Morwell Shire
Mountain Hut Road — Reconstruction and realignment of 3.9 km.
Yinnar-Driffield Road — Reconstruction and realignment of 0.8 km.

—Oxley Shire
Benalla-Whitfield Road — Reconstruction and culvert work of 5 km.

—Pakenham Shire
Bessie Creek Road — Reconstruction of existing pavement.

—Phillip Island Shire
Back Beach Road — Reconstruction of 1.2 km of existing pavement.

—Portland Town
Cape Nelson Road — Construction of bridge at Salt Creek.

—Richmond City
Bridge Road — Reconstruction between Church Street and the Yarra River.

—Ringwood City
Loughnan Road — Reconstruction of existing pavement between Hearthside Court and Ringwood Street.

—Rosedale Shire
Longford-Letts Beach Road — Reconstruction and realignment of 1 km.
Glengarry-Tyers Road — Reconstruction and widening of 1.8 km.

—Sherbrooke Shire
Kallista-Emerald Road — Reconstruction between Helena Avenue and O'Connors Road.

—Springvale City
Douglas Road — Reconstruction of existing pavement between Stuart Street and Mile Creek.

—Stawell Shire
Glenorchy-Roses Gap Road —Complete the construction and sealing to provide a sealed road between Glenorchy and the Western Highway.

—Traralgon City
Jeeralang North Road — Reconstruction and realignment of 1.6 km.

—Warrigal Shire
Bourke Street — Reconstruction of 1 km.

—Waverley City
Forster Road — Reconstruction including the installation of signals at Waverley Road.
Lawrence Road — Construction of bridge at rail crossing including approaches.

—Wimmera Shire
Longerenong Road — Preparation and sealing of 4 km to the Historic Longerenong Homestead.

—Woorayl Shire
Cape Patterson-Inverloch Road — Reconstruction and realignment of 2.9 km.

—Yackandandah Shire
Lockharts Gap Road — Reconstruction and realignment of 3 km.

Appendix 6

Special projects

Project No.	Description of project	Progress of Work to 30th June, 1977
24	Eastern Freeway — Construction of a multi-lane freeway from Alexandra Parade, Collingwood to Thompsons Road, Camberwell.	Work continued over the entire length of 9 km during the year.
25	Johnson Street Bridge over the Yarra west of Spencer Street Bridge.	Work continued on the bridge and the associated roadworks.
33	Princes Highway East — Construction of a new bridge over the Snowy River at Orbost and realignment of approaches.	Bridgeworks were completed and roadworks well advanced.
40	Princes Freeway — Construction of a second carriageway between Moe and Hernes Oak.	Duplication of the carriageways commenced during the year.
41	Princes Freeway/Princes Highway — Construction of dual carriageways between Morwell and Traralgon.	Work was well advanced to complete the duplication of the highway between Morwell and Traralgon.
42	Bass Highway — Improvements from Lang Lang to Dalyston. Including interchange with South Gippsland Highway.	The project was completed during the year.
43	Princes Freeway, Bypass of Drouin and Warragul.	Work continued on the construction of the Princes Highway interchange with the freeway, between Drouin and Warragul.
44	Tullamarine Freeway — Construction of diamond interchange with Essendon Airport and conversion of Lancefield Road to Freeway.	Work continued on upgrading Lancefield Road to freeway standard and the construction of the English Street interchange.
46	Omeo Highway — Omeo to Mitta Mitta	Work continued on sections of the highway between Omeo and Mitta Mitta.
47	Calder Highway — Harcourt to Bendigo.	Work continued on the reconstruction of sections of the highway between Harcourt and Bendigo.
48	Princes Highway East — Duplication through Pakenham and improvement of Army Road intersection.	Duplication work progressed during the year.
49	Goulburn Valley Highway-Trawool. Construction of a new bridge and realignment of approaches.	The construction of a new bridge and approach roads was completed during the year.
50	Metcon-Statcon	The installation of stop signs, give way signs and traffic signals continued throughout the State during the year.
51	Bellarine Highway — Construct duplicate carriageways and new bridge at Fenwick Gully, Wallington.	Work was substantially completed during the year.
52	Great Ocean Road — Reconstruction from Marengo to Calder River.	Realignment and reconstruction of the Great Ocean Road between Marengo and Calder River progressed.
53	Princes Highway East — Construct new bridge at Simpson's Creek and improve Sydenham Inlet Road intersection at Bellbird.	Construction of a new bridge and roadworks was completed during the year.
54	South Gippsland Freeway — Construction of road and bridge works at Hampton Park.	Work continued on the construction of the South Gippsland Freeway overpass of the South Gippsland Highway at Hampton Park and the south-bound carriageway, south from Pound Road.

Appendix 7

Motor Registrations

Registrations under the Motor Car Act during the year 1976/77 totalled 2,149,703, an increase of 1.6% over the total for the previous year.

Vehicle	Financial Year 1975/76		Financial year 1976/77		Increase	Decrease
Private						
New	130,205		125,504			
Secondhand:						
Re-registered	52,535		52,355			
Renewed	1,365,540	1,548,280	1,393,199	1,571,058	22,778	
Commercial and hire						
New	17,461		18,092			
Secondhand:						
Re-registered	5,432		5,407			
Renewed	130,578	153,471	129,323	152,822		649
Primary producers' trucks and tractors						
New	3,223		3,521			
Secondhand:						
Re-registered	2,735		2,716			
Renewed	82,190	88,148†	77,934	84,171*		3,977
Licences under the Motor Omnibus Act		848		820		28
Trailers		279,897		295,230	15,333	
Motor cycles		46,230		45,602		628
Totals		2,116,874		2,149,703	38,111	5,282

† Includes 45,258 no-fee tractors
* Includes 42,577 no-fee tractors

Appendix 8

Statement of receipts and payments

for year ended 30th June 1977 (Adjusted to nearest dollar)

Country Roads Board

		Country Roads Board Fund Act 6229	Act 6222 road maint. A/c
Receipts			
Balances as at 1st July 1976		3,175,871	
Motor Car Act 1958 (No. 6325)			
Motor car registration fees	67,229,429		
Drivers licence fees	1,468,333		
Drivers licence testing fees	476,525		
Trailer registration fees	1,933,085		
Learner drivers permit fees	207,842		
Examiners licence fees	8,304		
Sale of log books	14,656		
Motor driving instructors licence —			
Appointment and testing fees	2,115		
Motor driving instructors licence fees	5,560		
	71,345,849		
Less: Cost of collection	10,544,478	60,801,371	
Municipalities contributions			
Permanent works — main roads	157,175		
Maintenance works — main roads	2,360,521	2,517,696	
Fees — Commercial Goods Vehicles Act No. 6222 —			
Road maintenance A/c			9,967,856
Public Works and Services Act No. 8928		638,000	
Fines — Country Roads Act. No. 6229		4,825	
General receipts		1,740,712	
State loan funds — Act No. 6229			
Allocation — Roads (Special Projects) Fund			
Commonwealth grants			
National Roads Act 1974			
Roads Grants Act 1974			
Transport (Planning & Research) Act 1974			
Adjustment of grants for year ended 30th June 1975			
Adjustment of grants for year ended 30th June 1976			
Traffic & road safety improvement			
		$68,878,475	9,967,856
Payments			
Road expenditure			
Main roads — Construction and reconstruction		11,793,669	
Maintenance		5,736,446	5,884,680
State highways — Construction and reconstruction		7,672,173	
Maintenance		8,892,668	3,531,016
Freeways — Construction and reconstruction		581,663	
Maintenance		852,929	552,160
Tourists' roads — Construction and reconstruction		848,594	
Maintenance		1,168,446	
Forest roads — Construction and reconstruction		557,481	
Maintenance		847,982	
Unclassified roads — Construction and reconstruction		11,727,110	
Maintenance		2,256,109	
Contribution to Melbourne & Metropolitan Tramways Board			
Tram tracks reconstruction		195,000	
Metropolitan bridges		13,300	
State intersection Control (STATCON) Programme			
Murray River bridges and punts		144,486	
Traffic line marking		1,212,183	
Statutory payments			
Interest and sinking fund	2,933,899		
Traffic authority fund	508,268		
Tourist fund	1,016,536		
Transport regulation fund	607,929	5,066,632	
Planning & research		1,343,463	
Capital expenditure			
Plant replacement and additions	1,366,116		
Buildings, workshops, etc.	726,265	2,092,381	
Management & operating expenditure		5,082,840	
		$68,085,555	9,967,856
Balance available to the Board as at 30th June 1977		$ 792,920	

Auditor General's Certificate

The accounts of the Country Roads Board for the year ended 30th June 1977 have been audited. In my opinion, the above Statement of Receipts and Payments fairly presents in summary form the transactions during that period.

B. J. Waldron, Auditor-General, 6th September 1977

Loan funds	Roads (Special Projects) Fund	National Roads Act 1974	Roads Grants Act 1974	Transport (Plan & Res) Act 1974 Sections 7 & 8	C'wealth Traffic & Road Safety Improvement Trust Account		Total
			4,986,435				8,162,306
						60,801,371	
						2,517,696	
						9,967,856	
						638,000	
						4,825	
						1,740,712	
325,000						325,000	
	28,963,388					28,963,388	104,958,848
		30,800,000				30,800,000	
			58,745,000			58,745,000	
				1,225,667			
				172,771			
				101,624			
						1,500,062	
					146,572	146,572	91,191,634
325,000	28,963,388	30,800,000	63,731,435	1,500,062	146,572		204,312,788
	431,749		8,896,420		28,083	21,149,921	
						11,621,126	32,771,047
325,000	3,720,123	1,720,196	9,172,515		102,042	22,712,049	
		1,273,141				13,696,825	36,408,874
	19,235,274	17,300,000	16,500,000			53,616,937	
		725,000				2,130,089	55,747,026
	536,009		87,923			1,472,526	
			424,948			1,593,394	3,065,920
						557,481	
			74,817			922,799	1,480,280
	735,527Cr.	4,217,698	16,651,434		16,447	31,877,162	
			4,000,000			6,256,109	
						195,000	38,328,271
							13,300
	304,454						304,454
							144,486
							1,212,183
							169,475,841
							5,066,632
				1,500,062			2,843,525
							2,092,381
	5,471,306	5,563,965	7,923,378				24,041,489
325,000	28,963,388	30,800,000	63,731,435	1,500,062	146,572		203,519,868
							$ 792,920

R. G. Cooper, Chief Accountant, 31st August 1977

Appendix 9

Loan liability

as at 30th June 1977

Country Roads Board

	Main roads etc.	Developmental roads	Total
	$	$	$
Permanent works			
Main roads	16,730,322.16		16,730,322.16
State highways	18,954,304.20		18,954,304.20
Freeways	3,000,000.00		3,000,000.00
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	748,467.44	584,597.81	1,333,065.25
Total amount borrowed	39,662,578.13	13,436,112.90	53,098,691.03
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	3,550,848.82		3,550,848.82
National debt sinking fund	8,863,237.11	8,270,969.95	17,134,207.06
Consolidated fund	40,561.03		40,561.03
	13,196,461.83	9,673,908.70	22,870,370.53
Loan liability at 30th June 1977	26,466,116.30	3,762,204.20	30,228,320.50

Appendix 10

Works executed on behalf of Commonwealth and State Government authorities

for the year ended 30th June 1977
(Adjusted to nearest dollar)

Departments	Description of works	Expenditure	
Commonwealth			
Department of Construction	Access roads to various Commonwealth establishments		167
Victoria			
Housing Commission	Overpass at Riggall Street, Broadmeadows City	49,426	
Melbourne and Metropolitan Board of Works	Roadworks in connection with Cardina Reservoir, maintenance of Marysville-Woods Point Road	5,792	
Ministry of Tourism	Additional snow clearing on the Alpine Road to Mt Hotham	30,358	
Ministry of Transport	Grade separated level crossing projects etc. charged to the Transport Fund	4,204,288	
	Grade separated pedestrian crossings charged to State Treasury, Municipalities and Transport Fund	207,691	
Premier's Department	Roadworks in connection with Wonderland and Sundial Roads, Stawell Shire	300	
Rural Finance & Settlement Commission	Roadworks in Commission land settlement areas throughout the State	4,065	4,501,920
State Treasury	Kings Bridge — sundry expenditure less proceeds of rental of properties acquired in connection with construction of Kings Bridge	22,850 Cr.	
State Treasury	Improvements to various roads adjacent to State Forests to facilitate the extraction of timber and charged to Municipalities Forest Roads Improvement Fund	85,062	
State Treasury	Burial of dead stock following bushfires at Cressy and Creswick	9,415	
State Treasury	Restoration work on roads and bridges damaged by floods and bushfires	235,390	307,017
			$4,809,104

Engineer in Chief's Report

Country Roads Board
Melbourne

The Chairman

I submit herewith my Report for 1976/77. The Report deals with those activities within the Engineer in Chief's Branch which are considered to be of general or special technical interest.

K G Moody
Engineer in Chief

Contents

Section A: Bridge Sub-branch

1. Construction Division

Yarra River bridges, Eastern Freeway — permanent steel deck formwork

The superstructure of the twin bridges over the Yarra River on the Eastern Freeway comprises post-tensioned segmented precast beam stems with cast-in-situ deck. The deck soffit area between beam stems is in excess of 4,000 square metres, and during the planning stage a study of alternative types of deck formwork was undertaken to ensure maximum economy and efficiency at the deck casting stage. Design and construction aspects were considered in the study, and proper allowance was made for the cost of adopting re-usable forms.

Concrete formwork slabs were excluded at the design stage, as the effect of the dead load on the simply supported beam stems was unacceptable. Fibre reinforced concrete panels were rejected on the basis of cost. The cost of providing access for stripping and removal of timber and other types of re-usable forms excluded all types of temporary formwork.

After consideration of all factors, permanent galvanised steel formwork was adopted. This product is roll formed in sheets 600 mm wide with triangular shaped ribs 54 mm high at 200 mm centres. The sheet material is hot dipped zinc coated steel to A.S.1397, with minimum yield strength of 500 MPa. Sheet thickness of 1.00 mm with zinc coating of 400 gm per square metre minimum was adopted for the spans up to 1350 mm.

