60 Denmark Street, Kew 3101

28th September, 1979

The Honorable Robert Maclellan, MLA
Minister of Transport
570 Bourke Street, Melbourne 3000

Sir
In accordance with the requirements of Section 128 of the Country Roads Act 1958 No. 6229, the Board submits to you for presentation to Parliament the report of its proceedings for the year ended 30th June, 1979.

The Board wishes to thank the Government for the support and interest in its activities and wishes to place on record its appreciation of the continued co-operation and assistance of 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.

Yours faithfully

T H Russell
MEngSc (Hons.), BCE (Hons.), DipCE, CE, FIE Aust.
Chairman

W S Brake
BCE, CE, MIE Aust.
Deputy Chairman

N L Allanson
AASA (Senior), JP
Member

G K Cox
LL B, JP
Secretary

Cover:
Construction of a new carriageway on the Hume Freeway, north of Avenel, using the Autograde purchased by the Board in 1978/1979.

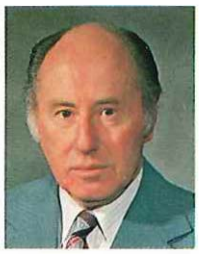
Country Roads Board

Victoria

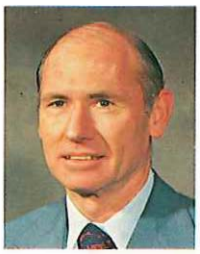
Sixty-sixth Annual Report for year ended 30th June, 1979
Presented to both Houses of Parliament pursuant to Act No. 6229

The CRB is the State Road Authority of Victoria. The CRB's aim is to create an efficient road system within the context of the overall transportation needs of the community.
There are about 160,000 km of public roads in Victoria, of which 23,706 km comprise the CRB's network of the State's principal roads.
The lengths of roads declared or proclaimed under the Country Roads Act are State Highways 7,022 km, freeways 288 km, main roads 14,567 km, tourists' roads 798 km, forest roads 1,031 km.

T H Russell
Chairman



W S Brake
Deputy Chairman



N L Allanson
Member

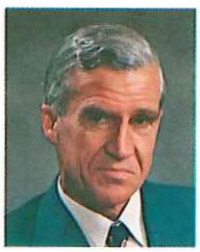
Principal Officers
as at 30th June 1979

K G Moody
Engineer in Chief

N S Guerin
Deputy Engineer in Chief

G K Cox
Secretary

P J McCullough
Deputy Secretary



R G Cooper
Chief Accountant

R J C Bulman
Deputy Chief Accountant

Divisional Engineers and Regional Divisional Offices

A N Jephcott
Bairnsdale

T M Glazebrook
Bendigo

J W Heid
Horsham

F G Lodge
Warrnambool

E T Oppy
Ballarat

S H Hodgson
Dandenong

R R Patterson
Metropolitan

B H Chandler
Benalla

G W Marshallsea
Geelong

D T Currie
Traralgon

Contents

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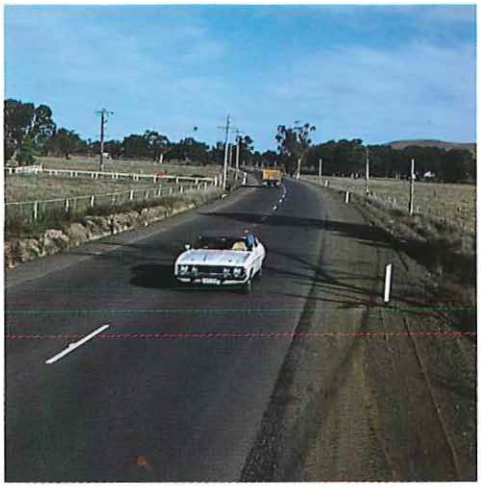

Main roads — construction work completed or substantially completed by municipal councils during the year:

1. Whittlesea Shire — Reconstruction of the Main Whittlesea Road between Cades Road and Donnybrook Road, Shire of Whittlesea.

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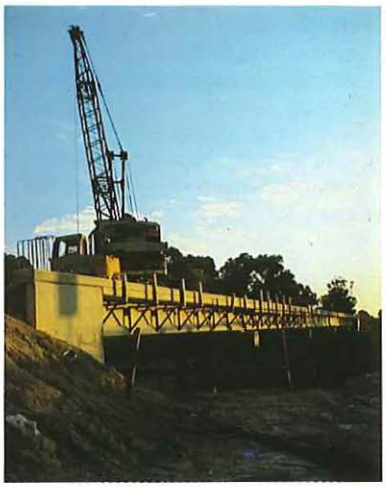

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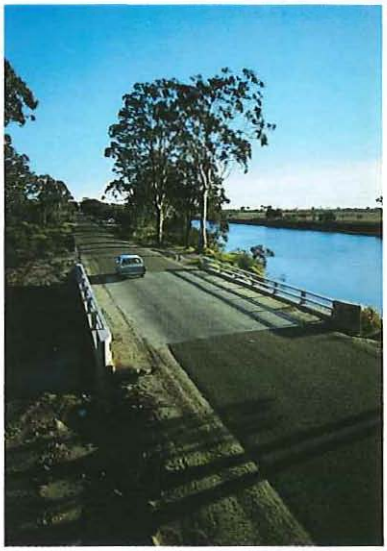

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2. Eltham Shire — Roundabout at the Eltham-Yarra Glen Road/Eltham-Templestowe Road intersection, Shire of Eltham.
3. Widening of 1.6 km of the Dandenong-Frankston Road nearing completion, City of Dandenong.
4. Construction of a 5 span bridge carrying Navarre Road over the Wimmera River, Shire of Stawell.
5. New 3 span bridge carrying Tarra Valley Road over the Tarra River, Shire of Bairnsdale.

Road construction funding

The inadequate level of funds available to the Board continues to be a matter of concern. Many essential projects in both the urban and rural areas of the State could be accelerated or commenced in 1979/80 to the economic benefit of the community if additional funds were made available to the Board. Some examples of significant projects are listed in the following table.

Urban area

Project	Description of work
Arterial Road Extension of the Eastern Freeway	Thompsons Road to Doncaster Road.
Burwood Highway	Construction of additional lanes between Springvale Road and Wantirna-Sassafras Road.
Calder Highway	Bypass of Keilor.
La Trobe Terrace, Geelong	Reconstruction between Hope Street and Fyans Street.
Mt Dandenong Tourists' Road	Widen and strengthen sections between Beauty Bend, Ferny Creek and Montrose.
Maroondah Highway Lilydale	Reconstruction between Queens Road and Warburton Highway.
Mornington Peninsula Freeway	Moorooduc Road to Dromana.
Mulgrave Freeway	Warrigal Road to Forster Road.
Nepean Highway	Widening between Elsternwick and Moorabbin.
Nepean Highway	Construction of additional lanes between Station Street, Mordialloc and Progress Avenue, Carrum.
Princes Highway West	Duplication from Princes Freeway to Werribee.
Tullamarine Freeway	Asphalt strengthening, Brunswick Road to Bell Street interchange.
Warburton Highway	Construction of climbing lane between Maroondah Highway and Seville.
Western Highway	Asphalt strengthening in Sturt Street, Ballarat.
West Gate Freeway	Graham Street to east of Kings Way.

Rural projects

Project	Description of work
Calder Highway	Construction of climbing lanes, intersection improvements, and regrading to remove crests between Gisborne and Bendigo.
Cann Valley Highway	Reconstruction north of Fiddlers Green Creek.
Glenelg Highway	Widening narrow sections west of Skipton.
Goulburn Valley Highway	Extension of duplication south of Shepparton.
Goulburn Valley Highway	Reconstruction in Seymour.
Great Ocean Road	Reconstruction on improved alignment between Apollo Bay and Calder River.
Henty Highway	Reconstruction between Hamilton and Cavendish.
Maroondah Highway	Replacement of bridge over Connellys Creek at Acheron.
Midland Highway	Reconstruction from Bagshot to Elmore.
Midland Highway	Construction of deviation through Dookie Hills.
Murray Valley Highway	Construction and sealing at Granya Gap.
Murray Valley Highway	Duplication through Echuca.
Murray Valley Highway	Reconstruction west of Wood Wood.
Murray Valley Highway	Construction and sealing from Lake Powell to Bannerton.
Northern Highway	Reconstruction north and south of Pyalong.
Omeo Highway	Replacement of road over rail bridge in Bruthen.
Omeo Highway	Construction of approaches to new bridge over Bundara River.
Ouyen Highway	General widening including realignment at the Boinka railway level crossing.
Ovens Highway	Replacement of bridge over Ovens River at Porepunkah.

Project	Description of work
Princes Freeway	Construction of bypass of Drouin.
Princes Freeway	Asphalt strengthening of sections between Brooklyn and Lara.
Princes Highway East	Extension of duplication east of Pakenham.
Princes Highway West	Construction of deviation at Cudgee.
Princes Highway West	Construction of deviation at Bolwarra.
Pyrenees Highway	Reconstruction at Mooney's Gap.

It is estimated that an additional $28 million over and above budgeted expenditure could be expended on the projects listed above in financial year 1979/80 if additional funds were to be made available to the Board.
Progress on a number of projects throughout the State which are under municipal control could also be accelerated if additional funds were available. It is estimated that an additional expenditure of $17 million could be expended on municipal projects in 1979/80.

New borrowing powers

During the year, the Country Roads (Borrowing Powers) Act 1978 was passed and came into operation on 5th December, 1978. The Act authorises the Board to borrow sums not exceeding $100 million and permits the Board to obtain a bank overdraft not exceeding $5 million.
The principal provisions of the Country Roads (Borrowing Powers) Act 1978:

(a) give the Board power to raise loan money with the consent of the Treasurer by the issue of inscribed stock or debentures; and
(b) enable the Board, for its temporary accommodation, to obtain advances by overdrafts on credit of the revenues of the Board or by such means as may be approved by the Treasurer.

Following the new powers given to the Board under that Act, the Board sought to have the Semi-Government Borrowing Programme for 1979/80 include an amount of $18 million to be borrowed by the Board for expenditure on land acquisition for future road projects.
Land acquisition costs would normally be met from revenue funds. If the Board were to receive $18 million loan funds in 1979/80 for land acquisition, a corresponding amount of revenue funds could be released for use in accelerating progress on road construction work.

Road maintenance charges

A special conference of National Ministers of Transport was held on 7th April, 1979 to deal with the emergency associated with blockades by transport operators. Arising from that conference, decisions were made by States to abolish road maintenance charges as from 1st July, 1979.
In Victoria, the obligation to pay road maintenance charges was imposed under the Commercial Goods Vehicles Act. The gross revenue to the Board from road maintenance charges in recent years under that Act has been as follows:

Year	$ million
1973/74	10.359
1974/75	10.038
1975/76	10.132
1976/77	9.968
1977/78	9.818
1978/79	9.577

With the object of replacing the revenue lost through the abolition of road maintenance charges in Victoria the Business Franchise (Petroleum Products) Act 1979 was passed during the autumn session of Parliament. That Act introduced a fuel franchise licensing system to apply to persons engaged in petroleum wholesaling and retailing. Details of this legislation are described on page 52 of this report.