Sheets were laid with the rib downwards, and the ribs checked out to provide a flat bearing surface. The prepared sheets were seated on a thin neoprene strip and interlocked progressively along each bay between the beams. The cost of steel formwork in place was $15 per square metre.

Use of superplasticizer in concrete

Investigations have been carried out into the effects of superplasticizing admixture in various grades of concrete. The superplasticizer consists of a 20 per cent by weight aqueous solution of a condensate of melamine formaldahyde. The investigation was carried out on concrete mixes designed to have a slump of 70 mm for both normal and superplasticized concretes. The effects of the amount of variation in cement and additive contents were then determined for different types of cement.

The investigation led to the following conclusions:

1. For most cements, and most concrete mixes, the water cement ratio can be reduced without loss of workability, and therefore placing and compacting high strength concrete in thin or heavily reinforced areas can be assisted (see Table 1).
2. High early strengths can be obtained in conjunction with steam curing without detriment to 28 day strengths.
3. Higher early strengths can be obtained with normal curing (see Table 2 and Figure 1).
4. The increase in workability is of short duration with the admixture having to be added at site.
5. Large variations in workability will occur especially at higher additive contents, although these variations will not necessarily result in significant variation in the properties of the hardened concrete (see Table 1).
6. Workability alone should not be used as an acceptance test for concretes containing superplasticizer as the relationship between workability and water content is not as consistent as obtained for normal concrete (see Table 1).

The amount of additive used in the concrete mix was 2 per cent by weight of the cement component. The cost of additive was $7 per cubic metre of concrete.

Table 1

Slump and water reduction of laboratory mixes

Mix	Admixture dosage	No. of batches	Mean slump (mm)	Slump range	Total water (kg)	W/C	Water reduction
	—	6	56	45- 70	180	0.46	—
390	1%	5	59	45- 75	170	0.44	5%
	2%	8	54	30- 75	162	0.42	10%
	3%	8	61	5- 95	156	0.40	13%
	4%	8	76	15-200 +	148	0.38	18%
	—	5	56	50- 65	185	0.37	—
500	1%	5	50	30- 65	179	0.36	3%
	2%	6	64	20-105	172	0.34	7%
	3%	10	68	25-115	166	0.33	10%
	4%	9	88	15-200 +	153	0.31	17%

Table 2

Site mixed concrete — test results

	Control mix		2% Superplasticizer mix	
	Mean	SD	Mean	SD
Slump (mm)	56.5	8.5	67.9	12.2
Total water (1)	185	13.7	170	10.1
Compressive strength (MPa)				
1 day	17.7	4.3	24.7	3.8
2 day	31.9	2.3	40.5	3.2
3 day	40.6	3.6	51.0	*
7 day	52.5	*	64.5	*
14 day	57.3	*	72.1	*
28 day	67.1	6.1	76.5	5.1

* Insufficient results

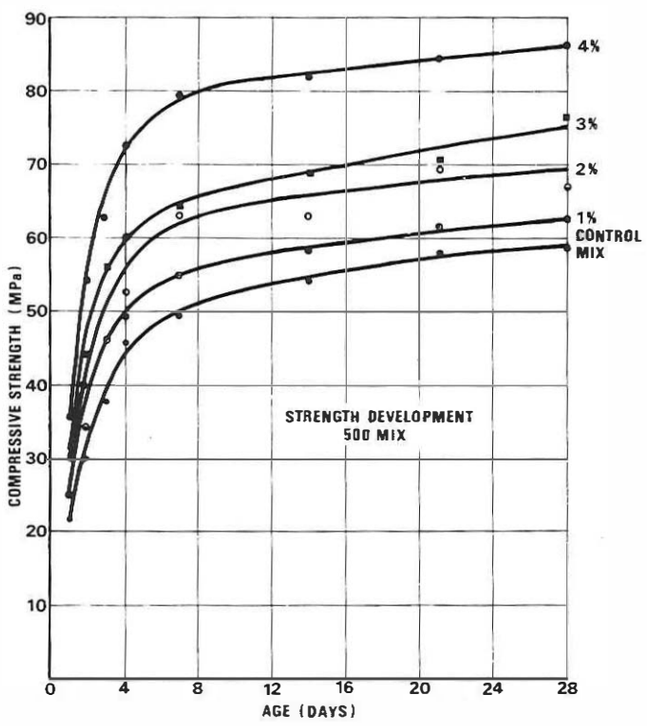


Figure 1: Strength development of concretes containing various percentages of superplasticizing admixture

Plate 1: Forster Road bridges construction site during the casting of the deck slab

Construction of Forster Road bridges — Mulgrave Freeway

The Forster Road bridges on the Mulgrave Freeway will carry the freeway over Forster Road, Mount Waverley, when the freeway is extended west of Forster Road.

The bridges are three-span, post-tensioned continuous voided concrete slab bridges with inclined reinforced concrete pier columns, hinged top and bottom by provision of 'pot' bearings. The abutments are on reinforced concrete piles driven to Silurian mudstone, and the piers are supported on spread footings, also founded on mudstone. The slabs are fixed at one abutment and free to move at the other abutment. Each bridge is 60 feet wide and 215 feet long.

The columns were precast off-site, with the bottom pot bearings cast into the columns. The top pot bearings were placed after the columns were erected. Steel straps were tack welded between the steel bearing plates in the bottom bearings to hold the plates parallel during casting, handling and erection of the columns.

The columns were transported to the bridge site and erected using two cranes. To assist with locating each column into its final position, two theodolites set at right angles to each other and a dumpy level with the line of sight set to the final level of the top of the column were used. The surveyors at these instruments were in two-way radio contact with the foreman directing the crane operations. When the column, still supported by the cranes, was in the exact final position, the levelling nuts on bolts cast into the footing were tightened against the lower plate of the bottom bearing. Temporary props and wire ropes attached to the abutments were then placed to support the columns, and the tack welded temporary support plates between the plates on the bottom bearing were removed.

At the request of the contractor, the whole of the deck slab for each of the bridges was cast in one continuous operation except for a closing section near the fixed abutment bearings. The separate casting of a closing section eliminated the possibility of the shrinkage of the slab pulling the slab away from the fixed bearings and damaging the concrete orthe bearings. For each deck slab, 685 cubic metres of concrete were placed in a nine-hour period.

One concrete batching plant was used exclusively, and another plant was kept on standby in case of breakdowns at the primary plant. One hundred and eighty truck loads of concrete were required for each cast, and trucks were despatched at an average of three minute intervals. Four concrete pumps were used on site to deliver the concrete from the trucks and into the forms for the slab. Forty-two workmen were employed to place the concrete, and a total of twelve supervisors were in attendance at the concrete batching plant and on site (see Plate 1). Two-way radio contact between site and the concrete batching plant ensured an optimum rate of supply of concrete.

2. Design Division

Greensborough Freeway — Devonshire Road retaining structure

As part of the Greensborough Freeway Project it was necessary to lower the railway by up to 6 metres over a length of 2.5 km.

The area of the railway cut comprises highly to moderately weathered Silurian siltstone, with bedding planes extensively jointed and dipping at 55°.

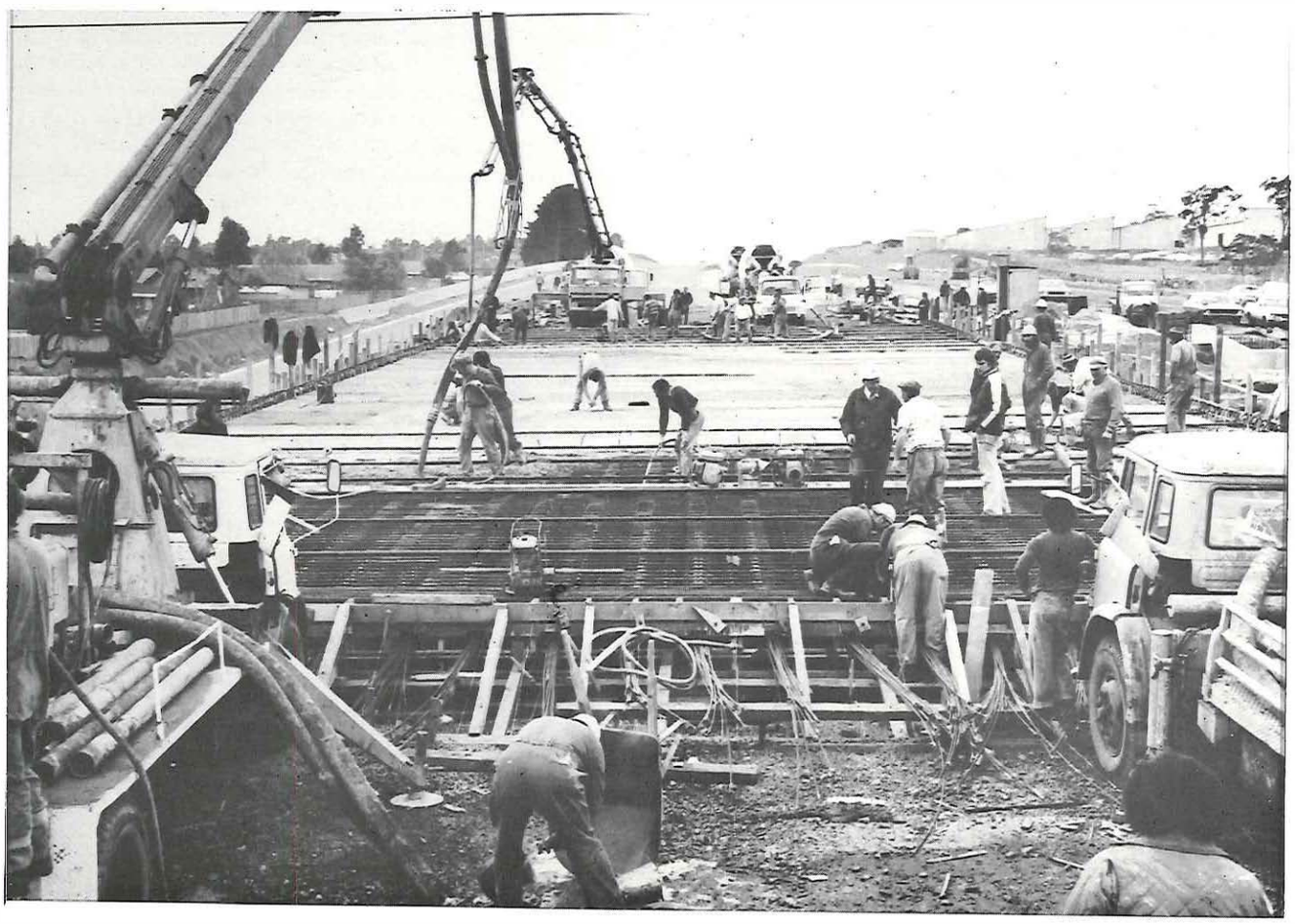
To avoid the high cost of a conventional retaining wall along part of the cut adjoining Devonshire Road, it was decided to stabilize the rock mass with unstressed stainless steel dowels, grouted into the rock, and to protect the rock face with shotcrete (see Figure 2).

The design is based on an assumed bedding plane failure with a slip plane intersecting the base of the wall.

The rock is relatively soft, particularly in the upper layers. To check the pressure on the rock and the forces on the dowel bars, a finite element analysis was carried out. The mathematical model considered plain strain conditions with beam and membrane elements to represent the dowels and the mudstone respectively. The in situ crushing strength of the rock was measured as 5 MPa. To simulate the non-linear stress strain behaviour, several iterations were required. The Young's Modulus of the crushed rock was lowered in each iteration until the computed stresses in the rock were equal to or below 5 MPa.

The results indicated that crushing of the rock would be localised and that the stresses in the dowels would not be seriously affected by the "softness" of the mudstone. The adequacy of the design assumption that the mudstone would be stabilized by anchor bars acting in shear was therefore validated.

Excavation of the cutting was carried out in four stages. After completion of each stage of excavation, the rock face was fully stabilized with dowels and shotcrete facing applied before the next stage of excavation to a lower level proceeded.



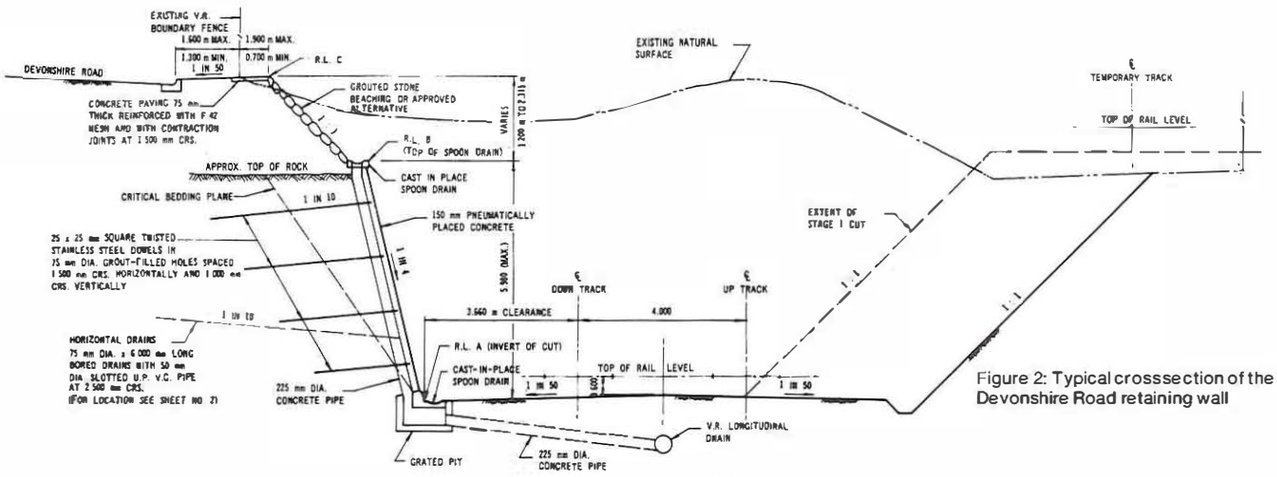


Figure 2: Typical crosssection of the Devonshire Road retaining wall

Formwork was kept to a minimum with the vertical points formed with impregnated fibreboard pinned directly to the rock. The fibreboard was also used as a screed allowing a continuous casting technique to be employed.
The shotcrete was applied with a 50 mm diameter nozzle. The premixed concrete was fed to the nozzle via squeeze crete pumps using a 7 mm maximum size aggregate sand cement mix.
The use of the shotcrete technique has allowed three men to spray an average of 25 panels per day, involving 20 cubic metres of shotcrete.

Section B: Mechanical Sub-branch

Unimog/Schmidt snow clearing equipment
During the winter of 1976 a Mercedes Benz model 406 truck and a comprehensive range of Schmidt attachments suitable for both snow clearing and summer maintenance work were made available to the Board for trial.
Unlike the existing snow blowing equipment, the Unimog has the ability to receive interchangeable items of equipment, such as front end loaders, mowers, and brooms, enabling the unit to be used for summer as well as winter maintenance activities.
The Unimog is a four-wheel drive, front wheel steer truck powered by a 90 h.p. engine and with transmission giving an operating speed range from 0.2 km/h up to 80 km/h. It is fitted with three power take off points which rotate at a nominal 540 rpm at maximum engine speed, and also with a number of hydraulic couplings which supply oil from a pump driven from the truck engine. The unit has left-hand drive to enable the driver to see the left-hand side of the road and the operation attachments when working in the normal direction of travel of traffic.
Only a few adjustments need to be made external to the cabin after the equipment has been fitted. The attachments can be fitted in approximately five minutes by one man. This is advantageous in an area where variability in snow conditions requires a range of equipment.

Snow blowing attachment
During the winter of 1976, a self-contained snow blower which can be mounted on any of the Board's Aveling Austin graders was developed (see Plate 2). Graders of this type equipped with a front mounted snow blade are normally used to clear a snow covered road and deposit this snow on the shoulder in the form of a windrow.
After the initial clearing pass with the snow blade, the grader can return and using the blower attachment pick up and throw the windrowed snow well clear of the road.
The blower unit fits on the blade mounting rails of the grader. It comprises a Schmidt S3 blower powered by a governed two litre Volkswagen engine driven through a modified Volkswagen gearbox. Two speeds of operation of the blower are available and provide two different casting distances.
The blower can be readily manoeuvred into any desired position using the normal side shift and other grader blade controls. The blower engine controls, including starting, clutch, gear change and chute direction, are connected from the cabin by means of a remote control box cable connected to the unit.

Plate 2: Grader mounted snow blower

Truck mounted drum spreader
For many years, sealing aggregate used in bituminous surfacing work has been spread with the belt spreader developed by the Board during the 1930s. This machine spreads aggregate uniformly and with minimum waste, but it is slow in operation and costly to maintain.
In order to increase efficiency of bituminous surfacing operations, it has been necessary to examine other types of spreaders. These include the box spreader, which has been found to be inferior to the belt spreader in respect to uniformity of spread, so that excess aggregate must be discharged to ensure that the bitumen is effectively covered. This leads to the need for additional clean-up work if windscreen breakages are to be avoided.
The main factor which slows up the belt spreader operation is the need to hitch and disconnect the spreader to and from a succession of trucks. In order to combine the best features of both concepts, it was decided to investigate fitting each truck with its own semi-permanently connected spreader which would have a performance comparable with the belt spreader.
To this end, a prototype 3 metre wide truck mounted spreader was designed, manufactured and field tested (see Plate 3). This machine is connected to the truck in place of its normal tailgate. It employs one wheel which, when pneumatically pressed on to the road, provides a drive to a rotating rubber-coated drum which is used in place of a belt. The wheel has a clutch so that spreading can be started and stopped by the operator who walks along-side the machine. This machine overcomes the delays associated with coupling and uncoupling. Equally importantly, it delivers a discharge of metered aggregate. For all practical purposes its performance is equal to that of the belt spreader.
However, experience with the prototype indicated that a smaller and lighter spreader would be desirable. A new 2.5 metres wide prototype has therefore been developed for the 1977/78 bituminous surfacing season. It is anticipated that the capital cost of this new spreader will be less than the annual maintenance charge on the existing belt spreaders.

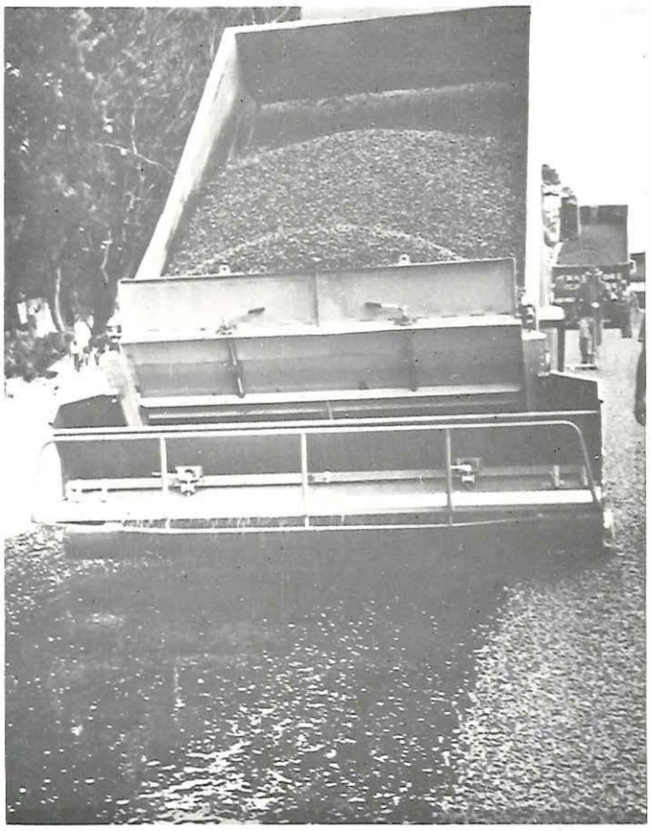


Plate 3: Truck mounted drum spreader

Trailer mounted advance warning sign

A trailer mounted advisory sign used in the metropolitan area during the 1976/77 sealing season has proved beneficial in communicating with motorists. This large sign is placed in advance of the work situation and advises motorists of 'Probable delay 15 minutes' (see Plate 4).

The 'advanced' location of the sign enables motorists to decide whether to risk being stopped at the work site for several minutes or to use an alternative route to reach their destination.

The sign is folded away for travelling and the trailer can also be used to carry other equipment (see Plate 5).

Plate 4

Trailer mounted advance warning sign in display (4) and travelling (5) positions

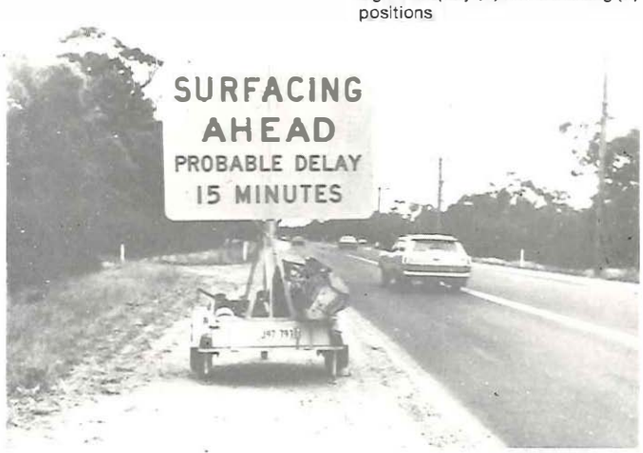


Plate 5

Section C: Planning Sub-branch

1. Advance Planning Division

Continuous road inventory survey programme

In 1972 a full-scale survey of the facilities and conditions of the road system was carried out. The information gathered at that time has been formed into a computer data bank which is now being further developed to provide support for some of the planning activities of the Board. This development is proceeding concurrently with the development by the National Association of Australian State Road Authorities (NAASRA) of a co-ordinated approach to the collection, storage and use of data by State Road Authorities. The NAASRA-co-ordinated data bank will utilize a suite of integrated inventory, project generation and costing programmes which can be used by all State Road Authorities.

A by-product of the development of the data bank will be an information system capable of supplying information about the

in the form of statistical summaries.

An essential aspect of the information within a data bank is its accuracy and its relevance to current conditions, i.e. the information must be of known and acceptable accuracy and it must be kept up to date. To this end, the Board is embarking on a programme to correct the data as changes are made to the road system, and to check the information in the data bank continuously for accuracy. The data is to be revised extensively in 1977/78.

Many of the uses of a road data bank rely on the ability to look back at the history of sections of road. Great difficulties have been encountered in the past in correlating the records containing historical data about a segment of road with the exact ground location of the segment. These difficulties generally result from the constant changes in the recording base (usually continuous distance from a zero point) caused by relocation of the road centreline during construction works without the changed location reference being marked on records.

An outcome of the NAASRA study has been the development of a system of reference points on the road network which would be permanent and immovable in location. Every segment of road which is to be referred would by design fall between a pair of these points. A reference to any point on the road network is then given by the names of the pair of points on either side of it and by the distance from one of the points. Changes to the system are thus localized to the immediate vicinity of the change. All other points retain the same reference as before the change. Record-keeping is facilitated by the need to change only the few records relating to the section in which the change actually occurs.

While the names assigned to the permanent reference points can take any desired form, the method adopted is to assign a map reference in the Australian Mapping Grid. This map reference consists of two letters designating a 100 km square and six numbers which define a point to within a 100 metre square. This eight-character reference is unique within Victoria and for all practical purposes is unique in each State.

A trial of the reference system has been carried out by the Board and has proved workable. The system is now being progressively implemented and will be used in the data bank for the management of road records.

Project generation and evaluation

A major function envisaged for the Board's road data bank is to provide information to assist in the choice of future road development strategies. The objects are to assess:

- the effects of a planned budgetary policy in terms of the kind of physical development which this imposes on a road system and the corresponding changes in road user costs; and
- the effects of a nominated policy of physical development of a road system in terms of the budgetary requirements for maintenance, rehabilitation and improvement.

The methods involved are being developed by NAASRA for use by all State Road Authorities, and are similar to those

which have been used in previous Australian Roads Surveys. In those surveys, however, the process was not carried through the iterations needed to disclose the physical effects of budget constraints on the road system. Also, in previous surveys the maintenance and road user cost computations have been made only as part of the economic evaluation of one set of improvement projects, never for all of the segments of the road system, improved or not, and for only one application of deficiency assessment and project design standards.

The technique used is to simulate with a set of computer models (for a planning period of, say, 5 to 10 years) the process of identifying road system deficiencies, designing and costing the appropriate improvement and rehabilitation projects, and then calculating the maintenance and road user costs for the whole road system. This is done separately for a number of selected assessment and design standards. The results of the analyses are compared until an agreed compromise is reached between the financial constraints and the road conditions which must be accepted with that level of constraint. The compromise may be reached by taking either finance or road conditions as the starting point, but the emphasis of the analyses is to quantify the connection between the level of funding and the condition of the road system.

The process involved is:

a. For each year of the planning period —
   1. obtain the initial road inventory;
   2. identify road system deficiencies using assessment standards which conform to the adopted policy;
   3. generate improvement and rehabilitation projects to eliminate the deficiencies using design standards which conform to the adopted policy;
   4. calculate the cost of improvement and rehabilitation projects, maintenance costs, and road user costs for all sections of the system.
b. Sum the total costs in each category.
c. Repeat (a) and (b) for various selected assessment and design standards until the total cost incurred by the road authority equals the total amount of money available during the planning period.
d. Compare each of the outputs from (c) to determine the optimum balance of standards and budget categories to conform to the given policy.
e. Make an economic evaluation to estimate the economic worth of the final set of projects and to assist in distributing the maintenance, rehabilitation and construction activities evenly through the planning period to conform to the flow of funds.

Although the projects generated in this process are not real, in the sense that they are not the outcome of proper engineering consideration of a specific situation, they can serve as a basis from which to plan and programme real projects incorporating all of the many factors considered in formulating a works programme. The advantage of the process is that it permits the whole road system to be considered jointly with consideration of road funds and road standards.

2. Road Planning Division

Forward-look programme

Development of 'forward-look' programmes for major road projects over the next fifteen to twenty years in both urban and rural areas has been initiated during the past year. The work is aimed at identifying those projects which have a reasonable probability of being implemented within the planning period, and at scheduling these in separate, but interrelated, urban and rural forward-look programmes. This has entailed a re-examination of the road system as a whole. The limited finance available for major road projects in recent years has meant that there is a need to reassess priorities and develop planning programmes which are in line with the funds likely to be available. Such programmes cannot be completely fixed as they must have some degree of flexibility to allow for unforeseen events and changing circumstances, but they will provide a framework of overall planning for the road system within which more detailed project planning can take place.

As well as giving a guide to the direction of project implementation, the forward-look programmes will:

- enable improved co-ordination of the planning and design of major road projects and therefore more efficient use of planning and design resources;
- permit assessment of the implications of changing priorities between major projects or injecting new projects into the programme;
- show what can be achieved at various levels of funding;
- guide road planning investigations on future road proposals within a framework of when these and other related projects might be financially possible;
- assist in determining whether the scale of particular road improvements should be modified or stage construction more fully investigated;
- assist in shaping land acquisition policy, particularly in the urban area.

In the urban area, options for selecting between major projects are now fairly limited as the Board has major expenditure commitments to several large projects over the next five to ten years. Nevertheless, it is important that priorities for smaller projects and for work in the medium to long term period be examined, and a detailed comparison of selected urban projects has commenced.

In the rural area, the study has been directed first at the development of broad strategies which can then provide a framework for more detailed planning and programming. To provide a factual basis for these categories, a study has been made of the physical and operating characteristics of the major rural highways along which large-scale capital improvements have been proposed. This analysis has been based primarily on deficiencies in road capacity, road accident data, overtaking conditions, and any special local conditions.