Australian Roads Report

In April, 1979, the Commonwealth Bureau of Transport Economics released its interim report 'An Assessment of the Australian Road System: 1979 Part I'. The interim report follows three previous roads reports prepared by the Commonwealth Bureau of Roads and released in 1969, 1973 and 1975.
One of the conclusions in the interim report was that over the period 1974/75 to 1978/79, the real level of Commonwealth funding for roads fell by 6%, whilst State funding increased by 39% and Local Government funding increased by 7%, leading to an overall increase in real terms in roads expenditure in Australia of 11% over the four year period 1974/75 to 1978/79. For Victoria, the corresponding situation was that in real terms Commonwealth funding fell by 14%, whilst State funding increased by 13% and Local Government funding increased by 7%, leading to an overall increase of 3%. During the period 1974/75 to 1978/79, the number of registered vehicles in Australia increased by 13%.

Looking ahead, the interim report expresses the conclusion that for the four year period 1979/80-1982/83, a total programme amounting to $11,288 million at 1978-79 prices is economically warranted on an Australia-wide basis. Victoria's programme is assessed at $2,383 million. Implicit in this finding is a substantial relative increase in funding for rural and urban arterial roads, a moderate relative increase in funding for national highways and a relative reduction in funding for both rural and urban local roads.
The conclusion in the interim report with respect to local roads, is similar to the conclusions reached in the 1973 and 1975 Bureau of Roads' Reports, particularly with respect to urban local roads. Expenditure on urban local roads construction has been more than twice that calculated as the warranted level by the Bureau of Roads in 1973.
As stated in the interim report the level of the economically warranted programme over the 1979/80-1982/83 period, would require an annual increase of 16.1% per annum in expenditure in real terms over the four year period, Australia-wide, but the information in the report indicates that the corresponding increase would require only 8.8% per annum in Victoria. A matter of concern is that if the present level of road expenditure in Victoria continues without being increased, there will be a deterioration in the physical standard of Victoria's road network related to traffic demands on that network.

Board members

Retirement of Mr R E V Donaldson

Mr R E V Donaldson, ISO, AASA (Senior), AIMA, FCIT, JP, retired as Chairman of the Country Roads Board on 8th December, 1978 after having occupied that position for seven years. His retirement ended 33 years' service with the Board. He rose through the administrative ranks to the position of Secretary on 1st July, 1956, before being appointed Board Member in August, 1962, Deputy Chairman in July, 1963 and Chairman in September, 1971.
Mr Donaldson also served terms as Chairman of the Australian Road Research Board, and Chairman of the National Association of Australian State Road Authorities.
In 1967 Mr Donaldson completed study tours of parts of North America, the United Kingdom and Europe and attended the Permanent International Association of Road Congresses Conference in Mexico City in 1975 and the International Road Federation Conference in Japan in 1977.
The period for which Mr Donaldson was Chairman of the Board saw the continued development of high standard roads in Victoria, including the progressive construction of divided highways and the opening of a number of freeways. A significant event during this period was the transfer to the Board in 1974 of the roading functions of the Melbourne and Metropolitan Board of Works.
Mr Donaldson became a Companion of the Imperial Service Order in the 1979 Queen's Birthday honours list.

Appointments

Mr T H Russell, M Eng Sc (Hons), BCE (Hons), Dip CE, CE, FIE Aust, formerly the Board's Deputy Chairman, was appointed Chairman to succeed Mr Donaldson. Mr Russell was appointed Board Member in 1971 and then Deputy Chairman in 1975.
Mr Russell's appointment as Chairman was followed by the appointment of the former Board Member, Mr W S Brake as Deputy Chairman and Mr N L Allanson as Board Member. Mr Allanson was formerly Secretary of the Board.
Mr Russell joined the Board in 1943 as a diplomate engineer from the Gordon Institute of Technology. His early service with the Board was mainly in the drafting, surveying and construction supervision field, including approximately one year in the Northern Territory on the construction of the North-South Road.
He worked in the Board's Benalla and Traralgon Divisions and was subsequently appointed Assistant Divisional Engineer, Traralgon Division. From 1959 onwards he occupied various positions including Assistant Engineer for Plans & Surveys, Assistant Bridge Engineer, Chief Bridge Engineer, Deputy Chief Engineer and Chief Engineer.
Mr Russell is a Fellow of the Institution of Engineers, Australia, and was Chairman of the Structural Branch of Victoria Division in 1967. He is currently a member of the Engineering Faculty of the University of Melbourne.
In 1973 Mr Russell was appointed Convenor of the National Association of Australian State Road Authorities Economics of Road Vehicle Limits Study which has resulted in substantial progress towards the rationalisation of mass and dimension limits for heavy vehicles throughout Australia.

Draft Transport Plan for Victoria

In December, 1978, the State Government released a three volume document entitled 'Transport Plan 1978 for Victoria'.

The plan, issued as a draft for community discussion, was compiled by a working party of the State Co-ordination Council comprising representatives from the following departments and authorities:

- ☐ Premier's Department.
- ☐ State Treasury.
- ☐ Ministry for Conservation.
- ☐ Town and Country Planning Board.
- ☐ Victorian Railways Board.
- ☐ Education Department.
- ☐ Department of Crown Lands and Survey.
- ☐ Ministry of Transport.
- ☐ Ministry for Planning.
- ☐ Country Roads Board.
- ☐ Melbourne and Metropolitan Board of Works.
- ☐ Road Safety and Traffic Authority.

The draft plan discusses a number of transport issues, including features and constraints of the existing public transport system, availability of transport services, energy conservation, protection of the environment. It then develops policies in response to these issues, some of these policies being of a general nature and some relating to specific geographic areas.

The draft plan presents a future transport strategy to implement the above policies aimed at optimising the use of the existing public transport system while at the same time reflecting the dominant place of the motor car in today's Australian society.

The plan lists the requirements of the future transport strategy as being to:

- ☐ work within realistic funding limits;
- ☐ focus on a short to medium term works programme rather than a longer term blueprint;
- ☐ place more emphasis on obtaining best use of existing facilities by appropriate modifications;
- ☐ be flexible, seeking to preserve as many options as possible for future developments;
- ☐ use stage construction as far as possible; and
- ☐ include a process for continual monitoring of supply and demand factors, periodic review, and co-ordinated planning and implementation.

Within the overall transport strategy, general transport policies to improve both private and public transport are contained in the document.

These policies are to:

- ☐ continue to improve the State's public transport services wherever it is in the overall community interest;
- ☐ encourage the use of public transport wherever possible;
- ☐ keep public transport fares at the lowest practicable levels;
- ☐ improve the availability of transport to those without access to private cars or existing public transport services;
- ☐ provide and improve metropolitan and country roads to cater for personal and goods movements that cannot be adequately handled by fixed-track public transport;
- ☐ encourage transport developments and uses that contribute to conservation of energy sources that are becoming scarce;
- ☐ minimise the adverse effects of transport on the environment;
- ☐ remove unnecessary restrictions on freedom of choice of transport modes;
- ☐ co-ordinate transport policies with land-use and other policies;
- ☐ preserve options for future improvements of the transport system to ensure flexibility of approach;
- ☐ improve safety in private and public transport;
- ☐ provide equitable compensation for property owners affected by transport improvements;
- ☐ develop a process for the modification, co-ordination and implementation of transport policies including inter governmental, inter agency and public participation; and
- ☐ continue with trials of alternative types of transport systems.

The draft Five Year Plan for the period 1978/79-1982/83 was prepared on the basis that the total expenditure on transport works undertaken by the principal transport agencies would be 10% higher in real terms over the five years than the expenditure achieved by the continuing 1977/78

Nepean Highway, at the Hampton Street intersection — construction of divided highway.

expenditure level of $292 million, adjusted only for cost escalation.
In addition to the completion of a number of large projects now in progress, the draft plan lists a number of highly desirable projects of metropolitan or State-wide significance for the period 1978/79-1982/83 including the following:
☐ the co-ordination of traffic signals with the installation of traffic signal control systems in congested areas;
☐ the widening of Bridge Road between Punt Road and Church Street;
☐ the upgrading of the Eastern Highway as an approach route to the Eastern Freeway;
☐ improvements to the Princes Highway East between Hawthorn Road and Waverley Road;
☐ the arterial road extension of the Eastern Freeway to Doncaster Road;
☐ the construction of Route E6, from the Eastern Freeway to Harp Road;
☐ the construction of the Outer Ring Freeway F5 from Dalton Road to the Heidelberg-Kinglake Road together with the section of Greensborough Freeway south to Watsonia Road;
☐ the Western Freeway — bypass of Melton;
☐ the Princes Freeway — bypass of Berwick;
☐ the Princes Freeway— bypass of Warragul;
☐ the Hume Freeway — bypass of Wodonga;
☐ the Calder Freeway— bypass of Keilor;
☐ the replacement of bridges over the Murray River at Mildura, Echuca, Swan Hill, Tocumwal and Barham;
☐ other projects to remove existing bottlenecks and eliminate hazards by pavement reconstruction and widening, and improvement to existing intersections.
For the period beyond the next five years, the plan indicates a number of desirable proposals to be implemented including the following:
☐ widening of Punt Road;
☐ widening of the Western Highway (Ballarat Road) between the Princes Highway West (Geelong Road) and Ashley Street;
☐ the development of Ashley Street as a connection between the Western Highway and the Princes Highway West;
☐ the connection of Mulgrave Freeway to the South Eastern Freeway along the Gardiners Creek Valley;
☐ Route 7 from Dingley Freeway to Highbury Road;
☐ the extension of the Eastern Freeway from Doncaster Road to Ringwood including an arterial bypass of Ringwood.
The draft plan also lists a number of road improvement proposals which will receive further examination.

Johnson Street Bridge opening

The Johnson Street Bridge over the Yarra River was opened by the Acting Minister of Transport, the Hon A H Scanlan, MP, on Friday, 4th August, 1978.
The project involved the construction of twin 5 span bridges, each with 4 traffic lanes, connecting Footscray Road, north of the Yarra River, to Lorimer, Johnson and Montague Streets in South Melbourne.
The bridge superstructure was constructed of precast, prestressed concrete beams with a 150 mm reinforced concrete deck slab.
The bridges are low level structures with a maximum river clearance of 3.9 m at mean low water level.
Most of the dock and wharf facilities upstream have been replaced elsewhere in the Port of Melbourne.
In addition to the bridge, approach roads were constructed on either side of the river and a number of local roads were improved.
Computer controlled traffic control signals at the main intersections in the vicinity of the new crossing have been linked to obtain optimum traffic flow.
The total cost of the bridge and approach works was approximately $30 million.

Johnson Street Bridge across the Yarra River.

West Gate Bridge Opening

The West Gate Bridge was opened by the Premier, the Hon R J Hamer, ED. MP, on Thursday, 15th November 1978.

The 5.63 km bridge was constructed by the West Gate Bridge Authority.

The Board spent in excess of $14 million on the western approaches to the bridge and in excess of $6 million on road improvements and an Advisory Truck Route on the eastern approaches to the bridge.