The study has shown clearly that on rural highways the greatest deficiencies in capacity exist at present on the Princes Highway East between Pakenham and Traralgon, and on the Calder Highway between Gisborne and Bendigo. If present traffic growth rates continue and no improvements are made to these highways, the situation will worsen considerably by 1991, especially on the Princes Highway East. The following graph illustrates this:

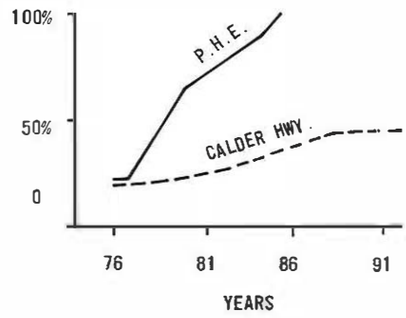


Figure 3: Percentage of highway length with overloaded sections 1976 to 1991 (only 2 lane, 2 way sections considered)

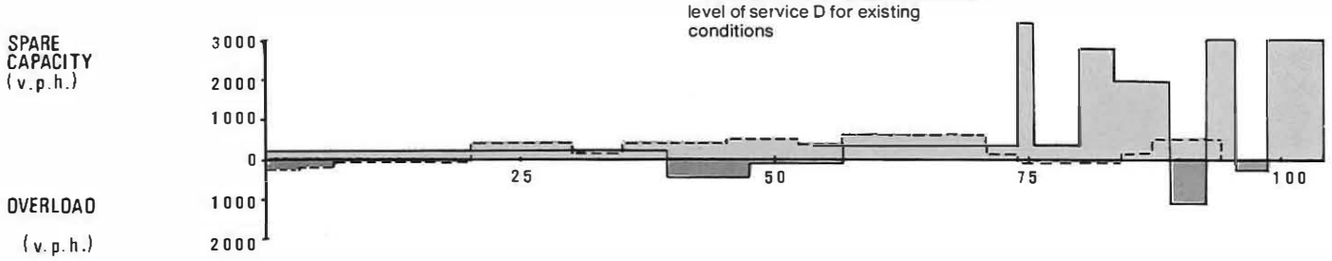
Figure 4 presents a detailed comparison of conditions along these two highways. Parts A and B show capacity deficiencies in 1976 and 1991 respectively by plotting sections of each highway with spare capacity and the sections which are, or will be, overloaded.

Part C presents accident data for 1973, 1974 and 1975 expressed as casualty accidents per 100 million vehicle miles of travel on each section. Part D illustrates the extent to which restricted sight distance limits overtaking opportunities; this is expressed as the percentage of each section of highway where there is insufficient sight distance for safe overtaking.

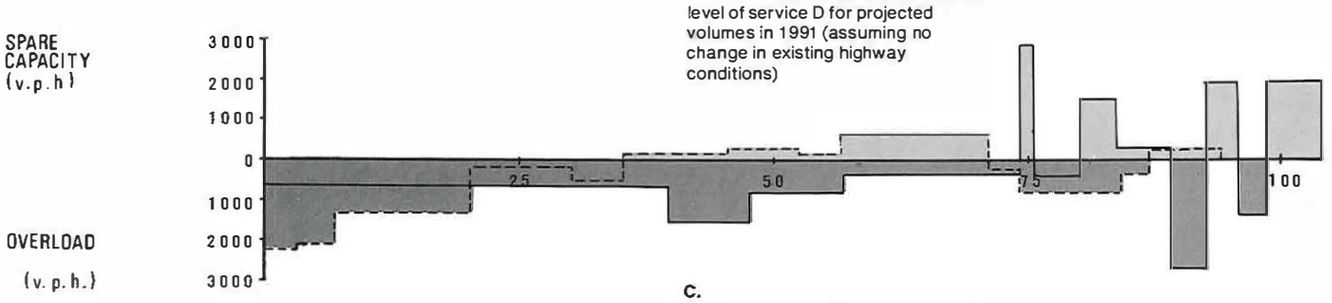
Further work on the forward-look programmes will include the preparation of more detailed programmes incorporating the project priorities, economic analysis and the examination of the possibilities of lower-cost proposals, such as stage construction and reduction of standards of initial works, so that at least some improvement to the levels of service in certain areas may be provided in the medium term.

Figure 4: Comparison of Princes Highway East (Pakenham to Traralgon) and Calder Highway (Gisborne to Bendigo).

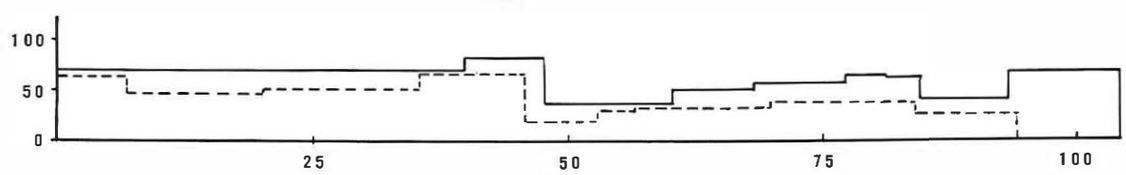
A. 1976
Comparison of 30th highest hour volume minus the service volume at level of service D for existing conditions



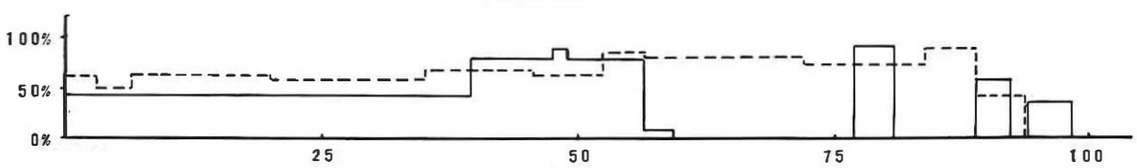
B. 1991
Comparison of 30th highest hour volume minus the service volume at level of service D for projected volumes in 1991 (assuming no change in existing highway conditions)



C.
Casualty (fatality and personal injury) accidents per 100 million vehicle miles



D.
Percentage sight distance restriction on overtaking opportunities along the highway



Legend:

Princes Highway East
Calder Highway

Horizontal axis indicates distance in kilometres from Melbourne urban boundary.

Spare capacity at level of service D
Overload at level of service D

Major investigations

During the year, Road Planning Division staff were engaged on a number of major planning investigations. A brief description of some of these is given below.

Hume Freeway — Baddaginnie to Bowser

The investigation extends over a length of approximately 65 km and includes the by-passes of Benalla and Wangaratta. As reported in the 1975/76 Annual Report, a Band of Interest, containing a number of feasible alignments, was defined over the investigation section. This was done to advise the land-owners, councils and other authorities of the Board's interests in the area well in advance of the stage where a favoured alignment could be recommended and discussed.

Investigations of the alternatives within the Band of Interest continued to the stage where the route likely to be favoured consisted of essentially one line with an alternative alignment over each of two shorter sections around Winton and north-east of Glenrowan. These proposals were the subject of an intensive programme of involvement of councils, authorities and the public. At a series of meetings, Board officers discussed the various freeway alignment proposals. The participation of members of the public, both at the meetings and at various other times throughout the investigations, provided substantial useful information for the development of a favoured scheme.

It is anticipated that, with the involvement of councils, other authorities and the public throughout the investigations, the route which is finally adopted for the freeway will be seen by all concerned as the one which best meets the needs and interests of the community.

Gardiners Creek Valley study

In January 1977 the Government established the Gardiners Creek Valley study involving the Ministry of Planning, Ministry of Transport, Ministry for Conservation, Melbourne & Metropolitan Board of Works, Town & Country Planning Board, Malvern, Camberwell and Hawthorn City Councils and the Country Roads Board to investigate and recommend a course of action on the future allocation of space in the valley for the transport, drainage, recreation and other community uses. The work is progressing under the direction of a Steering Committee comprising representatives of these authorities. The investigation work being done by officers from participating authorities is being co-ordinated by a full-time independent Study Manager, who is also responsible for the public involvement aspects of the study.

Staff from Road Planning Division have formed the Road Study Team for this investigation. The Study Team has made an intensive study of the transport problems and needs in the area, and prepared a number of alternative road proposals which have been widely publicized throughout the area for the purpose of obtaining comment. The more promising alternatives will be evaluated in greater depth in conjunction with the results of other studies being undertaken. It is anticipated that the Steering Committee will make its recommendations to the Government in the latter part of 1977.

Energy study

During the past year, a study has been made of energy consumption and conservation related to road transport using Australian and overseas information in this field. The study has shown that energy conservation in road transport can be directed at two levels: Firstly, by including energy conservation as a factor when evaluating alternative proposals for major road improvements; and secondly, by giving particular attention to the possibilities for energy conservation in road design and traffic management.

The Board has made a submission to the Victorian Government's Joint Select Committee on Conservation of Energy Resources. The submission identifies the potential for energy conservation in road transport generally and for fuel conservation in particular. Road Planning Division has a continuing task in keeping informed of new developments and trends in energy conservation related to road transport.

Eastern approaches to West Gate Bridge — land use and environmental study

During the year, work proceeded on an environmental study for the West Gate Freeway. The purpose of the study was to assess the impact of the future freeway and its traffic and to ensure that any opportunities which the new facility may present for improving the environment can be taken.

The main objects of the study were:

— to aggregate local traffic management proposals prepared by councils and designed to protect areas susceptible to future traffic intrusion, so that system effects can be evaluated;
— to formulate suggested guidelines for the future development along the West Gate Freeway corridor; and
— to assess the impact of the West Gate Freeway route.

a. Social analysis.

A social analysis of the municipalities of Port Melbourne and South Melbourne was carried out as part of this study.

The overall purpose of this analysis was to broadly describe the study area in social terms, and, based on this analysis, to isolate distinctive sub-areas or streets which could be adversely affected by through traffic. The sub-areas identified in this analysis do constitute environmental areas to some extent. It was found, however, that no area studied is self-sufficient, and that residents from all areas move outside their areas, across busy roads, for some of their needs. Further, with the exception of Middle Park and Albert Park in South Melbourne, and Garden City in Port Melbourne, which are residential neighbourhoods, all the other areas contain a mixture of land uses and activities. Substantial industries which generate heavy volumes of industrial and commuter traffic are located in these suburbs.

b. Corridor development.

An assessment of the future development potential of the West Gate Freeway corridor together with compatible landscape treatments was carried out by Board staff in conjunction with Professor Kenneth J. Polakowski of the Melbourne University Centre for Environmental Studies. The West Gate Freeway corridor development study examined the freeway reservation in a regional and corridor context. Site development concepts and guidelines were examined with regard to the environmental, social, political and economic conditions of the region in which the freeway is to be located. Data on land use and natural systems was collected to provide a base for the subsequent town planning and landscape architectural analysis.

Various possible site development options in and around the freeway reservation were then prepared as a basis to guide in the selection of a site development concept plan. Consideration was given to various aspects, including planting and screening adjacent to the freeway, potential land uses adjacent and underneath the freeway, use of residual open spaces adjacent to the freeway, and the treatment of abutting buildings.

c. Traffic noise.

Traffic noise may cause annoyance by interfering with human activities. It is not clear which aspect of traffic noise best expresses its intrusiveness. In some parts of the USA the peak noise level from a single truck is taken as a control. Such an approach addresses the problem of peak noise at night, but does not come to grips with the noise climate produced by large volumes of traffic during the rest of the day.

In Britain, an index which approximates the average successive peak noise levels from the combined traffic flow in the 18 hours from 6 am to midnight is used. This approach has been followed in the study.

The three major areas of concern in the study were the route of the freeway itself, the residential sub-areas isolated in the social analysis, and the major arterial roads which will carry a component of the West Gate Bridge traffic.

The general approach to the measurement and prediction of road traffic noise has been reached in consultation with officers of the Environment Protection Authority. A programme of field noise measurements was undertaken, together with traffic counts, and a recent UK prediction method (CORTN) has been used to examine existing noise levels, and to predict future noise levels.

d. Industrial relocation.
Industrial relocation caused by the construction of the West Gate Freeway was evaluated, and, based on field interviews, it was concluded that the effect on employees as a result of the acquisition of business premises for the construction of the freeway will be small. The study found that most of the affected businesses planned to re-establish elsewhere and as most of the employees live in other parts of Melbourne and at present commute daily (mainly by car) it seems likely that this practice will continue. Further, most work forces are small — the large employers are, in general, not affected.

e. Air pollution.
Air pollution in the study area was investigated and the impact of the changed traffic movements resulting from construction of West Gate Bridge, Johnson Street Bridge and the West Gate Freeway were analysed. Two surveys were conducted to determine the characteristics of the study area in relation to meteorology and air quality.
A meteorological installation was erected at the West Gate Freeway/Graham Street interchange. This installation was equipped to measure wind speed and direction. A study was also undertaken to determine the levels of airborne particulate lead throughout the area. Twelve sites were monitored, including one site in a commercial zone, two in a mixed industrial commercial zone, four in an industrial zone and five in residential zones.
To examine future air quality resulting from changed patterns of traffic movements, roads where the traffic volume exceeds 15,000 v.p.d. were defined as principal line sources. The source strength of the principal line sources was determined as a function of the traffic volume and the emission factor. In considering the future source strength, cognisance was given to the effect of Australian Design Rule 27A which sets upper limits for the emissions of carbon-monoxide, hydrocarbons and oxides of nitrogen. It is anticipated that future emission factors will be less than one half those which exist at present. If traffic volumes increase by less than 100 percent, principal line sources of pollution will in future be less polluting than existing sources. Because of this limitation, only the West Gate Freeway from Graham Street to Sturt Street, Graham Street from the West Gate Freeway to Bay Street, and the Johnson Street/Montague Street/York Street/Ferrars Street route from the Yarra River to Park Street, increase source strength.
It was concluded that the effect of freeway development upon air quality in these areas would not be significant. Maximum levels of pollutions set for the various air quality standards are not expected to be exceeded, except for levels of ozone and visibility, which are regional problems and not peculiar to the study area.

3. Environmental Studies Section

Environmental assessment of the Board's programmes and projects

In recent years it has been necessary to ensure that works programmes and individual major projects carried out by the Board comply with the appropriate environmental protection requirements of the Australian and State Governments. The administrative procedures under the Federal Environment Protection (Impact of Proposals) Act 1974-1975 stipulate that the proponent of any works supply to the Minister through his Department such information as is required for consideration of the necessity for an Environmental Impact Statement in relation to the proposed action.
The Department will review the information supplied, and will either determine that an Environmental Impact Statement is not required, or refer the matter to the Minister who may direct that an Environmental Impact Statement be prepared. A draft statement will generally be made available for comment by any interested persons or bodies, or any State or Australian government departments. The Environmental Impact Statement is then prepared by revision of the draft statement, taking account of the comment and the findings of any public hearing.
In Victoria, legislation of this nature has not been enacted, but the Premier has directed in Circular 76/37, dated 2nd September 1976, that all Government Departments, Statutory Authorities and Agencies shall bring to the attention of the Director of Conservation any works, proposals or actions which could have a significant or controversial environmental effect.
To this end, the Victorian Ministry for Conservation has developed Guidelines for Environmental Assessment to ensure compliance with the Premier's direction. The guidelines provide for procedures under which the proposer of works shall decide if a proposal could require an Environment Effects Statement, and if there is any doubt about the need for a Statement, a Preliminary Environment Report should be prepared and sent to the Director of Conservation.

Hume Freeway, Seymour to Avenel Section

The Seymour to Avenel Section of the Hume Freeway programme was considered of sufficient significance in environmental terms to warrant the preparation of an Environmental Impact Statement, and the Australian Ministry of Transport, in consultation with the then Department of Environment, directed that the Board prepare such a statement.
During the planning process, 21 Federal, State and Local Government Departments were consulted, and copies of letters from those with significant input were included in the Statement.
As a result of detailed examination of alternative routes, it was concluded that many of the various adverse consequences noted for all routes were much less pronounced in the case of the favoured route. Further, in many instances, remedial action could be more effectively accomplished. The favoured route is generally supported by government departments and local government officers consulted during the investigation.
In environmentally sensitive areas, such as Old Sydney Road Reserve, and river and creek crossings, specific measures will be taken to minimise disturbance to the environment, and to restore natural vegetation.
The draft report was circulated to statutory bodies and the local council, and was forwarded to the Ministry for Conservation for public exhibition, and written submissions by interested parties were collected. These submissions were reproduced in full in the Ministry's assessment of the report. The Ministry's assessment contained five specific recommendations for further additional work, to assess —
— the fog characteristics and possible safety measures in fog;
— archaeological factors relating to the favoured route;
— the need for and the possibility of providing an off-road highway park in accordance with State Government policy.

These further studies have been completed.
The Australian Ministry has accepted the Statement of Environmental Considerations as a Notice of Intention, and has expressed its satisfaction with the report as such.

Other items in the National Highways programme

Environmental aspects of the National Highways Programme have been dealt with in Highway Planning Reports. This is a submission required under the administrative procedures which have been developed for the National Highways Programme, which contains not only information of an engineering nature but also a broad environmental assessment of the project.
This assessment examines the extent of planning undertaken and the various alternatives which have been considered. Highway conversions (e.g. two-lane two-way to four-lane divided) must be justified by documentation of considerations including engineering feasibility, cost, effect on existing settlement patterns, and social and physical impact of proposal.

Board's proposed urban and rural arterial programme 1976/77

The Australian Department of Transport requested the Board to provide an environmental clearance for various projects on its proposed programmes. The approach adopted was to include a senior member of the Assessment Branch of the Victorian Ministry for Conservation in discussions on each job in the programme. The discussions have been led by the respective Divisional Engineers, and each item has been examined to demonstrate that the

Table 5:
Average cost of sprayed bituminous surfacing done by CRB plant
(On roads to which the Board contributed funds during 1976/77)
(Costs in cents per square metre)

Item	Nature of work																	
Square metres costed	ITP&S S.13 & over		ITP&S Size 10		ITP&S S.7 & sand		Primer-seals		IT Two-application seal only		ITSO & reseals S.16 & over		ITSO & reseals Size 13		ITSO & reseals Size 10		ITSO & reseals S.7 & sand	
	929477		709484		36562		1337534		5811		7519		3432617		7376004		6791509	
	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%
Material	48.3	49.5	45.6	54.7	35.2	53.6	33.3	53.4	59.1	57.4	42.4	64.7	39.7	55.0	32.2	55.0	26.9	56.9
Stores	3.4	3.5	2.6	3.1	2.7	4.1	2.1	3.4	4.3	4.2	1.6	2.4	2.4	3.3	1.9	3.3	1.6	3.4
Plant hire	18.5	18.9	14.3	17.2	10.7	16.3	10.2	16.3	15.0	14.6	8.8	13.4	11.2	15.5	9.2	15.8	7.2	15.2
Labour	27.5	28.1	20.8	25.0	17.1	26.0	16.8	26.9	24.5	23.8	12.8	19.5	18.9	26.2	15.1	25.9	11.6	24.5
Totals	97.7	100	83.3	100	65.7	100	62.4	100	102.9	100	65.6	100	72.2	100	58.4	100	47.3	100

ITP&S Indicates 'Initial Treatment Prime & Seal' ITSO Indicates 'Initial Treatment Seal Only'

Materials

a. Aggregate.
The total quantity of covering aggregate used was approximately 213,700 cubic metres on sprayed work done by the Board's plant and 47,400 cubic metres on sprayed work done by municipalities and contractors. Table 6 sets out the average prices of aggregates over the last five years and shows that the average price in 1976/77 was $1.41 per cubic metre higher than the average price in 1975/76.

b. Bitumen.
The Board purchased 30,468 tonnes of bitumen by contract with four marketing companies at a cost of $3,578,000.

Table 6
Average price of aggregate for bituminous surfacing
(in roadside stacks)

Material Prices/cubic metre	72/73	73/74	74/75	75/76	76/77
	$	$	$	$	$
Screenings	7.01	7.39	9.31	11.19	12.66
Gravel	6.76	6.53	9.24	11.36	12.25
Sand	2.64	3.68	3.06	5.23	4.89
Scoria	5.10	4.49	5.38	6.51	6.41
Average price all aggregates	6.83	7.08	9.13	11.01	12.42

Bituminous surfacing manual
In 1933 the original 'Book of instructions — surface treatment of roads, handbook', commonly known as the 'blue book', was printed. This useful and extensively used handbook was revised in the early 1950s.
Since that time the Board's sealing practices and procedures have changed considerably and a number of new developments have occurred. The need for an up-to-date revision has been highlighted by the recent change to metric units. The current revision is now nearing completion. The new publication will be known as the 'CRB — bituminous surfacing manual'.

Bituminous surfacing film — sprayed work
A bituminous surfacing film depicting the Board's current sealing techniques was completed during the current financial year. This new production replaces an old and outdated film made by the Board in 1947.
It is anticipated that the film will have a wide and varying audience as it is used for:
— training Board engineers and key bituminous surfacing field personnel;
— introducing overseas and other State Road Authority representatives to Board sealing practices;
— background information for municipal engineering groups;
— a lecturing aid at tertiary institutions.

Bitumen specification
The new Australian Standard Specification AS2008-1977, Residual Bitumen for Pavements, was published on 1st March 1977. This updates and supersedes AS A10-1967, Residual Bitumen and Fluxed Native Asphalt for Roadmaking Purposes.
An important difference from AS A10 is that this new standard introduces a classification based on a viscosity at 60°C instead of penetration at 25°C. The temperature of 60°C is near the middle of the range of temperatures of practical interest in Australia.
The methods of test have undergone considerable change, and take into consideration the latest editions of American and British methods from which they have been derived.
The number of tests for viscosity is considerable and provides a comprehensive choice.
A range of viscosities is imposed at 135°C to confine bitumens to an acceptable range of temperature-susceptibility. To exclude bitumens of greater temperature-susceptibility which might be too brittle at low road temperatures, a minimum limit is placed on penetration at 15°C and, in order to use a more sensitive test procedure, the penetration is performed with a 200 g load applied for 60s.
These controls on consistency at the top, middle and near the bottom of the practical temperature zone adequately specify the rheological properties of bitumens and also focus attention on the bitumen consistency at temperatures which are relevant to possible performance problems.
The classification of residual bitumens provided for in AS2008 are:

Table 7

Class	Viscosity at 60°C, Pa.s*
80	60-100
160	120-200
320	240-400
640	480-800

*1 pascal second = 10 poise

Class 160 residual bitumen is normally used on Board's work and approximates AS A10 Grade 85-100 penetration (Class R90) residual bitumen.
The new standard will be adopted by the Board from 1st July 1977 with an additional requirement that the bitumen shall take a minimum time of 10 days to reach critical viscosity when tested by the Australian Road Research Board Durability Test, ATM No.3. This test is designed to identify bitumens which may give poor durability in service.

Primerbinders
Primerseals were initially introduced for winter sealing and therefore the viscosity of the primerbinders was designed for such conditions. However, due to the traffic problems associated with primed roads, the use of primerseals has been extended over the full year and to a large range of traffic volumes.
To cover this situation the specification for Special Cutback Bitumen Primerbinders was amended to provide 'winter' and 'summer' grades, namely:

Table 8

	May-Nov	Dec-Apr
Viscosity Poise @ 50°C	15-25	25-40
Residue from distillation to 360°C %	78 min	80 min

This modification of viscosity, together with more attention to detail in carrying out the work and aftercare, has resulted in less problems with primerseals.

A limited quantity of a commercial primerbinder of higher viscosity (80-220 poise at 50°C) has been used successfully in warmer weather conditions.
Due to increased costs of commercial primerbinders increasing use is being made of field produced primerbinders.

Precoating limestone aggregate
It has been Board practice in the past to precoat limestone aggregate for sprayed surface sealing work with a tar/tar oil mixture. This resulted in the achievement of a more uniform mat of aggregate, less aggregate breakdown and a longer seal life. It is now difficult to obtain supplies of this precoating material. Also, it can have an irritating effect if it comes in contact with the skin of plant operators during the precoating and/or aggregate loading operations and for these reasons is now seldom used.
To keep costs down it is desirable that the precoating material adopted can be applied with the Board's existing equipment and procedures, preferably during the normal loading operations.
A trial was conducted to determine the suitability of other precoating materials — Distillate, Cationic Bitumen Emulsion Precoat, and AP-66 Cutback Industrial Bitumen.
The Board's normal equipment and processes were used to satisfactorily apply the distillate and the AP-66 precoating materials. Difficulties were experienced with the emulsion 'breaking' in the aggregate loader during its application resulting in the blocking of the trommel screens on the aggregate loader.
The cationic bitumen emulsion precoat was mixed with water as follows:
Emulsion-water, 1 to 1.
With this mixture the precoating material was uniformly applied on the aggregate, however when the emulsion completely 'broke' the residual precoat was very variable.
Emulsion-water, 2 to 1.
With this mixture it was difficult to achieve the desired application rate because of the relatively high viscosity of the mixture.
The initial observations indicate that the distillate and AP-66 precoating materials can be satisfactorily used with the Board's normal loading and precoating equipment, but the cationic bitumen emulsion precoat cannot be satisfactorily handled.
The field performance of the three sections is in good condition with some breakdown of aggregate having occurred. The amount of breakdown is less in the section where the AP-66 precoat was used. The tentative conclusion is that the AP-66 cutback industrial bitumen is the most suitable replacement material for precoating limestone aggregate.

Experimental reseal using a synthetic aggregate
A short experimental reseal was applied to the approaches to a pedestrian crossing in Glenferrie Road, south of Park Street, in the City of Hawthorn.
The aggregate used was a mixture of a light coloured rhyodacite and a white coloured calcined pyrophyllite synthetic aggregate (2 parts of rhyodacite to 1 part of calcined pyrophyllite).
The high luminance light coloured aggregates were placed at this location in an endeavour to improve the delineation and silhouette background at the crossing (see Plate 8).
Because of the high stresses produced by stopping and starting traffic at this location, a bitumen/rubber buffings type binder was used (14% scrap rubber buffings). This type of binder has a strong initial adhesion to the aggregate and is less susceptible to temperature changes.

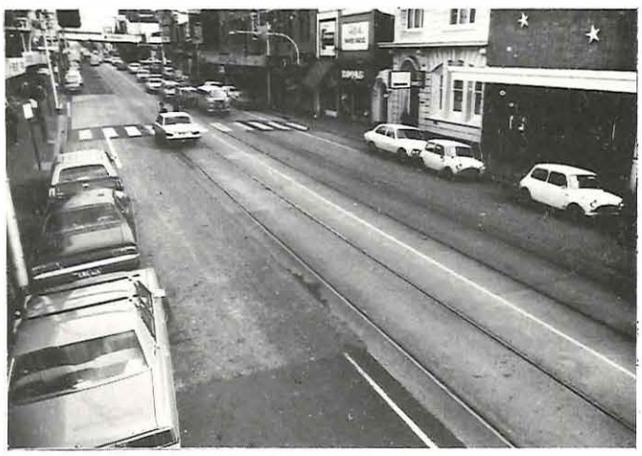


Plate 8: High luminance light coloured aggregate at pedestrian crossing

Report on previous experimental work
Table 9:

Road & location	Nature & reason for work	Date work done	Conclusions to date
Hume Highway north of Violet Town	Evaluation of low 'vispen' class R90 bitumens used in a size 13 reseal (ARRB Road trials)	Feb 1974	The low 'vispen' class R90 bitumens used had no visual effect on the initial retention of aggregate, ie. all sections are in good condition with a firmly held mat of aggregate having been achieved. The long term effect of binder hardening will be ascertained at the end of seal life.
Northern Highway north of Elmore	Evaluation of low 'vispen' Class R90 bitumens used in a size 10 reseal (ARRB Road Trials)	Mar 1973	As above.
Woolsthorpe-Heywood Road. Shire of Minhamite	Evaluation of the performance of various primerbinders applied at various rates of application on a volcanic tuff pavement covered with a size 7 scoria aggregate	Dec 1973	The first 6 sections were given a size 7 scoria final seal in Feb 75 (14 months after the initial primerseal) and the balance of the job given a size 7 scoria final seal in Feb 76 (26 months after the initial primerseal). It is therefore evident that the 3 primerbinders performed adequately. There was a tendency to a longer life with the heavier rates of application. There was not sufficient evidence to indicate that the modified primerbinder performed any better than the normal primerbinder, therefore there is no reason to change from the currently used primerbinders. It is obvious that a good pavement material, soundly constructed, is a pre-requisite for a long life for primerseals on lightly trafficked roads. Also, primerseals located in a coastal region will normally have a longer life than a similar primerseal in an inland area (with similar pavement type and condition and traffic volumes).
Hume Freeway (Wallan-Broadford Section)	Evaluation of the performance of a high viscosity proprietary primerbinder used for a size 7 primerseal	Oct 1973	The primerbinder performed very satisfactorily for a period of 28 months under light traffic. The final seal was then applied.