The Board is currently engaged in the construction of the West Gate Freeway (South Melbourne Section), which when completed, will provide a continuation from the eastern approaches to the West Gate Bridge at Graham Street, Port Melbourne to east of Kings Way, South Melbourne. The freeway is needed to cater for West Gate Bridge and Johnson Street Bridge traffic and will provide a vastly improved road connection between the western and south-eastern suburbs.

New Autograde

In February, 1979, the Board took delivery of a CMI Autograde TS 500 machine for use in shaping road formations and spreading layers of pavement material to an accurate finished level. The Autograde machine has been proven throughout the world as an efficient and highly productive item of road making equipment and its use will result in cost savings and the earlier completion of major projects. The machine was imported from the USA at a cost of approximately $411,000.

The Autograde machine can operate over a two lane width of road. It has automatic controls and is self-propelled, utilising electronic sensing devices operating along string lines set by surveyors ahead of the machine. This enables a high degree of accuracy to be offered in the finished work and also enables the machine to work on curves as well as straight sections of road.

Since its commissioning the Autograde machine has been used on the Hume Freeway, Avenel to Tubbs Hill Project and will be used on other major projects on the Hume Freeway and other freeways.

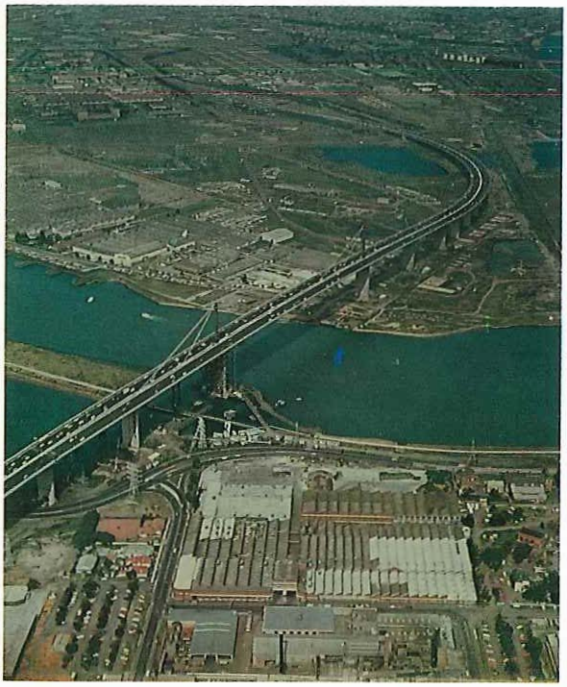
Eastern Freeway traffic study

In April, 1979, the Board released the findings of a study into the traffic distribution effects of the Eastern Freeway. The study showed that although there had been traffic volume increases on some roads, there had been no significant increases in total traffic volumes in the western approaches area to the freeway since it was opened in December, 1977.

The study titled "Eastern Freeway Corridor Traffic Studies — Before and After Opening of Freeway", revealed details of a major traffic counting survey, a travel time study and an origin and destination survey, extending from Carlton to Ringwood.

The study placed special emphasis on the western approaches area of Carlton, Fitzroy and Collingwood.

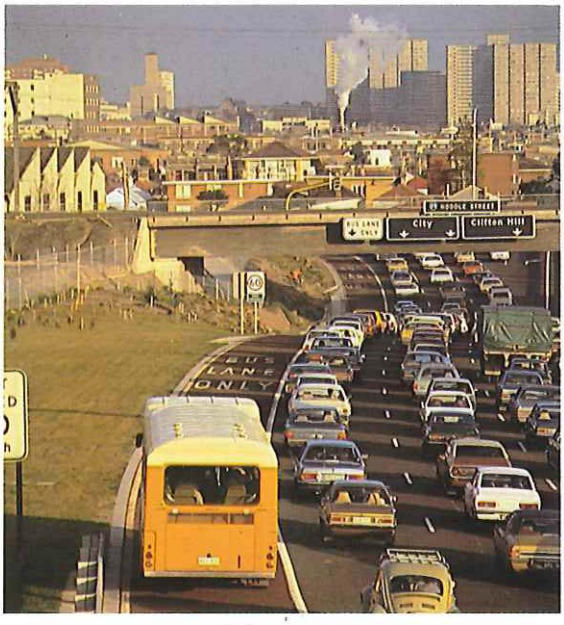
The study showed that total traffic crossing Hoddle Street, between Heidelberg Road and Victoria Street, had only increased from 153,000 vehicles per day before the freeway opened to 159,000 vehicles per day, with approximately half of this increase being attributable to natural growth in traffic.



West Gate Bridge across the Yarra River.

CMI Autograde in operation on the Hume Freeway, north of Avenel.

A significant fact disclosed by the study was the large percentage of freeway users who had origins and destinations in the western approaches area of Carlton, Fitzroy and Collingwood. The study showed that this percentage varied during the day, but that in peak hours it was approximately 28%.
The study also showed that the freeway had resulted in major community benefits in the corridor, including:
☐ Reduction in the travel times for motor vehicles by up to 18 minutes or 50% of travel time, depending on the origin and destination.
☐ Improvement in tram and bus service travel times, together with a 24% increase in bus patronage from the Doncaster area.
☐ Substantial redistribution of traffic away from local residents and commercial streets to the freeway.



Eastern Freeway — exclusive bus lane and morning peak traffic on exit ramp at Hoddle Street.

In addition, the Board expects that the freeway will result in an annual reduction in traffic casualty accidents of more than 60, including 4 fatalities. Measured in monetary terms, it is estimated that this would result in an annual community saving of at least $1 million.
Whilst in overall terms the study showed that the freeway has resulted in a nett benefit to the community, some localised areas were identified that had been disadvantaged with the opening of the freeway, and remedial action is being taken where possible to improve conditions in these areas.

Traffic management and road safety

In recent years the Board has been involved to an increasing extent in planning and implementing traffic management measures in conjunction with road improvements of all kinds on the Board's declared road system. These measures improve traffic flow and control traffic movements and can result in a substantial reduction in accident rates.
The Board's program of freeway and major road widening projects can significantly improve traffic flow and road safety within given corridors. However, these major facilities are expensive to construct and traffic management techniques can provide a relatively low cost means of improving traffic flow on the existing road system.
The Board's main aims when considering the use of traffic management techniques are the improvement of safety and road capacity, the reduction of travelling times and the reduction of the adverse effects of traffic, with improvements to both driver and pedestrian safety as the primary aim.
The Board has at its disposal a wide variety of techniques to provide better traffic management. These techniques include the installation and linking of traffic signals, flaring and channelisation of intersections, the construction of roundabouts and the installation of priority bus lanes.

Traffic signals

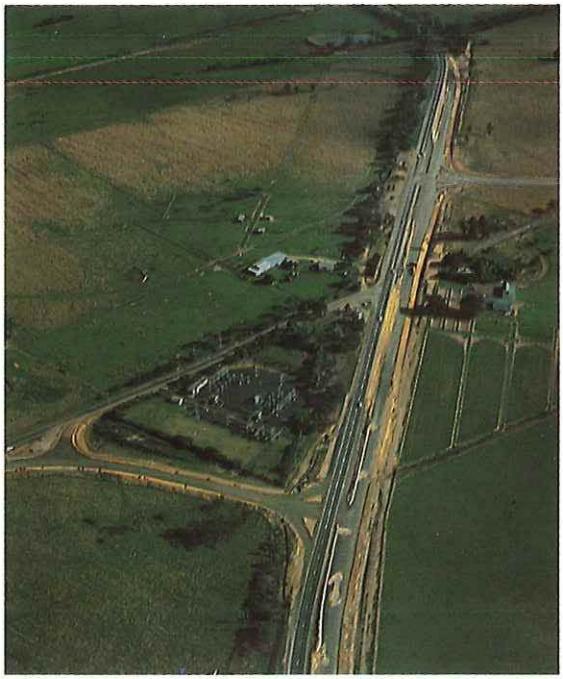
Traffic signals are vital to the road network, particularly in the Melbourne urban area, where large numbers of vehicles passing through intersections from different directions make it essential that the flow of traffic be regulated.
The effective control of traffic through intersections by the installation of traffic signals can reduce accidents by up to 50%. In addition to the obvious benefit of reductions in the numbers of fatalities and injuries, this means less damage to vehicles and therefore lower operating costs for motorists.
With the sophisticated equipment now being installed by the Board, traffic signals can be controlled by mini-computers making it possible to link traffic signals on a particular route to assist the flow of traffic.
In August, 1978, the traffic signals on the approach roads to the newly opened Johnson Street Bridge over the Yarra River were linked by a mini-computer that analyses traffic flow and adjusts the signal phases accordingly.
On the Maroondah Highway through Ringwood the Board has linked the traffic signals so that traffic passing through this busy shopping centre flows more freely, which in turn improves access to the shops.

Flaring and channelisation of intersections
In many cases when traffic signals are installed by the Board, the intersection is flared or channelised to remove the obstruction caused by turning traffic. Channelisation or line marking, increases the number of lanes over a length of road resulting in improved traffic flow and increased capacity of the road. This type of improvement is illustrated on the Calder Highway east of Keilor, where in September, 1978, the pavement was marked and signs were erected to allow two lanes for traffic in the direction of the peak traffic flow, and one lane in the other direction.

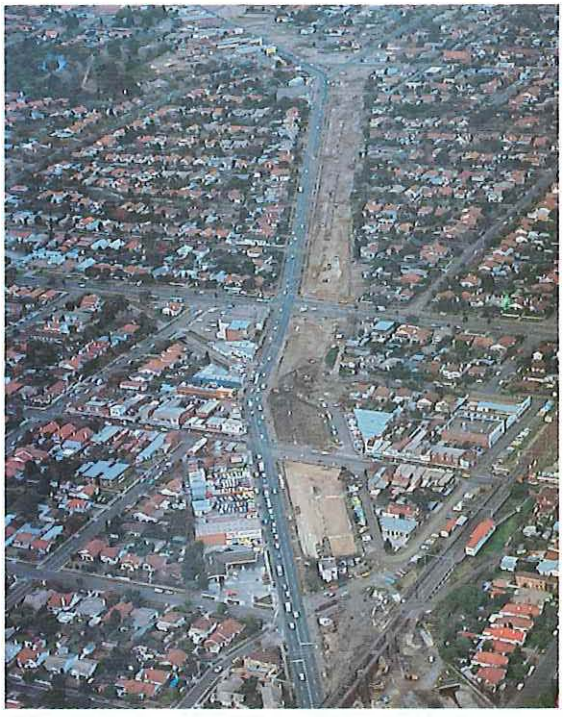
Roundabouts
In recent years the Board has become more involved in the construction of roundabouts which in some cases have advantages over traffic signals or conventional unsignalised intersections. Roundabouts can be easier and cheaper to install on low volume roads and can allow for better landscape treatment. They are also capable of catering for high traffic flows and can reduce traffic delays.
In South Melbourne the Board constructed a roundabout at the Normanby Road-Clarendon Street-Yarra Bank Road intersection as part of the improvements for the $600,000 Advisory Truck Route to the West Gate and Johnson Street bridges. In addition to the roundabout, the Bay Street/Graham Street intersection was flared and channelised, Market Street and York Street were converted to one way streets and traffic signals were installed at the Normanby Road/Lorimer Street intersection.