Bitumen/scrap rubber seals

As reported in 1975/76, bitumen scrap rubber seals (BSRS) show considerable promise as a thin flexible surfacing for use on the cracked pavement/high stress situation.

Table 10 lists details of bitumen scrap rubber seals (BSRS) placed during the 1976/77 season with Board sealing units. A total of approximately 75,000 m² (equivalent to 10 km of 7.4 m wide two-lane road) was sprayed and involved the mixing of approximately 14 tonnes of rubber buffings into the bitumen binder.

During 1976/77, a mixing box was developed for mixing the rubber buffings or granulate with the bitumen while the hot bitumen is being loaded into the sprayer. This has proved satisfactory for rubber buffing percentages up to 20% by mass, but modifications are proposed for next season to provide better flow conditions and allow up to say 30% by mass of rubber buffings to be mixed with the hot bitumen.

A Board standard sprayer has been used for the experimental work carried out and the following practice has been developed.

a. Cutter.
The amount of cutter required to temporarily reduce the binder viscosity during spraying and covering with aggregate is as follows, based on the bitumen at 15°C:
Minimum cutter to be added — 5 parts/100 parts bitumen
Air shade temperature 20°-25°C — 10 parts/100 parts bitumen
Air shade temperature + 25°C — 8 parts/100 parts bitumen

b. Quantities.
Because the bitumen and buffings froth up when mixed and loaded, the quantity of bitumen should be kept to about 3000 litres hot for a sprayer of capacity 3600 litres.

Table 10
Details of bitumen scrap rubber seals placed during the 1976/77 season with Board sealing units

Division	Location date of work	Binder type Normal design app. Traffic	Average application rate of binder l/m^2	Aggregate size	Aggregate application rate m^2/m^2	Comments
Ballarat	Calder Highway Gisborne March 1977	R90 bit + 9% scrap rubber buffings. Normal Design -1.5 l/m^2 (4800 vpd)	1.78 (1.74 to 1.89) (Bitumen — 1.62)	13	61	The scoria aggregate reseal was applied to improve the skid resistance as some vehicles were having difficulty in negotiating the curves on the downhill run into Gisborne. The reseal has been successful in this regard. However on the climbing lane which is subject to slow moving grinding traffic, some aggregate breakdown has occurred.
Benalla	Summit Road, Mt. Buller February 1977	R90 bit + 13% scrap rubber buffings. Normal Design — 1.8 to 2.0 l/m^2 (-50 vpd)	2.26 (2.04 to 2.33) (Bitumen — 1.97)	13	59	The altered mudstone reseal was successfully applied to an extensively ravelled asphalt on a steep sharp curved alignment.
Bendigo	Northern Highway Rochester December 1976	R90 bit + 18% scrap rubber buffings. Normal Design — 1.55 to 1.90 l/m^2 (3000 vpd)	1.94 (1.88 to 2.00) (Bitumen — 1.61)	13	66	The scoria aggregate reseal was applied to improve the skid resistance around a sharp curve. Although there has been extensive aggregate breakdown on the inside of the curve improved skid resistance has been achieved.
Bendigo	Byrneside-Kyabram Rd Kyabram May 1977	R90 bit + 2% scrap rubber buffings R90 bit + 4% scrap rubber buffings. Normal Design — 1.0 l/m^2 (800 vpd)	1.11 (Bitumen — 1.09) 1.15 (Bitumen — 1.11)	13 13	86 86	The diabase aggregate reseal was applied over a smooth surface. The 2% and 4% scrap rubber buffings were added to the binder to improve the initial adhesion to the aggregate.
Dandenong	Maroondah Highway Ringwood March 1977	R90 bit + 13% scrap rubber buffings. Normal Design — 0.85 to 0.95 l/m^2 (25 000 vpd)	1.7 (1.38 to 1.95) (Bitumen — 1.48)	10	91	The rhyodacite aggregate reseal was applied over a cracked asphalt surfacing.
Dandenong	Nepean Highway Frankston May 1977	R90 bit + 2% scrap rubber buffings. Normal Design — 0.95 l/m^2 (17 000 vpd)	1.03 (1.0 to 1.05) (Bitumen — 1.0)	10	98	The basalt aggregate reseal was applied over a hungry surface. The 2% scrap rubber buffings was added to the binder to improve the initial adhesion to the aggregate.

c. Spraying temperatures, pump shaft speed and manifold spraying pressure

Table 11:

Parts rubber/ 100 parts bitumen	Binder spraying temperature* (°C)	Increase in pump shaft speed** RPM	Increase in manifold spraying pressure %
10	190-200	20	25
15	200-210	20	25
25	210-220	10	33

* Minimum air temperature for spraying should be 20°C. Normal spraying temperature is 185°C maximum.

** Increase is above the rpm shown on bituminous surfacing spraying table — Form 1044.

Scrap rubber asphalt

A laboratory study of a coarse graded asphalt containing 3% by mass of scrap rubber granulate (approximately 3 mm nominal size) was referred to in the 1975/76 Annual Report. This mix was developed in Sweden and is claimed to retain a good surface texture, and hence skid resistance, under severe traffic conditions and also to give a greater resistance to reflective cracking.

Trial sections were placed in January 1977 in Kingsway, South Melbourne, and Nepean Highway, Mordialloc (see Plate 9). At Mordialloc the mix was placed over an old and cracked Portland cement concrete pavement.

After approximately six weeks the scrap rubber asphalt at Kingsway, South Melbourne, was observed to be deteriorating with a general loss of cohesion and a migration of fines to the bottom of the layer. The conclusion after investigation was that the failure was due to stripping of the binder from the aggregate. The stripping was caused by water entering the fairly high air void mix obtained in the field (6-10%) and being placed under extreme pressure by the flexing of the mix under the very heavy traffic conditions.

Division	Location date of work	Binder type Normal design app. Traffic	Average application rate of binder l/m^2	Aggregate size	Aggregate application rate m^2/m^2	Comments
Geelong	Princes Highway West 50.75 to 52.30 km 58.60 to 59.90 km March 1977	R90 bit + 13% scrap rubber buffings Normal Design — 0.90 l/m^2 (9000 vpd)	1.86 (1.69 to 2.05) (Bitumen — 1.62)	10	98	The basalt aggregate reseal was applied over a cracked asphalt surfacing.
	Princes Highway West (Brougham Street, Geelong) March 1977	R90 bit + 11.5% scrap rubber buffings Normal Design — 0.80 l/m^2	1.71 (Bitumen — 1.51)	10	105	The basalt aggregate was applied on the approaches to traffic lights to improve the skid resistance. Binder application too high, leading to a flush surface.
	Princes Highway West (Separation St. Bridge) March 1977	R90 bit + 19.5% scrap rubber buffings Normal Design — 0.90 l/m^2 (30 000 vpd)	1.74 (Bitumen — 1.40)	10	105	The basalt aggregate was applied on a sharp radius curve to improve skid resistance.
Horsham	Henty Highway Wonwondah February 1977	R90 bit + 13% scrap rubber buffings Normal Design — 1.3 l/m^2 (490 vpd)	1.98 (Bitumen — 1.73)	10	100	The quartz porphyry aggregate reseal was placed over a cracked surface seal.
Metropolitan	Glenferrie Road, Hawthorn March 1977	R90 bit + 14% scrap rubber buffings Normal Design — 0.7 l/m^2 (11 000 vpd)	1.18 (Bitumen — 1.03)	7	120	The mixture of rhyodacite/calcined pyrophyllite synthetic aggregate (2 to 1 by volume) was placed on the approaches to a pedestrian crossing.
Traralgon	South Gippsland Highway, Korumburra March	R90 bit + 12% scrap rubber buffings Normal Design — 0.85 l/m^2 (3000 vpd)	1.68 (1.44 — 2.13) (Bitumen — 1.51)	10	82	The basalt aggregate reseal was placed over a cracked surface seal in the township of Korumburra.
Warrnambool	Cobden-Warrnambool Rd 7.07 to 7.83 km Shire of Warrnambool March 1977	R90 bit + 13% scrap rubber buffings Normal Design — 1.2 l/m^2 (580 vpd)	1.97 (1.85 — 2.13) (Bitumen — 1.72)	10	107	The basalt aggregate reseal was placed over a cracked surface seal.
	Ocean Road 262.3 to 262.6 km March 1977	R90 bit + 12% scrap rubber buffings Normal Design — 1.0 l/m^2 (520 vpd)	2.06 (Bitumen — 1.81)	10	105	The basalt aggregate reseal was placed over a cracked surface seal.

A replacement test section was placed in March 1977. Lime filler was used in the aggregate portion of the mix to act as an anti-stripping agent and also to increase the density of the mix so that the entry of moisture is less likely. The binder content was also increased slightly.
At the time of preparation of this report, the replacement material is performing satisfactorily. The test sections placed on the Nepean Highway at Mordialloc also appear to be satisfactory. The difference between the two test sites is that the original work at South Melbourne received heavy rain two days after placing whereas the work at Mordialloc was followed by several weeks of fine warm weather.
The various mixes used are shown in Table 12.

Plate 9: Placing of coarse graded asphalt containing scrap rubber granulate, Nepean Highway, Mordialloc

Table 12:
Scrap rubber asphalt

Mix	Aggregate grading % by mass passing AS sieve											Rubber granulated % by mass of total mix	R65 bitumen % by mass of total mix
	19.0	13.2	9.5	6.7	4.75	2.36	1.18	600	300	150	75		
1	100	92	76	66	50	38	30	24	14	8	5.8	—	5.2
2	100	86	49	43	41	33	26	21	16	11	8.0	3.0	7.5
3		100	71	47	33	24	19	15	12	9	5.0	3.0	7.5
4	100	82	50	39	37	28	22	18	14	10	8.6	3.0	7.8

Mix 1 — Control mix, standard CRB size 13 dense graded wearing course asphalt.
Mix 2 — Swedish developed scrap rubber asphalt as originally placed at Kingsway, South Melbourne and Nepean Highway, Mordialloc but failed on Kingsway, South Melbourne.
Mix 3 — Australian Road Research Board version of scrap rubber asphalt.
Mix 4 — Replacement Swedish scrap rubber asphalt as placed on Kingsway, South Melbourne.

Bitumen treated crushed rock and crushed rock asphalt
Bitumen treated crushed rock (BTCR) and crushed rock asphalt (CRA) are used where there is a requirement for a bitumen bound material that has greater strength and moisture resistance than an untreated rock, but at a lower cost and lower strength than conventional asphalt.
BTCR may be produced by either the foam bitumen process or by a high impact process in a pugmill. The crushed rock is not heated and the mixture must contain sufficient moisture for optimum compaction. Binder content is usually 3-4% by mass. There is virtually no coating of the coarse particles and the bitumen is dispersed as tiny globules of bitumen and fine particles, and the product has the appearance of untreated crushed rock. BTCR is handled and placed in the same manner as plant mixed wet mix crushed rock.
CRA is produced by heating and drying the crushed rock and mixing with bitumen in an asphalt mixing plant. In appearance it is similar to normal asphalt and is handled and placed in the same manner and at the same working temperatures. Binder content is usually 4% by mass.
Typical prices for supply and delivery of alternative materials in the metropolitan area during the year were:

Class II plant mixed wet mix crushed rock	$ 7.00 per tonne
Bitumen treated crushed rock (4.0% bitumen)	$13.50 per tonne
Crushed rock asphalt	$15.50 per tonne
Size 20 asphalt	$18.40 per tonne

Plate 10: Acrylic roadmarking material in good condition after 15 months' wear (x13)

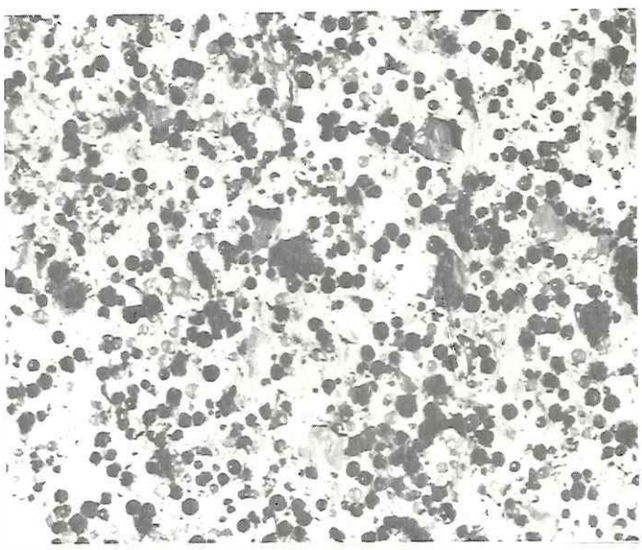
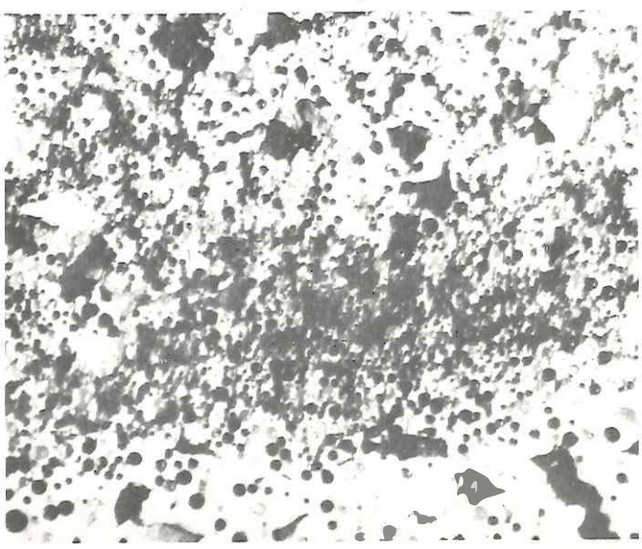


Plate 11: Acrylic roadmarking material showing worn area after 15 months' wear (x13)



2. Materials Research Division

In-service performance of acrylic roadmarking materials
In October 1975 and March 1976, intersection markings were placed at Kew Junction using a cold applied plastic material. The material consists of a thixotropic acrylic resin (polymethyl-methacrylate) containing white pigment, fillers, calcined bauxite and reflective glass beads. Prior to application, a hardening agent (benzoyle peroxide paste) is mixed with the resin. Depending on ambient temperature, 4% to 15% by mass or volume of hardener is added to produce a set time of 15-20 minutes. A 2 mm thickness of material is hand spread between masking tapes and glass beads applied before the resin sets to provide immediate reflectivity.