Bus lanes
The Board provided an exclusive bus lane at the Hoddle Street exit of the Eastern Freeway. In March, 1979, this lane was extended easterly along the freeway by approximately 1 km, to improve conditions for buses.
Proposals were considered during the year in conjunction with municipal councils concerned for the installation of a special bus lane in Johnston Street, Collingwood, from east of Nicholson Street, Abbotsford to west of Wellington Street, for a trial period.

Rural roads
A wide range of relatively simple measures is used by the Board to improve safety on rural roads throughout the State.
Some examples include the erection of slip base sign poles that break away at the base if hit by vehicles; the planting of trees and shrubs back from the road pavement so that a driver has time to take corrective action if the vehicle leaves the road; the



Princes Highway — construction of a staggered 'T' intersection at Racecourse and Army Roads, Pakenham.



Nepean Highway — widening work south from Gardenvale.

erection of guard railing to keep vehicles away from solid objects; the use of guide posts, raised reflective pavement markers and linemarking to delineate the road; and the introduction of the STATCON system which by the erection of "Stop" and "Give Way" signs establishes a system of priority roads.

In addition, the construction of climbing lanes to allow faster vehicles to pass slower vehicles, and staggered "T" intersections to eliminate minor cross roads, can improve safety. During the year, the Board constructed climbing lanes on the Princes Highway East at Jefferson Hill, Tynong and a staggered "T" intersection at Racecourse Road and Army Road, Pakenham.

The total number of intersection improvements on arterial roads in the Metropolitan area, including major and minor reconstruction, traffic signals and safety features were as follows:

	1977-78	1978-79
Constructed by Councils (with the Board's financial assistance)	44	62
Constructed by the Board	24	45
Total	68	107

Flood and storm damage restoration works

Extensive flooding in eastern Victoria in June, 1978, and in the southern and northern areas of the State in August, November and December, 1978, caused widespread damage to roads, road closures and hazards to traffic. State highways affected were the South Gippsland Highway, Cann Valley Highway, Princes Highway East, Midland Highway and the Bonang Highway.

Severe windstorms in the north central areas of the State in January, 1979, also caused considerable damage to State highways including the Northern Highway, Calder Highway, Loddon Valley Highway, Midland Highway and the McIvor Highway. Emergency work was required to re-open these highways to traffic.

During the 1978-79 financial year grants totalling $3.82 million were made by the State Government, under a Commonwealth/State agreement, for restoration works following natural disasters. Some works were carried out under the direct supervision of the Board's staff and others were carried out under municipal supervision.

Under a new Commonwealth/State agreement which came into effect on 1st January, 1979, the State Government meets the first $7 million of restoration costs and the Commonwealth Government meets any additional amount required. Local Government is responsible for the full cost of the restoration where the total cost does not exceed $10,000. Where the total cost exceeds $10,000, but is less than $110,000, Local Government is responsible for the first $10,000 plus 25% of the balance of the total cost. Where the total cost exceeds $110,000, Local Government is responsible for an amount of $35,000. Allocations for emergency works are made free of Local Government contribution. Assistance is not provided for any expenditure incurred in restoring assets beyond the standards which existed prior to the disaster.

Applications from councils for funds to restore roads and bridges damaged by floods are referred to the Board for investigation and recommendation to the Treasurer.

The road system

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 7,022 km, as at 30th June, 1979.
Significant works completed or substantially completed during the financial year are listed in the Road Construction and Maintenance section of the report.
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 States Grants (Roads) Act 1977. These declarations permitted funds made available by the Commonwealth to be spent on the Hume Highway/Freeway and the Western Highway/Freeway.

Western Highway reconstruction completed east of the Hadden-Windermere Road.

Eastern Freeway.

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 carriageways by means of carefully designed ramps. The Board bears the total cost of all work on freeways.
Significant works completed or substantially completed during the financial year are listed in the Road Construction and Maintenance section of this report.

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.
Significant works completed or substantially completed during the financial year are listed in the Road Construction and Maintenance section of this report.

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. Significant works completed or substantially completed during the financial year are listed in the Road Construction and Maintenance section of this report.

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 work on main roads completed or substantially completed during the year is given in the Municipal section of this report.

Springvale Road, City of Waverley (Main Road).

Lavers Hill-Cobden Road, new 4 span bridge over Kennedy Creek, Shire of Otway (Forest Road).

Kings Road, City of Keilor, reconstruction between Gillespie and Taylors Roads (Unclassified Road).

The total length of roads declared or proclaimed in Victoria under the Country Roads Act was 23,706 km as at 30th June, 1979.

The declared road system

'000s km	0 2 4 6 8 10 12 14 16 18 20 22 24
State Highways	7,022
Freeways	288
Tourists' Roads	798
Forest Roads	1,031
Main Roads	14,567
Total length of declared road system	23,706

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 municipal council concerned.

A summary of the more significant works on unclassified roads completed or substantially completed during the year with financial assistance from the Board appears in the Municipal section of this report.

The amount of money spent on each type of road is outlined in the Finance section of this report.

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

As at 30th June, 1979.

State Highways declared as at 30.6.79

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	554.6

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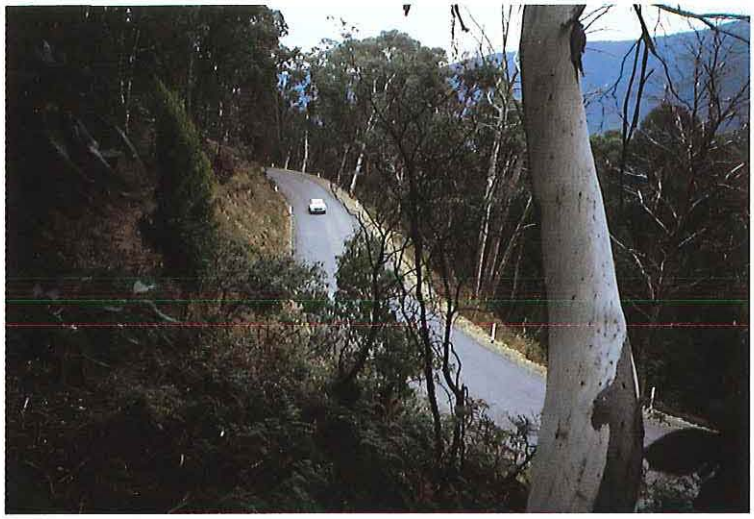

Work on tourists' roads for the benefit of recreation travel:

1. Alpine Road — extension of sealed pavement, south of the 'Meg'.
2. Bogong High Plains Road — widened section near Turnback Creek.
3. Alpine Road — extension of sealed pavement between Loch Spur and Hotham Heights.
4. Phillip Island Road — resurfaced.

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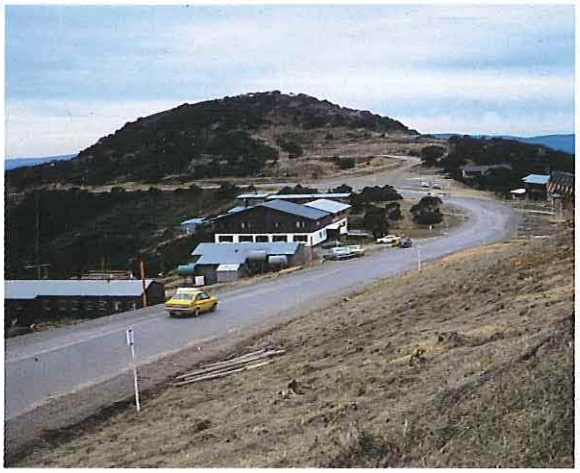

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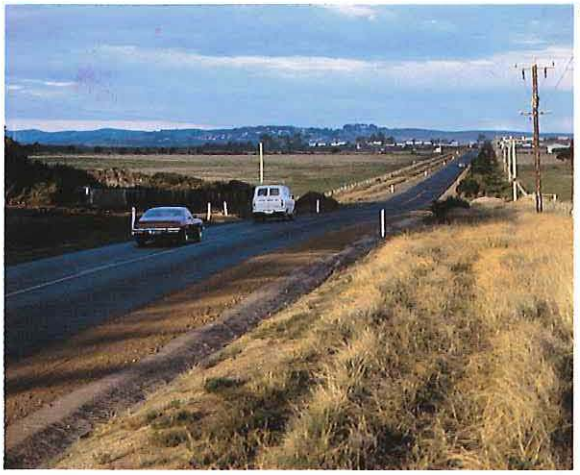

State Highways — declared as at 30.6.79 (cont.)

Name	Section	Length (kilometres)
Cann Valley	Cann River-NSW border	44.9
Eastern*	Nicholson Street-Gold Street	1.2
Glenelg	Ballarat-SA border near Mt Gambier	282.2
Goulburn Valley	Eildon-Strathmerton	223.8
Hamilton	Geelong-Hamilton	231.0
Henty	Portland-Lascelles	336.1
Hume*	Melbourne-NSW border near Albury	210.5
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-Mansfield	414.7
	Morwell-Port Welshpool	78.9
Murray Valley	Corryong-Hattah	737.0
Nepean	Melbourne-Portsea	91.1
Northern	Kilmore-Echuca	161.9
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	499.4
Princes (West)*	Melbourne-SA border near Mt Gambier	401.9
Pyrenees	Elphinstone-Ararat	147.1
South Gippsland*	Dandenong-Yarram-Sale	254.0
Sturt	Mildura-SA border near Renmark	113.6
Sunraysia	Ballarat-Calder Highways	340.0
Warburton	Lilydale-Warburton	34.6
Western*	Melbourne-Serviceton	371.5
Wimmera	Apsley-St Arnaud	222.2

*Lengths quoted do not include freeway sections.

Freeways — as at 30.6.79

Name	Section	Length (kilometres)
Calder	Keilor	2.8
	Elphinstone	2.8
Eastern	Hoddle Street to Bulleen Road	9.0
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	15.6
	Chiltern	21.3
West Gate	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 and Haunted Hills	19.7
	Laverton	12.8
	Maltby	10.2
	Lara	24.4
	Dartmoor	3.0
South Eastern	Anderson Street to Tooronga Road	6.8
South Gippsland	Whitelaw	3.8
	Princes Freeway to Pound Road	5.6
Tullamarine	Flemington Bridge to Melbourne Airport	20.9
Western	Deer Park to Melton	13.3
	Bacchus Marsh	8.9
	Pentland Hills	9.0
	Pykes Creek	7.3
	Ballan	7.8
	Gordon	8.9

Forest roads — declared as at 30.6.79

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

Forest roads— declared at 30.6.79 (cont.)

Name	Municipalities	Length (kilometres)
Buchan-Ensay	TamboShire	19.8
Bullumwaal-Tabberabbera	Bairnsdale Shire	30.3
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	42.7
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

Tourists' roads— declared as at 30.6.79

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	209.0
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

Road construction and maintenance

Major projects

During the year the Board continued work on 16 projects, each having an estimated cost of at least $4 million. Many of the major projects included the construction of divided roads which as a result of work completed during the year have increased the total length of dual carriageways on freeways, State highways, and main roads throughout the State to 765 km. The more important major projects in progress during the year included:

URBAN

Arterial Road Extension of the Eastern Freeway

Preliminary work for a 2.7 km arterial road from the Eastern Freeway, at Bulleen Road, to Doncaster Road began during the year.