Prior to reconstruction, the painted markings at Kew Junction required repainting about three times per year. The new markings only show minor signs of wear to date at locations where the material was applied thinner than the desired 2 mm. Maintenance of the acrylic markings will be carried out by patching worn areas only instead of complete re-application as for paint. It is estimated that a further 6-12 months will elapse before this maintenance is required. Present painting costs are $10/m² and costs for acrylic markings amount to $20/m², but based on a four-month life for paint and two years for acrylic the annual cost of markings amounts to $30/m²/year for paint and $10/m²/year for acrylic.

Application of the material by manual trowelling is relatively costly at present, but it is hoped to achieve further economies if mechanical application techniques can be developed. To date, pump and spray gun suppliers consider the material too abrasive and difficult to mix in the gun, but investigations are proceeding in this area and that of mechanical screeding.

Plates 10 and 11 show the acrylic after 15 months' wear. Plate 10 shows a marking in good condition whereas Plate 11 shows a worn area where the material had been applied more thinly than the desired 2 mm. Indications of plucked out glass beads and calcined bauxite can be seen, revealing the road surface underneath.

Proof load testing of reinforced concrete driven piles

Due to unacceptable dynamic pile test results obtained during construction of the Parwan Creek bridge on the Geelong to Bacchus Marsh Road, a system was devised to enable, at short notice, proof loading of 355 mm by 355 mm reinforced concrete driven piles to 1.5 times the working load of the pile. A proof load of 1.5 times the working load is required by the Draft Australian Piling Code.

Dynamic pile capacity formulae can give unrealistic results in a wide variety of soil conditions and in the majority of cases the failure of a pile to achieve the required dynamic capacity does not necessarily mean that the pile has an unsatisfactory static capacity. An appreciation of how a soil will behave under a dynamic load allows the engineer to assess, with a reasonable degree of confidence, whether a soil which has failed a dynamic test will behave satisfactorily under a static load. In the case of the Parwan Creek pile, it was considered that a proof loaded pile would give a satisfactory result and that this would be a more economical solution than splicing on an extra pile length and driving to a greater depth.

The test procedure and equipment is designed to allow the test to be carried out within one to two days of a request being received from the site. The two piles adjacent to the test pile are used as reaction piles. The starter reinforcing bars of the reaction piles are exposed and welded to a pair of mild steel stirrups at each pile. A reaction beam (2.5 tonne 'I' beam) with flange stiffeners at the reaction and loading points is placed in the stirrups and the test pile loaded with a 1000 kN manual hydraulic jack. Vertical pile deflections are measured relative to a datum beam remote from the loading system. The procedure caters for raker piles, provided the reaction piles have approximately the same rake, by installing a frictionless bearing between the test pile and the hydraulic jack. The exercise requires four to five hours on site with the only other delay being the time taken to transport the beam and equipment from Syndal to the site.

The Parwan Creek pile gave a satisfactory result with virtually no irrecoverable settlement under the proof load. It is proposed to perform similar pile load tests on other friction piles to verify pile design based on Quasi-static Penetration Tests.

Tiltmeters

Tiltmeters are gravity sensing electrolytic transducers designed to measure change in angle from an installed position. Each device consists of three platinum electrodes partly immersed in an iodine solution and wired in a Wheatstone Bridge circuit so that the millivolt output gives the change in angle. The electrodes and solution are contained in a 13 mm diameter by 30 mm long glass tube.

Two strings of tiltmeters were used on the Johnson Street Bridge project to monitor ground movements close to the MMBW main sewer during percussive driving when sealing the piles in bedrock. The tiltmeters were placed in pairs at right angles to each other so that the soil movement in different directions could be measured. Figure 9 shows the recorded soil movements during the driving of Pile no. F6. The calculated soil movement was less than 30 mm.

Tiltmeters were also used on the Johnson Street Bridge project to measure the inclination of a raked pile below water line. Conventional surveying techniques can only be used to measure the inclination above water line. The measuring instrument consisted of two tiltmeters fixed to a trolley which followed the invert of the pier casing. One tiltmeter measured the vertical inclination of the pile while the second ensured that the trolley remained in contact with the invert. Figure 10 shows the comparison between the slope of the pile as intended by the designer and as actually installed. By calculation, it was found that the horizontal displacement of the casing toe was only 115 mm from the required design position.

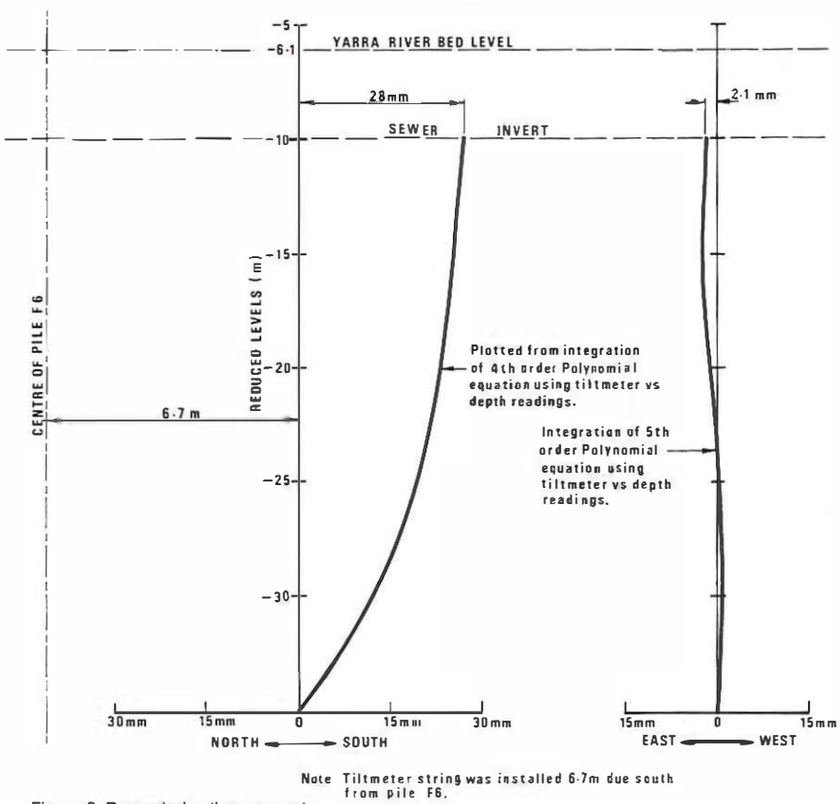


Figure 9: Recorded soil movements during the driving of Pile no. F6

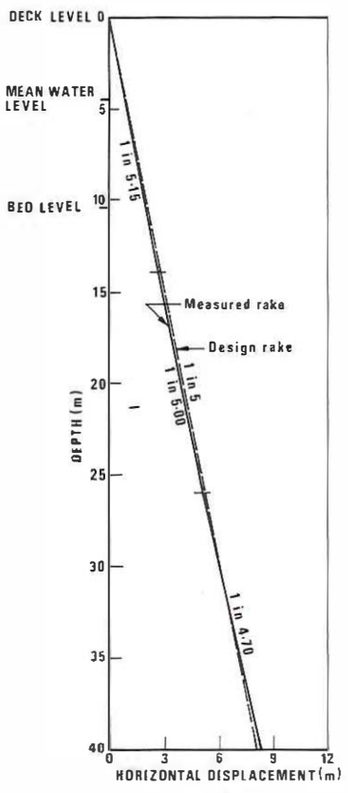


Figure 10: Comparison of the intended and actual slope of Pile no. F6

Tiltmeters have also recently been installed in the 33 m high earth embankment on the Western Highway at Pykes Creek. The soil movements which have caused the road pavement to deform in recent years will be monitored.

Johnson Street test pile

The Johnson Street bridges over the Yarra River are supported by 24 cylinder piles, 1.68 m in diameter. The piles are founded in moderately weathered Silurian mudstone, which is located beneath 35 to 45 m of alluvium. The piles were designed to cater for loads varying from 5 to 11 MN and the initial design called for the piles to be socketed for 3 to 15 m into the mudstone. Inspections of the first sockets to be hand-excavated indicated that the designed side resistance component of the pile capacity could be unduly conservative and that socket lengths could be decreased. Hand excavation of the sockets is a slow, hazardous and expensive construction method and it was obvious that significant cost savings would result if the socket lengths could be safely reduced. It was agreed with the designers of the bridge that a reduction in socket length should be proven by load testing. Consequently, an abutment pile was constructed using revised, less conservative design parameters and was proof loaded to twice its design load. The proof loading was applied by jacking against a reaction beam (see Plate 12) using two rock anchors. The load distribution in the socket was determined from measurements made by electrical resistance strain gauges and the magnitude of the applied load was checked using load cells. The maximum load was applied for a period of 20 hours during which the pile settlement and socket gauges showed no creep.

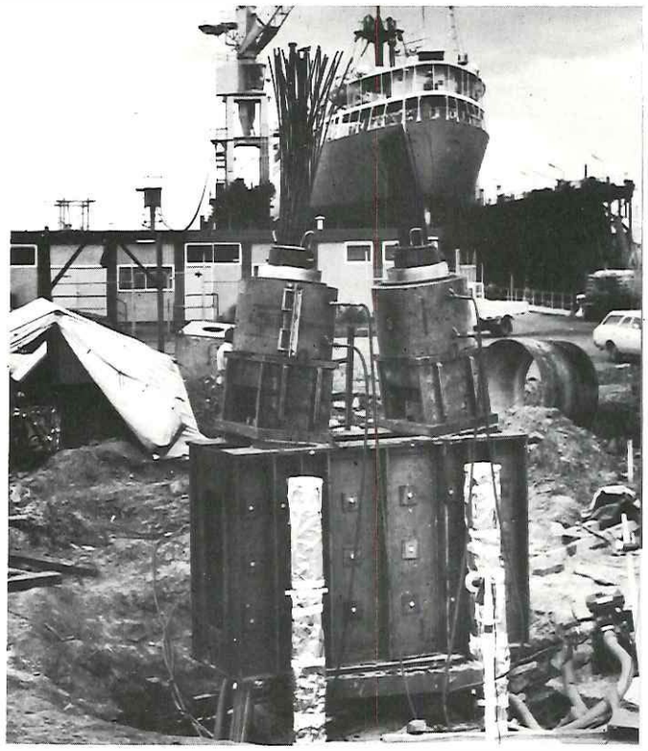


Plate 12: Proof loading of test pile at the Johnson Street Bridge construction site

The top of the pile settled 6.7 mm under the maximum applied load of 11.8 MN. During unloading, 4.4 mm of this settlement was recovered. These settlements were well below the maximum allowable of about 30 mm. Of the 11.8 MN applied load, approximately 5.5 MN actually reached the top of the socket. The remainder of the load was carried by the alluvium and the pile casing, which had been driven 2.2 m into the sandstone.

The load distribution down the socket was found to be independent of the socket load, ie. the shape of the load distribution curve remained the same, regardless of the magnitude of the load reaching the socket. The load distribution indicated by the strain gauges, expressed as a percentage of the load actually reaching the socket, and the theoretical distribution, determined by an elastic finite element analysis, is shown in Figure 11.

Generally, the strain gauges and the theoretical distribution agreed well in the upper sections of the socket, but varied toward the base. This variation near the base is caused by the sharp strain gradients across the socket section. Consequently, some strain gauges did not reflect the average socket strain but when corrections for this effect were made good agreement was also found for the lower gauges. It therefore appears that only 20 percent of the applied socket load reached the base.

The results of the load test were used to modify the design of the sockets of the piles installed subsequently, with significant cost savings.