Work at the Doncaster Road terminal which began in early 1979, includes the widening and channelisation of the Doncaster Road-High Street intersection.

The total estimated cost of the arterial road extension and the Doncaster Road intersection work is $18.7 million at 1979 prices. The Doncaster Road intersection work is expected to be completed in 1980 and the arterial road extension in 1983 subject to the availability of funds.

West Gate Freeway

Work continued on the 3.6 km West Gate Freeway, between Graham Street, Port Melbourne and Grant Street, South Melbourne. The freeway will be elevated for 1.85 km from west of Johnson Street to east of Kings Way and will provide three lanes for traffic in each direction.

Land acquisition and site clearance is well advanced and a contract for the construction of 122 foundation piles has commenced.

Alterations to the existing freeway between Graham Street and Rogers Street were completed and opened to traffic on 15th November, 1978, when the West Gate Bridge was opened. Work is continuing on improvements to local streets adjacent to the freeway alignment.

The project is estimated to cost $87 million at 1979 prices.

Tullamarine Freeway

Work continued during the year on the upgrading of Lancefield Road, adjacent to the Essendon Airport, to freeway standard. The project includes the construction of an interchange at English Street to provide access to Essendon Airport and Mathews Avenue. The project is estimated to cost $8 million at 1979 prices and is expected to be completed in mid 1980.

Johnson Street Bridge

The Johnson Street Bridge over the Yarra River, linking Footscray Road, Melbourne, and Lorimer Street, South Melbourne, was opened to traffic by the Acting Minister of Transport, the Hon A H Scanlan, MP, on 4th August, 1978.

The bridge consists of twin structures, each with four lanes for traffic, and cost $30 million.

A more detailed description of this project is included on page 8 of this report.

Latrobe Terrace, Geelong

Work began on the construction of a high capacity arterial road along Latrobe Terrace in Geelong. The new arterial road will pass to the west of Geelong's Central Business District and is part of the recommendations of the Geelong Transportation Study.

The first stage of the Latrobe Terrace project currently underway involves the construction of a road over rail overpass from the Princes Highway West, near York Street, to Hope Street, and duplicate carriageways from Keera Street to Fyans Street, a distance of 2.4 km.

An 8 span pedestrian overpass over the railway line is being constructed to restore pedestrian access.

Later stages will extend the duplicate carriageways to the south and include a new bridge across the Barwon River and improvements to Settlement Road, Belmont.

The first stage is estimated to cost $10 million at 1979 prices and is expected to be completed in 1982.

Tullamarine Freeway — asphalt resurfacing south of Brunswick Road.

Nepean Highway
Work continued on the widening of 6 km of the Nepean Highway between Cochrane Street, Elsternwick and South Road, Moorabbin.
The demolition of properties on the first section between Cochrane Street and Hampton Street was completed and preliminary earthworks began. Work by the Victorian Railways at the Gardenvale railway bridge progressed satisfactorily.
The total project is estimated to cost $38 million at 1979 prices and is expected to be completed in 1984.

Calder Freeway
Work continued during the year on the 5 km Calder Freeway, Keilor Section, between Erebus Street and the Keilor-Melton Road. Earthworks are underway on the first section of the freeway between Erebus Street and Arundel Road.
The total project is estimated to cost $17.6 million at 1979 prices and is expected to be completed in 1983/84.

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. Earthworks were substantially completed during the year together with the placement of pavement material on various sections. The construction of bridge structures at Thompson Road, Chelsea Road and Patterson River progressed satisfactorily.
The project is estimated to cost $15 million at 1979 prices and is scheduled for completion in mid 1980.

Mulgrave Freeway
Work continued on the construction of the 3.7 km extension of the freeway from Forster Road to Warrigal Road, Oakleigh.
The section of the freeway between Forster Road and Huntingdale Road is expected to be opened to traffic in late 1979.
Between Huntingdale Road and Warrigal Road earthworks continued and the construction of the Atkinson Street bridge began. The reconstruction of 1.2 km of Warrigal Road at the freeway terminal progressed satisfactorily.
The whole project is estimated to cost $15.5 million at 1979 prices and is expected to be completed in 1981.

RURAL

Western Freeway
Wallace-Bungaree Section
Work continued on the construction of the 11.9 km freeway section bypassing the townships of Wallace and Bungaree. Work proceeded on earthworks throughout the project and on bridgeworks at Ormond Road and Wallace Street.
The project is estimated to cost $15 million at 1979 prices and is expected to be completed in 1983.

Princes Freeway
Drouin Section
Construction of the 7 km bypass of Drouin continued during the year. Earthworks advanced satisfactorily and the bridge structures were completed at Robin Hood on the Princes Highway East and Main Neerim Road.
The project is estimated to cost $10 million at1979 prices and is expected to be completed in early 1981.

Hume Freeway
Seymour to Avenel
Minor bridge and culvert construction on the 7 km Seymour Section between Ford Road and the Goulburn River began during the year.
Work continued on the 20 km Avenel Section between the Goulburn River and north of Avenel. Earthworks were well advanced and work on the freeway bridges over the north east railway and the existing Hume Highway continued. Bridges across Hughes Creek at Avenel were completed during the year.
The whole project is estimated to cost $41 million at 1979 prices and the Avenel and Seymour Sections are expected to be completed in 1981 and 1983 respectively.

Avenelto Tubbs Hill
Duplication work on the 12 km section of the existing Hume Highway continued during the year.
This section is estimated to cost $7.9 million at 1979 prices and is expected to be completed in late 1979.

Euroa to Violet Town
Duplication of 6 km of the existing Hume Highway commenced during the year. Clearing and drainage work within Violet Town Shire progressed satisfactorily.
The project is estimated to cost $4.2 million at 1979 prices and is expected to be completed in 1981.

Violet Town Bypass
Work continued on the construction of a 6.1 km freeway bypass of Violet Town including the construction of an overpass at Harrys Creek Road.
The project is estimated to cost $7 million at 1979 prices and is expected to be completed in mid 1980.

Violet Town to Baddaginnie
Construction of a 10 km duplicate carriageway and upgrading the existing highway as the southbound carriageway between Violet Town and Baddaginnie was completed in early 1979 at a cost of $5.1 million.

Major freeway construction:

1. Calder Freeway, Keilor.
2. Princes Freeway, Drouin.
3. Western Freeway between Wallace and Bungaree — rock drilling prior to blasting.
4. Hume Freeway — under construction from north of Euroa to Violet Town.

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 1977/78 are shown in the following table:

	1977-78		1978-79	
Type of contract	No. of contracts	Value $	No. of contracts	Value $
Road construction —				
1. Over $1M	1	3,074,845	1	1,437,524
2. $100,000 to $1M	3	884,798	4	1,084,935
3. Under $100,000	1	26,884	4	268,005
Supply of roadmaking materials	112	5,173,648	121	6,089,928
Bituminous treatment and supply of materials	54	11,130,377	78	15,675,050
Bridge construction —				
1. Over $1M	—	—	1	3,212,598
2. $100,000 to $1M	9	2,640,745	4	963,780
3. Under $100,000	8	412,790	5	270,166
Components and fabricated steel	19	1,260,821	17	1,254,088
Building construction	—	—	2	145,302
Construction equipment	19	1,389,507	27	1,645,696
Divisional facilities	1	64,489	1	52,682
Miscellaneous stores	2	520,000	1	37,030
Miscellaneous services	53	2,174,613	44	1,258,899
Total	282	28,753,517	315	33,400,683

Bituminous surfacing

Bituminous surfacing forms an important part of road construction and maintenance work.

A total amount of $32.8 million was spent in surfacing 4,897 km of road during the financial year. Approximately 95.5% of the total length of bituminous surfacing done was of the sprayed seal type.

The balance was of asphalt surfacing which is plant mixed and spread in a layer with a mechanical paver.

The sprayed seal process involves the spraying of a thin hot bituminous layer on to the road surface, followed by spreading a layer of aggregate which is rolled into the bitumen by pneumatic tyred rollers and controlled traffic. It is an economical surfacing process which provides a safe, skid resistant surface and for these reasons is used widely throughout the world. For a successful sprayed seal to be obtained it is necessary for some loose aggregate to be left on the road surface on completion. The Board is conscious of the need to prevent windscreen damage caused by loose aggregate and provides appropriate warning signs, requesting motorists to travel slowly during the first few days after sealing. Traffic controlmen are also on duty while the work is in progress.

The Board's 17 mobile bituminous surfacing units, together with plant owned by municipal councils and contractors, completed 4,697 km of sprayed work at a cost of approximately $20.3 million.

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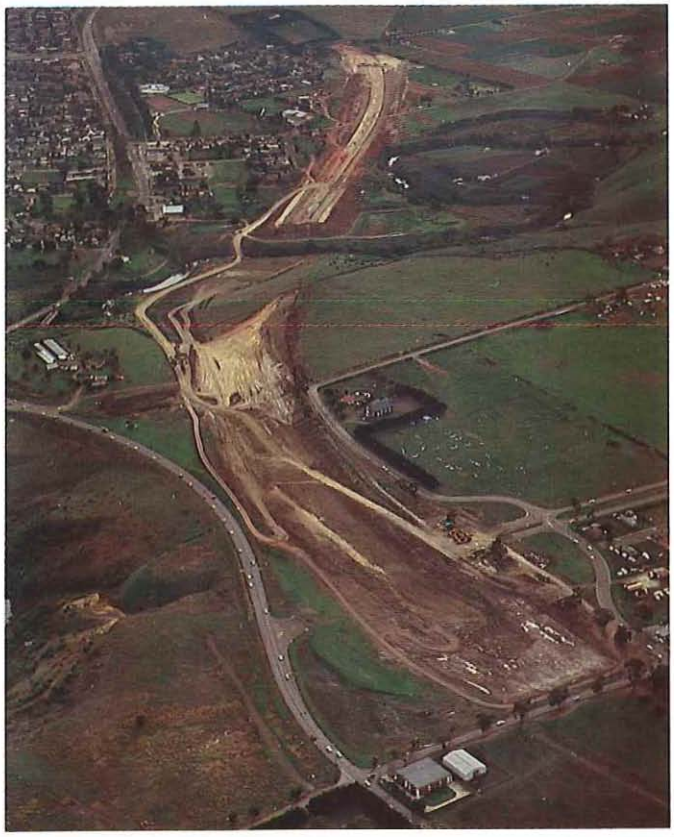

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Contractors operating from fixed asphalt plants completed 200 km of plant mix work on densely trafficked roads at a cost of approximately $12.5 million using 446,700 tonnes of asphalt.
The lengths of the various types of work completed during the year were:
224 km of sealing widened pavements,
25 km of initial sealing on dual carriageways,
594 km of restoration of sealed coats on reconstructed sections,
494 km of final sealing on initial treatments,
2,620 km of maintenance retreatments,
369 km sealed on behalf of other State and municipal authorities, and
571 km of extensions to the bituminous sealed road system of the State including 33 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	36,000 tonnes
Bitumen for asphalt	23,000 tonnes
Aggregate for sprayed work	285,000 cu. metres
Aggregate for asphalt	303,000 cu. metres
Other bituminous materials for sprayed work and maintenance	9,000 tonnes

State highways and Freeways

Significant works completed or substantially completed during the financial year 1978-79.

Bonang Highway
Orbost Shire
Construction of a 3 span bridge and approaches at Goongerrah Creek.

Burwood Highway
Box Hill City
Alterations to the highway to provide for a tramline extension from Warrigal Road to Middleborough Road.
Knox City
Reconstruction and signalisation of the intersection with Wantirna-Sassafras Road, Wantirna.

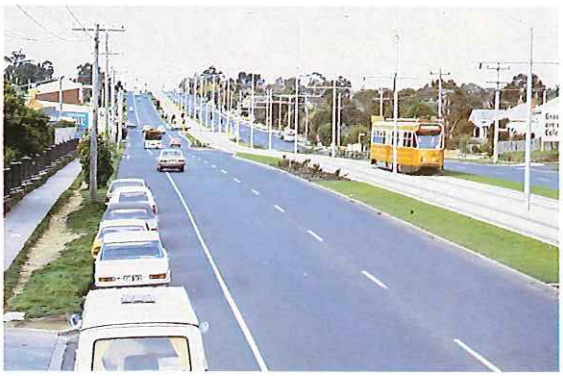
Calder Highway
Marong Shire
Widening of 1.1 km between Station Street and Alder Street, Kangaroo Flat.
Walpeup Shire
Reconstruction and widening of 5.8 km north of Kiamil.

Glenelg Highway
Glenelg Shire
Widening the existing bridge and approaches at Glenelg River, Casterton.

Goulburn Valley Highway
Euroa Shire
Widening of 5.8 km near Arcadia.

Hamilton Highway
Geelong City
Reconstruction of 0.2 km between Fenwick Street and La Trobe Terrace.
Mortlake Shire
Duplication of 0.8 km at Mortlake.

Hamilton Highway—duplication in Mortlake.



Burwood Highway — completed alterations to highway to allow for extension of tramline from Warrigal Road to Middleborough Road.

Henty Highway
Portland Shire
Reconstruction of 3.4 km through and south of Branxholme.
Portland Town
Duplication of 2.1 km at Portland North.
Warracknabeal Shire
Realignment of 0.9 km at the rail crossing north of Warracknabeal.

Hume Highway
Benalla City
Reconstruction of 0.3 km of the northbound carriageway between Arundel Street and Broken River in Benalla.
Wangaratta City
Reconstruction of 0.4 km between Ford Street and Faithful Street, Wangaratta.
Wodonga City
Reconstruction of 0.2 km at High Street and Elgin Street intersection in Wodonga.

Midland Highway
Buninyong Shire
Reconstruction of 2.1 km at Scotsburn Creek.
Metcalfe Shire
Reconstruction of 1.1 km between Castlemaine and Harcourt.

Murray Valley Highway
Cobram Shire
Reconstruction of 0.6 km on the western approach to Cobram.
Kerang Shire
Reconstruction of 1.3 km between Mystic Park and Tresco.
Tallangatta Shire
Construction of a culvert and approaches at Washaway Creek east of Tallangatta.
Swan Hill Shire
Reconstruction of 1.6 km near Wood Wood.

Nepean Highway
Flinders Shire
Reconstruction at the intersection with the Bittern-Dromana Road, Dromana.

Omeo Highway
Omeo Shire
Realignment of 1.8 km east of Bingo Munjie Creek.
Tambo Shire
Construction of a 3 cell culvert at Dirty Hollow Creek.

Ovens Highway
Bright Shire
Widening of 4 km northwest of Porepunkah.

Princes Freeway East
Moe City
Construction of 3.4 km of duplicate carriageway.

Princes Freeway West
Werribee Shire
Reconstruction and realignment of the on ramp to the freeway at the western interchange with the Maltby Bypass.

Princes Highway East
Buln Buln Shire
Widening of 0.9 km in Longwarry North.
Dandenong City
Reconstruction and signalisation of the intersection with the Dandenong-Frankston Road.
Dandenong City
Reconstruction of the intersection with Gladstone Road and improvement to traffic signals.
Dandenong City
Widening of the bridge over Eumemmerring Creek, Doveton.
Moe City
Construction of 3.4 km of duplicate carriageway between Watson's Road and Gunns Gully.
Morwell Shire
Duplication of 2.9 km in Morwell.
Narracan Shire
Duplication of 1.1 km in Trafalgar.
Orbost Shire
Resurfacing of 1 km east of Bellbird.
Orbost Shire
Resurfacing of 3 km between Tonghi Creek and Reedbed Creek.
Orbost Shire
Resurfacing of 5 km east of Jones Creek.
Pakenham Shire
Duplication of 3.6 km between Toomuc Creek and Army Road, Pakenham.
Pakenham Shire
Construction of a climbing lane at Jefferson Hill, Tynong.

Princes Highway West
Winchelsea Shire
Construction of a footbridge across the Barwon River at Winchelsea.

Pyrenees Highway
Metcalfe Shire
Reconstruction of 1.4 km through Chewton.
Tullaroop Shire
Reconstruction of 1.7 km east of Carisbrook at Shepherd's Hill.

Sunraysia Highway
Avoca and Lexton Shires
Reconstruction and realignment of 4 km between Bet Bet Creek and Lamplough.

South Gippsland Highway
Bass Shire
Reconstruction and widening of 0.8 km on the approaches to the Bass River bridge.
South Gippsland Shire
Reconstruction of 0.8 km east of Stoney Creek.

Western Highway
Ballarat Shire
Reconstruction of 0.4 km east of the Hadden-Windermere Road.
Kaniva Shire
Reconstruction of 4 km west of Merwyn Swamp.
Kaniva Shire
Reconstruction of 0.3 km east of Kaniva.

Wimmera Highway
Dunmunkle Shire
Resurfacing of 2.2 km at Lallat Plains.
Horsham City
Reconstruction of 0.3 km in Horsham.
Kowree Shire
Reconstruction of 3 km west of Miga Lake turnoff.

Greendale-Trentham Road, Shire of Ballan— reconstruction north of Barry's Reef.

Tourists' roads

Significant works completed or substantially completed during the financial year 1978-79.

Alpine Road
Bright Shire
Extension of the sealed pavement for 1.3 km south of the "Meg" and for 0.9 km between Loch Spur and Hotham Heights.

Bogong High Plains Road
Bright Shire
Reconstruction and widening of 1.6 km near Turnback Creek.

Great Ocean Road
Otway Shire
Reconstruction of 6.7 km west of Apollo Bay.

Phillip Island Road
Phillip Island Shire
Resurfacing of 4.1 km west of Newhaven.

Forest roads

Significant works completed or substantially completed during financial year 1978-79.

Alberton Shire
Carrajung-Woodside Road
Construction of 1 km.

Avon Shire
Dargo Road
Construction of a 3 span bridge over Castleburn Creek.

Balian Shire
Greendale-Trentham Road
Reconstruction of 2 km north of Barry's Reef.

Otway Shire
Forrest-Apollo Bay Road
Repairs to damage caused by floods in June, 1978.
Lavers Hill-Cobden Road
Construction of a 4 span bridge over Kennedy's Creek.

Land purchase

During the year the Board paid compensation and associated costs totalling $22.95 million for land required for the construction of new roads, the widening of existing roads or deviations from existing roads.

The expenditure incurred included $4,793,000 for the widening of the Nepean Highway from Elsternwick to Moorabbin and $3,675,000 for properties affected by the West Gate Freeway project.

The table below shows the road classification on which expenditure occurred.

	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	1,360	10,535	—	596	—	—	12,491
State highways	2	5,980	—	261	—	—	6,243
Tourists' roads	—	—	—	38	—	—	38
Forest roads	—	—	—	1	20	—	21
Main roads	—	1,692	2	293	118	—	2,105
Unclassified roads	—	1,699	182	1	162	12	2,056
Totals	1,362	19,906	184	1,190	300	12	22,954

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 five years.

	1974/75	1975/76	1976/77	1977/78	1978/79
Number of land purchase cases settled	923	661	671	786	629
Compensation and associated costs paid by the Board	$19.34m	$16.02m	$20.97m	$22.53m	$22.95m
Land purchase expenditure on unclassified roads under council supervision	$0.53m	$0.73m	$0.74m	$1.26m	$1.70m

Of the $22.95 million expended during the year, $10.43 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 $1,766,584 from 788 rented residential or commercial properties and 149 separate areas of vacant land. During the year 51 separate areas of surplus land were sold for $727,889, 8 residential properties surplus to requirements were sold for $314,200 and 27 houses were sold for removal for $44,680.

Bridges

Construction of new bridges

A total of 113 new bridges estimated to cost $18.3 million were commenced during 1978/79. The following table gives a comparison between the number and estimated cost of bridge projects commenced in 1978/79 and those for the preceding financial year.

Description	1977/78		1978/79	
	No.	Est. cost $'000	No.	Est. cost $'000
New bridges commenced under the supervision of the Board's staff	42	9,265	46	14,708
New bridges commenced under municipal supervision with financial assistance from the Board	52	3,120	67	3,476
Miscellaneous — Sign structures, poles, footings, stone beaching and block facing		160		113
Total bridges commenced	94	12,545	113	18,317

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:

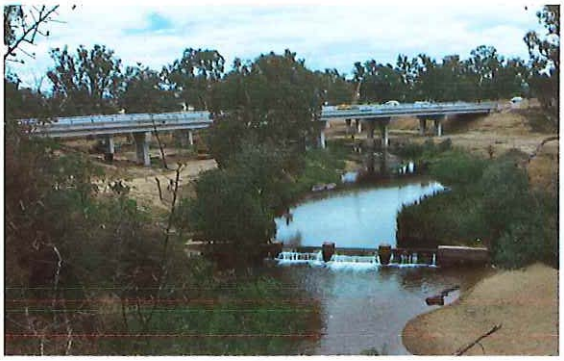
Hume Freeway, Avenel

Hughes Creek — two 5 span prestressed concrete beam and reinforced concrete structures, 114 m long and 11 m between kerbs.

Princes Freeway, Drouin

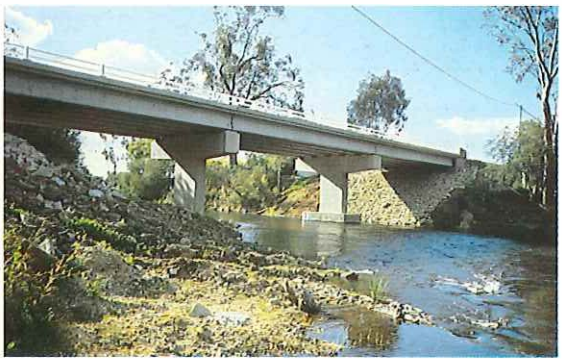
☐ Main Neerim Road — two span, prestressed and reinforced concrete structure, 88.75 m long and 9.8 m between kerbs.