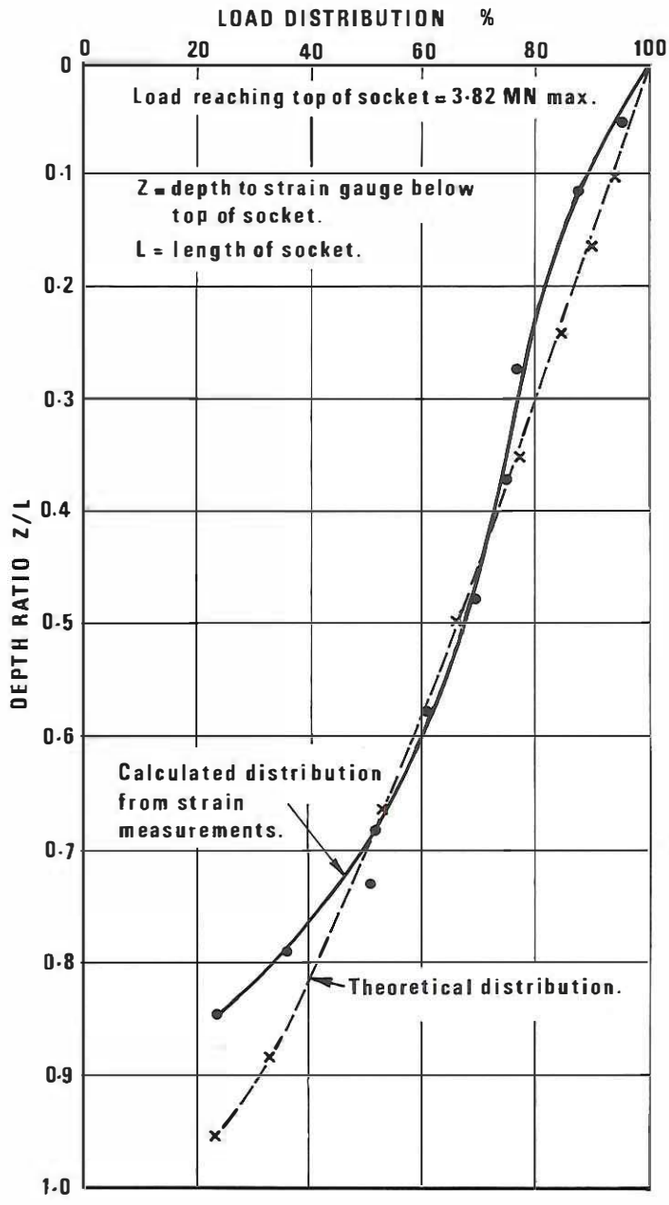


Figure 11

Crushed rock for pavements

In 1972 the Board adopted a standard specification for crushed rock, replacing a number of specifications which had been developed to suit local practices and material sources.

The standard specification embodied experience gained in the use of crushed rock in the metropolitan area where the material was produced generally from basalt or hornfels source rocks. Because of needs of road authorities, the quarry industry had installed sophisticated plants capable of crushing, separating and recombining materials, including imported fines and fillers such as cement works flue dust, to meet close specification requirements. Plant mixed wet mix crushed rock has been used extensively for base course construction.

The programme of major rural freeway construction has required large quantities of pavement material in rural areas.

With the exhaustion of locally available roadmaking materials of satisfactory quality, it has been necessary to adopt crushed rock for pavement construction and to develop new quarries.
Source rock in several of these new quarries has been unusually hard, and difficulties have been encountered in producing crushed rock of the required properties to obtain dense stable impermeable pavements.
Constructed free of other than construction traffic, these crushed rock pavements have been surface sealed before opening to traffic. In some areas, subsequent pavement performance has been poor with a general pattern of rutting of the surface and cracking of the surface seal, followed by ingress of water, development of pore pressure in the pavement base and subbase under traffic loadings, and general deformation and potholing of the pavement.
The specifications developed from experience in the metropolitan area for crushed rock to be surfaced with asphalt have proven to be inadequate in the conditions encountered in rural areas. In particular, the introduction of cement works flue dust as a filler has been found to be highly detrimental to proper construction of pavements and to subsequent pavement performance. As a consequence, specifications have been amended to prohibit the use of this and other cementitious fillers in pavement courses within 200 mm of pavement surfaces in all circumstances.
Specifications for crushed rock pavements have been amended to provide for control of specified properties in a more enforceable manner, and to ensure that the material will perform satisfactorily in service.
These amendments allow for the introduction to crushed rock of a proportion of natural sand of suitable quality where this is available. Quarry plant must be more complex and, where necessary, new types of crushers capable of producing very fine components for the crushed rock have been introduced. Provision has been made in construction programmes for construction of trial sections of pavement to fully evaluate materials from new sources.

Section G: General

1. Computer Section

In the 1976/77 year, the use of the Board's IBM 370/135 computer increased by approximately 80%, mainly because of the increasing use in the fields of structural analysis and transportation planning. As a result of the increase in computer use, the IBM 370/137 will be replaced by the faster IBM 370/145 in July 1977.

Regional Divisions
Late in 1976 a terminal was installed in Benalla Division. This terminal, an IBM 3767 keyboard terminal, is linked directly to the computer at Head Office via a leased telephone line.
The initial justification for the terminal was based on the Division's use of the Roadway Integrated Design and Geometry (RIDGE) computer system. The staff at Benalla Division have since used other computer programs via the terminal in areas such as traverse analysis, bridge design and analysis of Benkelman beam results.
The Division has been able to demonstrate that savings in time and effort can be achieved using the terminal to access the Board's computer.

Graph plotter
In June 1976 the Board acquired an automatic graph plotter which, by using results from computer programs, can produce high quality drawings.
The graph plotter is used, for example, for producing road cross sections, natural surface cross sections, terrain contours and roadway perspectives from the RIDGE system. Use is also made of the graph plotter for drawing transportation networks, plotting penetrometer test results and vehicle turning paths.
Mylar stationery can be used on the plotter as well as standard translucent white paper or graph paper. Both ballpoint and wet ink pens can be used. The permissible drawing area is approximately 83.9 cm wide and up to 36.6 metres long.

Use of the Board's computer during 1976/77
The following table indicates the percentage use of the computer facilities by user for the period July 1976 to June 1977:

Bridge Sub-branch	13.3
Plans and Surveys Division	9.2
Title Survey Division	3.2
Traffic Engineering Division	8.6
Works Sub-branch (excluding Materials Research Division)	1.5
Materials Research Division	3.2
Advance Planning Division	3.7
Road Planning Division	11.4
Secretary's Branch/Chief Accountant's Branch	25.4
Computer Section and Miscellaneous	20.5
Total	100.0

2. Safety

Details of the increases and decreases of accidents, the accident frequency rate and the days lost per million manhours worked are shown in the following tables:

Table 13:
Accidents in the 1976/77 year compared with 1975/76

Type of injury	1975/76	1976/77	Decrease	Increase
Back strains	69	83	—	14
Burns and scalds	18	12	6	—
Burns to eyes	10	5	5	—
Fatal injuries	—	1	—	1
Foreign body in eyes	36	34	2	—
Fractures	24	28	—	4
Head injuries	18	16	2	—
Lacerations and wounds	71	63	8	—
Miscellaneous	61	68	—	7
Multiple injuries	—	—	—	—
Occupational diseases	14	20	—	6
Sprains and strains	76	81	—	5
	397	411	23	37

Table 14:
Trend in accident frequency rate and the days lost per million manhours worked for the five-year period 1972/73-1976/77 (fatal accidents are assessed in accordance with Australian Standard 1885 — 1976 as being equivalent to 6,000 days lost)

	1972/73	1973/74	1974/75	1975/76	1976/77
Total manhours worked (million)	9.05	8.75	9.06	8.55	8.37
Lost time accidents	355	315	380	397	411
Accident frequency rate per million manhours	39	36	42	46	49
Days lost (excluding fatalities)	2,051	1,998	2,222	2,375	2,601
Resultant days lost per million manhours (excluding fatalities)	226	228	245	277	310
Number of fatalities			1		1
Total days lost (including fatalities)	2,051	1,998	8,222	2,375	8,601
Total resultant days lost per million manhours (including fatalities)	226	228	904	277	1,027

3. Publications

The following papers by officers of the Engineer in Chief's Branch were presented or published in the 1976/77 year:

'Elastomeric bearings in structures' Presented to the Structural Branch, Institution of Engineers Australia (Victorian Division), Melbourne, March 1977.	H B Day Assistant Bridge Design Engineer
'Design and use of open-graded friction course asphalt for road surfacing' Published in the proceedings of the eighth ARRB conference, August 1976.	D T Currie Divisional Engineer — Traralgon J D Bethune Asphalt Engineer
'Standard specifications for pavement materials of the Country Roads Board, Victoria' Published in Australian Road Research, September 1976.	D T Currie Divisional Engineer — Traralgon K I York Scientific Officer Materials Research Division
'Traffic noise — measurement and procedures available for reduction of effects of such noise on the community' Published in MEMO, August 1976.	D T Currie Divisional Engineer — Traralgon
'Johnson Street Bridge Project — project development' Presented to the Civil Engineering Branch, Institution of Engineers Australia (Victorian Division), Melbourne, October 1976.	R Valentine Urban Projects (Administration) Engineer
'The control of heavy vehicle loading on bridges' Published in the proceedings of the eighth ARRB conference, August 1976.	D E Charrett Hardcastle and Richards Pty Ltd J R Webber Engineer NAASRA Economics of Road Vehicle Limits Study
'Low cost, high value traffic management schemes' Published in MEMO, May 1977.	A M Noble Assistant Chief Road Design Engineer
'Testing the shape of roads' Published in the proceedings of the eighth ARRB conference, August 1976.	B J Weinberg Research Engineer Materials Research Division
'Materials for subsoil and subgrade drainage' Presented at the NAASRA subsoil drainage workshops, Sydney, November 1976.	P W Lowe Materials Research Engineer
'Automatic open arc welding on West Gate Bridge' Presented at the International Institute of welding assembly and metals technology conference, Sydney, October 1976.	R S Gilmour Assistant Materials Research Engineer
'Some roads in the Horsham area — a performance survey' Published in the proceedings of the eighth ARRB conference, August 1976.	A Ratnarajah Research Scientific Officer Materials Research Division
'Design and use of asphalt mixes' Published in the proceedings of the eighth ARRB conference, August 1976.	B L Phillips Engineer Materials Research Division J D Bethune Asphalt Engineer
'Ultrasonic inspection of weldments' Presented at the International Institute of welding assembly and metals technology conference, Sydney, October 1976.	R S Gilmour Assistant Materials Research Engineer
'Stabilization of rock batters with dowels' Published in the proceedings of eighth ARRB conference, August 1976.	M C Ervin Engineer Materials Research Division G C Black Engineer Materials Research Division
'The determination of deformation and shear strength parameters for sands using the electrical friction cone penetrometer' Published in Norwegian Geotechnical Institute Publication No.110, Oslo, 1976	J C Holden Engineer Materials Research Division
'Limited area traffic analysis' Presented at the Australian Transport Research Forum, Melbourne, May 1977.	D G Ferguson Engineer Road Planning Division
'Highway location and design using photogrammetric methods' Presented at the Twentieth Australian Survey Congress, Darwin, May 1977.	D J Ross Engineer Plans and Surveys Division
'Design and construction of full depth and deep strength asphalt pavements' Presented at the Third International Asphalt Conference of the Australian Asphalt Pavement Association, Sydney, February 1976; and at the Quarterly Meeting of the New South Wales Branch of the Australian Asphalt Pavement Association, Sydney, July 1976.	J D Betnune Asphalt Engineer
'Types of asphalt mixes, mix design and quality control' Presented at the seminar on hot mix asphalt, Preston Institute of Technology, Melbourne, October 1975.	J D Bethune Asphalt Engineer
'Cold weather asphalt paving' Presented at the seminar on practical asphalting for engineers, Australian Asphalt Pavement Association, Melbourne, June 1976.	J J Rebbechi Engineer Asphalt Division
'Full depth and deep strength asphalt pavements in Victoria, Australia' Published in Shell International Bitumen Review No. 54, July 1976.	J D Bethune Asphalt Engineer
'Job management and quality control' Presented at the symposium and workshop on design and construction of bituminous concrete pavements for roads and airfields, Institution of Engineers Australia (Queensland Division), Brisbane, November 1976.	J D Bethune Asphalt Engineer
'Bituminous surfacing procedures — asphalt spreading, bitumen spraying and re-surfacing techniques' Presented at the Municipal Superintendents of Works Conference, Melbourne, November 1976.	R G Allen Assistant Asphalt Engineer
'Bituminous materials for maintenance patching' Published in the proceedings of the eighth ARRB conference, August 1976.	J J Rebbechi Engineer Asphalt Division

'Maintenance of bituminous surfaces' Presented at the Municipal Superintendents of Works Conference, Traralgon, September 1976.	J J Rebbechi Engineer Asphalt Division
'Community participation in road planning' Published in the proceedings of the eighth ARRB conference, August 1976.	R T Underwood Chief Planning Engineer
'Some aspects of community participation in road planning' Presented at the Annual Engineering Conference, Institution of Engineers Australia, Cooma, March 1977.	R T Underwood Chief Planning Engineer
'Urban transportation corridor studies' Published in MEMO, May 1977.	R T Underwood Chief Planning Engineer A C Robertson City Engineer City of Ringwood
'Ring roads, their justification and effects' Presented to the Transportation Branch, Institution of Engineers Australia (Victorian Division), Melbourne, June 1977.	N S Guerin Deputy Engineer in Chief
'Inner urban traffic management' Published in MEMO, May 1977.	B J Negus Engineer Traffic Engineering Division
'Some safety considerations for rural intersections' Published in the proceedings of the eighth ARRB conference, August 1976.	A P O'Brien Engineer Traffic Engineering Division
'Planning studies for new roads' Presented to the Victorian Division, Royal Australian Planning Institute, Melbourne, October 1976.	R S Matthews Town Planner B Cramphorn Sociologist K Bush Economist Environmental Studies Section
'Synthetic aggregates for road surfacings' (Director's Prize Paper) Published in the proceedings of the eighth ARRB conference, August 1976.	B L Phillips Engineer Materials Research Division

Other publications in 1976/77 were:

Engineering note no. 113	Additives to crushed rock
Engineering note no. 114	Painting of guideposts
Engineering note no. 115	Instrumented load tests — bitumen coated piles

4. Staff

As at 30th June 1977, personnel in the Engineer in Chief's Branch numbered:

Technological staff (professional)	609
Technical staff	508
Administrative staff	371
Supervisory staff — Field	172
— Depot	67
Clerks of Works	86
Construction and maintenance personnel	2,224
Workshop and depot personnel	591
	4,628

K G Moody
Engineer in Chief

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