☐ Princes Highway at Robin Hood — two span, prestressed and reinforced concrete structure, 92.52 m long and 9.8 m between kerbs.



Hume Freeway, Avenel—twin 5 span bridges over Hughes Creek.

Forge Creek Road bridge over East Gippsland railway, Bairnsdale.



Upper Merriang Road bridge over Buffalo River.

Pearce Street bridge under construction over House Creek in Wodonga.

Murray Valley Highway
Keiwa River Flats
☐ Three span reinforced concrete structure, 27.4 m long and 9.85 m between kerbs.
☐ Five span reinforced concrete structure, 68.75 m long and 9.8 m between kerbs.
☐ Two span, reinforced concrete structure, 18.29 m long and 9.8 m between kerbs.
Some of the larger bridges completed during the year under municipal supervision, with financial assistance from the Board were:

Bairnsdale Town
☐ Forge Creek Road, bridge over East Gippsland Railway — 3 span, reinforced concrete structure, 27 m long and 7.4 m between kerbs.

Myrtleford Shire
☐ Upper Merriang Road, bridge over Buffalo River — 3 span reinforced concrete structure, 45.5 m long and 8.6 m between kerbs. This bridge was opened by the Chairman, Mr T H Russell, on Friday, 9th March, 1979.

Wodonga City
☐ Pearce Street, bridge over House Creek — 2 span reinforced concrete structure and 7 cell reinforced concrete culvert.

Metropolitan bridges and overpasses

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

Johnson Street Bridge, South Melbourne
Twin bridges over Yarra River — five spans, prestressed concrete beams and reinforced concrete structures each 181 m long and 15 m between kerbs, plus 2.7 m footway.

Kew, Camberwell and Heidelberg Cities
Burke Road over Yarra River — duplicate bridge, 11 span, prestressed concrete beams and reinforced concrete structure, 138.17 m long and 10.6 m between kerbs.

Broadmeadows and Keilor Cities
Melrose Drive, road over rail bridge — 3 span steel girder and reinforced concrete deck structure, 34 m long and 10.4 m between kerbs with 1.9 m footway.

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, 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.

Grade-separated crossings to serve schools
Twenty-two structures have now been constructed under the Victorian Government scheme.

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 1st July, 1974, the total cost of this work has been charged to the Transport Fund. Since the inception of the scheme 66 road overpasses, or underpasses have been constructed to eliminate railway level crossings.
The following projects were completed by the Board during the year:
☐ Princes Highway West, road over rail overpass at Weerite — three span prestressed concrete and reinforced concrete structure, 41.97 m long and 9.76 m between kerbs.
☐ Camp Road, road over rail overpass, Broadmeadows — five span prestressed and reinforced concrete structure, 118.2 m long and 21.7 m between kerbs including two 8.5 m carriageways and three span off-ramp, 6 m wide.
Work was commenced by the Board on the following projects in conjunction with major road improvements.
☐ Latrobe Terrace, road over rail overpass, twin, 15 span structures, 269 m long and 8.6 m between kerbs.
☐ Princes Highway East near Cudgee, road over rail overpass, 3 span structure, 45 m long and 9.8 m between kerbs.

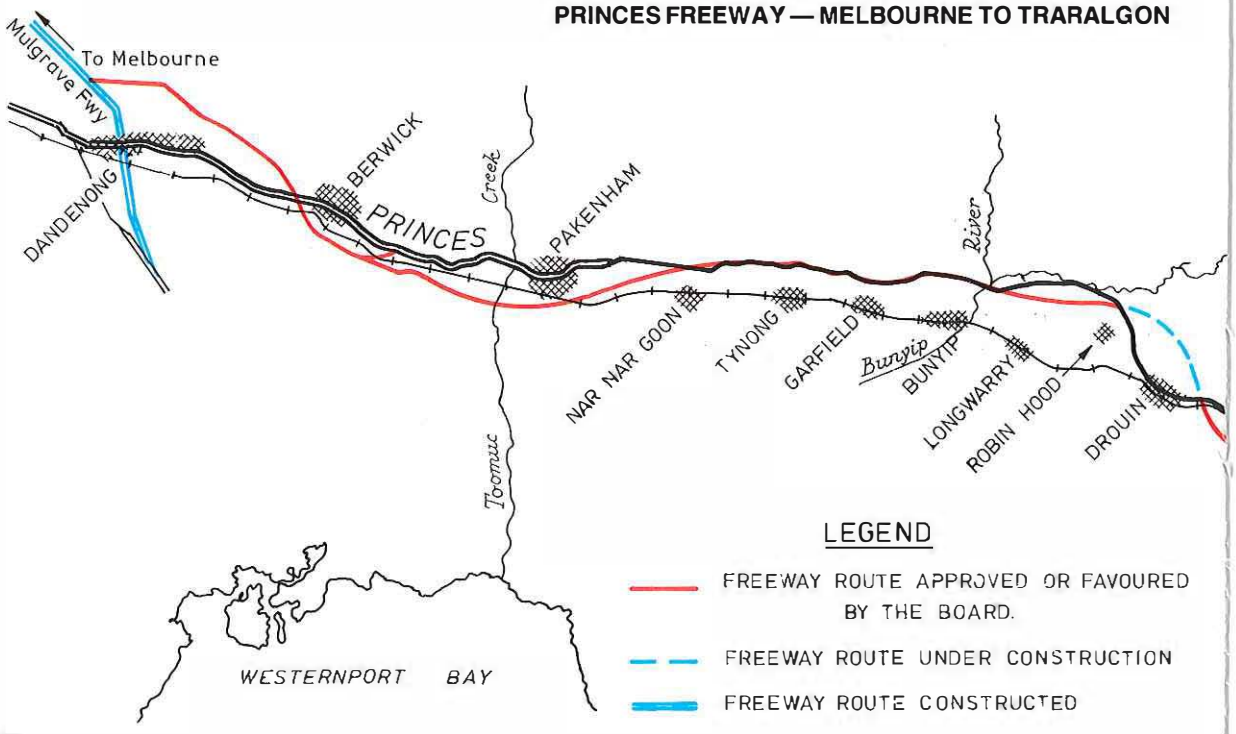
Road planning studies

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 bring 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.
Significant planning studies in which the Board was involved during the year are described below.

South Eastern Freeway — Malvern Section

In August, 1978, the Government approved Route C3 to link the terminal of the South Eastern Freeway at Toorak Road with the section of the Mulgrave Freeway, currently under construction, which will terminate at Warrigal Road. Route C3 generally follows the Main Road Reservation in the Metropolitan Planning Scheme between Toorak and Burke Roads, then follows an alignment along the north side of the Glen Waverley railway line from High Street to East Malvern, and then a route along Scotchmans Creek to the Mulgrave Freeway.
Route C3 was recommended to the Government by the Steering Committee appointed in 1976 to carry out the Gardiners Creek Valley Study. The corridor study was set up by the Government to investigate the need to link the South Eastern and Mulgrave Freeways and to 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 involved the Ministry for Planning, Ministry of Transport, Ministry for Conservation, Melbourne & Metropolitan Board of Works, Town and Country Planning Board, Malvern, Camberwell and Hawthorn City Councils and the Country Roads Board. The study also included an extensive process of public consultation.
In making a decision on the recommendations of the Steering Committee, the Government accepted the principle that a four lane freeway should initially be constructed in conjunction with the provision of a right-of-way for a future six lane freeway. The Government decision finalised the basic planning issues allowing the Board and the Melbourne &

PRINCES FREEWAY — MELBOURNE TO TRARALGON

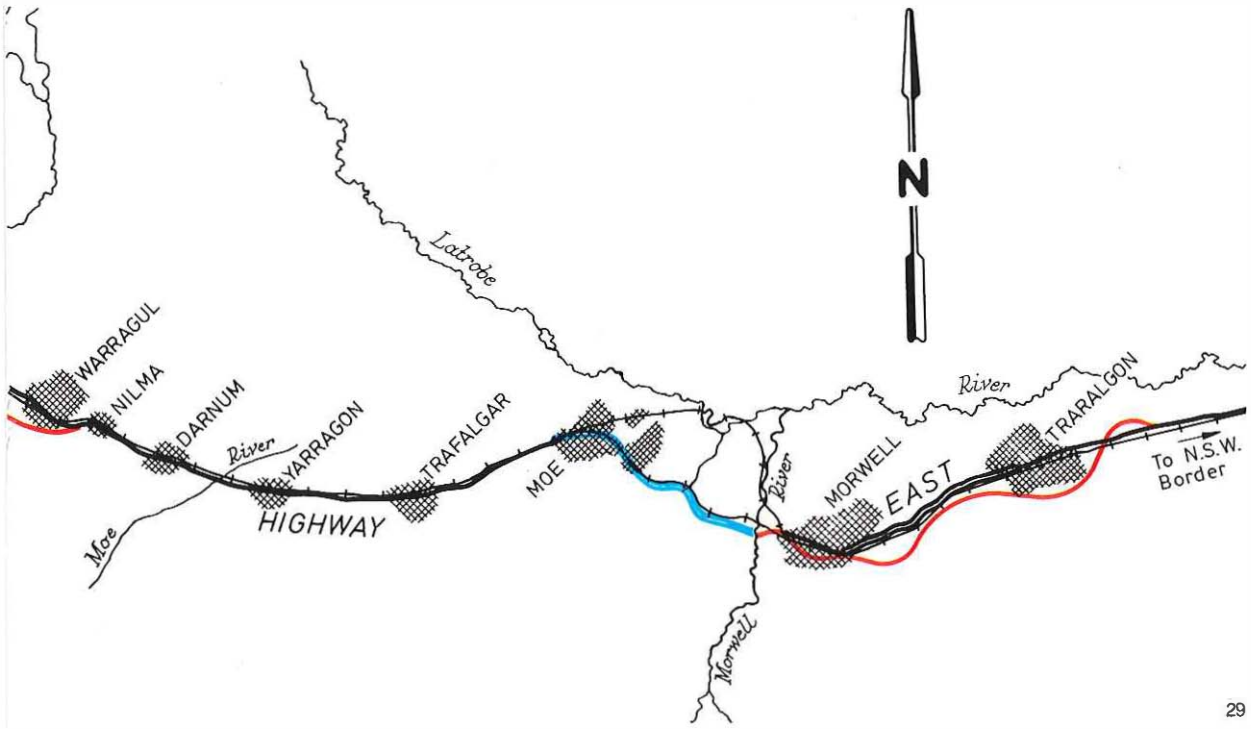


Metropolitan Board of Works to work jointly towards the preparation and exhibition of an amendment to the Melbourne Metropolitan Planning Scheme incorporating the necessary Main Road Reservation. Following the Government's approval of the recommended Route C3 the Board commenced the design of this alignment. Design work is proceeding in consultation with the councils and other authorities previously involved in the Gardiners Creek Valley Study. Work is also in progress on the assessment of possible traffic management improvements in the area to provide traffic relief in the short term and to facilitate the staging and implementation of the South Eastern Freeway— Malvern Section.

Princes Freeway East
The Board carried out road planning studies on four sections of the proposed Princes Freeway between Melbourne and Traralgon.

Berwick Bypass
Plans for the 7.3 km Princes Freeway bypass of Berwick were nearing completion at the close of the financial year and were released by the Acting Minister of Transport the Hon James Balfour, MP, in July, 1979. Copies of the plans were sent to the municipal councils concerned and relevant authorities for comment.
The new freeway will bypass Berwick to the south and follow a route from the Princes Highway east of Narre Warren to the start of the proposed bypass of Pakenham at Cardinia Creek, east of Beaconsfield. As the bypass of Berwick will be constructed before the bypass of Pakenham a connection to the Princes Highway at Pink Hill will be constructed.
More than 14,500 vehicles use the existing Princes Highway at Berwick, between 7 am and 7 pm daily.
A main road reservation in the Melbourne Metropolitan Planning Scheme already exists for much of the freeway route.
Landscaping of the new freeway will ensure that the new road blends with the local environment.
The Princes Freeway bypass of Berwick is estimated to cost $12 million at 1979 prices. Preliminary work is expected to begin early in the 1979/80 financial year, with bridge and road works beginning in 1981.

Pakenham and Tynong Sections
In June, 1979, a report detailing the Board's "favoured route" for this 34 km section of the Princes Freeway from west of Pakenham to the Bunyip River, was forwarded to local councils and other interested parties for comment.

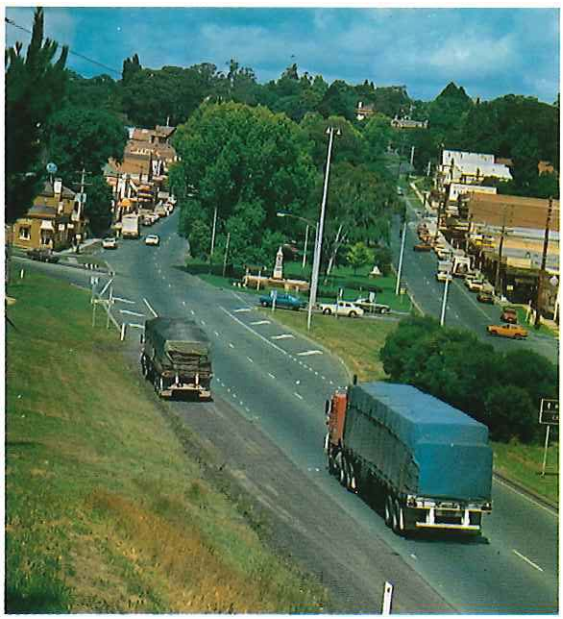


The favoured route bypasses Pakenham to the south, joining the existing Princes Highway in the vicinity of Nar Nar Goon. From Nar Nar Goon easterly the route generally follows the existing highway.
The proposals are of a long term nature and are being developed now to allow local development to proceed with the Board's favoured route in mind.
Pakenham is an expanding community and the freeway, when constructed, will result in a quieter and safer town.
While the long term proposals are being developed, it is the Board's intention to continue the work of duplicating the existing Princes Highway easterly from Pakenham.
The Princes Highway through Pakenham is currently carrying about 11,000 vehicles each day between 7 a.m. and 7 p.m. This traffic is currently increasing by about 7½ % each year.
At a later stage, as Pakenham develops and traffic increases, the Board will construct the freeway to bypass Pakenham and upgrade the Princes Highway to the east of Pakenham to freeway standard.

Morwell Section
In February, 1979, revised plans for the 10.5 km Princes Freeway bypass of Morwell were forwarded to Morwell Shire Council and other interested parties for their consideration and agreement.
The revised plans resulted from discussions with Morwell Shire Council, the State Electricity Commission and the public. These discussions followed the issuing of preliminary layout plans in March, 1978.
The major features of the revised plans for a bypass to the south of Morwell include:
☐ the adoption of a route for the extension of Commercial Road to the Midland Highway to the south of the future freeway thus providing better access to the SEC works area;
☐ the adoption of a reduced median width for the freeway, resulting in an increased distance between the traffic lanes and residential properties;
☐ relocation of the freeway alignment by up to 70 m to the south near Willis Street to provide greater separation between the freeway and the adjacent residential properties;
☐ development of a landscaping concept for the freeway in the vicinity of residential areas, allowing for earth mounds and plantations.

Traralgon Section
In June, 1979, a report detailing the Board's "favoured route" for the 16.7 km Princes Freeway bypass of Traralgon was forwarded to local municipal councils and other interested parties for comment.
The adoption of a route for the freeway bypass at this time will enable the land required for the future freeway to be protected and also enable compatible development of the land adjacent to the future freeway.
The favoured route will bypass Traralgon to the south, and follow a route from the vicinity of the drive-in theatre west of Traralgon, to North Minniedale Road to the east.
The Board's report contained an evaluation of the effect the various alternatives for the freeway bypass would have on Traralgon, including effects on the environment, properties and public utilities and access to SEC complexes.

Hume Freeway — Euroa Bypass
The Hume Highway/Freeway between Melbourne and Sydney is a declared National Highway under Section 4 of the National Roads Act 1974. The goals of the Commonwealth Government's National Highway Policy are to foster the economic development and social welfare of the nation, provide opportunities for the social welfare of the nation, provide opportunities for social and cultural interaction and safeguard national defence objectives. The planning and the future construction of the Euroa Bypass is required because of the inability of the existing Hume Highway in this area to handle traffic demands.



Princes Highway, Berwick.

The Board's planning investigations for the location of the Euroa Bypass considered in detail all the relevant engineering, economic, social and environmental aspects. A large number of alternatives. both north and south of the town, were examined and assessed. This examination involved extensive consultation with officers of the Euroa Shire Council, relevant Government Departments and Authorities, together with local interest groups and members of the general public. As a result, two alternative routes, termed the Northern Route and the Southern Route, were considered the most viable options.

After careful consideration of the cost and the environmental and social factors involved, the Board concluded that it favoured the adoption of the Southern Route for the bypass of Euroa. A summary report presenting the results of the Board's planning investigations was prepared for discussion purposes and steps were taken to obtain the views of the local community.

As a result of comments received on the Board's favoured route from the Euroa Shire Council, various Government departments and authorities and from the general public, the effects of the Southern Route in the Seven Creeks/Balmattum Hill area were examined in more detail. These further investigations, which incorporated landscape and noise studies, resulted in the formulation of a route termed the Modified Southern Route. The Board concluded that the Modified Southern Route had a number of significant environmental and visual advantages.

This Modified Southern Route, employing careful landscape design including the use of earth mounds as screens, achieved a significant reduction in the effects on houses, the growth potential of the town, the timber mill and Balmattum Hill. The Modified Southern Route is estimated to cost $20 million and to be $2.8 million (1977 prices) cheaper than the Northern Route.

The Board subsequently prepared an Environment Effects Statement which was placed on public exhibition in September, 1978, in accordance with the Guidelines of the Ministry for Conservation, and public comment was invited. Following the receipt of comments the Ministry for Conservation made an assessment of the Environment Effects Statement and of the public comment received.

The Ministry for Conservation's assessment concluded that from an environmental point of view, the Northern Route was preferred and would have less direct effects on the town of Euroa. The main disadvantage of the Modified Southern Route was considered by the Ministry to be its effect on the site of the Seven Creeks Run proposed tourist project. However, on the information given, the Ministry for Conservation found it impossible to judge the viability, strength, or future importance of the proposed tourist project and its compatibility or otherwise with the bypass of Euroa. The advantages of cost and community support for the Modified Southern Route were recognised. The Ministry concluded that the Minister of Transport should arrange detailed discussions with relevant parties to resolve the effects on the proposed tourist project.

In addition, the Euroa Shire Council conducted a referendum of its ratepayers on the issue of the bypass location on 21st October, 1978. Six hundred and ninty-one ratepayers favoured the Modified Southern Route whereas 493 ratepayers favoured the Northern Route (45% of ratepayers voted).

The Council subsequently advised all concerned that the Shire supported the Modified Southern Route.

Depending on the outcome of the discussions referred to, a decision will be made on the ultimate route to be adopted for the Euroa Bypass.

Bicycle studies

The Board is concerned about the needs of all road users, which includes bicyclists. The Board is represented on the State Bicycle Committee which is responsible to the Victorian Government for advice on matters concerning bicycles and their use.

The Board is also represented on the Bendigo Bicycle Committee and is involved with the implementation of the Geelong Bike Plan. As part of the widening of the Nepean Highway between Elsternwick and Moorabbin a bicycle path is being provided between Rose Street, Gardenvale and South Road, Moorabbin. The detailed design of this bicycle path is well advanced.

Energy and road transport

The Board is closely monitoring the energy position, both in Australia and overseas, in an effort to be fully aware of current trends and of their implications as far as future road travel is concerned. The road transport section of Australia's economy is heavily dependent on petroleum as a vehicle fuel. There is little doubt that the world wide demand for crude oil will exceed production capabilities from known sources in the near future, that fuel prices will continue to increase, and that as Australia's dependence on overseas fuel supplies increases, the future availability of fuel will be subject to possible disruption or regulation.

Present indications are that the demand for road travel, and the number of vehicles on the roads, will continue to increase in the future.

There is a limit to the future availability of currently

used liquid fuels, and in the future other sources of fuel will have to be found and/or other types of engines developed. There are several technological possibilities in these areas, and considerable research and development is underway in various countries. This effort can be expected to increase in the future. However, because of the long lead times, and high costs, involved in the development and ultimate implementation of new technologies, there will be no significant alternative in the short to medium term to the continued use of existing fuels. Thus, it is essential that effort be directed to the development and early implementation of fuel conservation policies and practices.

By far the greatest potential for energy conservation is the use of smaller and more energy efficient vehicles. It is not inconceivable that this measure alone could reduce fuel requirements for cars by up to 35% or so.

A further significant saving in fuel is possible by the adoption of improved driving practices, such as driving at a uniform steady speed, attempting to minimize speed changes, and using gradual acceleration and deceleration rates when starting, stopping or changing speed.

The more wide-spread use of known traffic management and operations techniques, particularly in urban areas, offers further scope for fuel conservation. These techniques, which basically are designed to reduce congestion and to permit traffic to flow at or close to optimum speeds with a minimum of stops and speed changes, include the linking of traffic signals to give progressive flow on a route and/or area basis, improved intersections, priority routes, truck routes, reversible lanes to give additional capacity for peak direction travel, parking restrictions and the use of clearways, the control of bus-stops and loading zones, and improved signing and line marking. The Board is actively involved in traffic management and encourages municipal councils to do like-wise. Car-pooling and the staggering of working hours also have potential for reducing the total travel in terms of vehicle kilometres, leading to a reduction in congestion particularly in peak hours, and some saving in fuel.

In Australia, in both urban and rural areas, the basic road pattern is now well established and extensive. Even in the longer term, provision of new and improved roads will represent only a very small proportion of the total road system. For this reason, road planning techniques and road design and road construction practices offer less scope for energy conservation, although some worth-while savings are still possible.

In the road planning area, increasing attention is being directed to the relationship between the location and density of various types of land use development and travel, with a view to minimising road travel. At present little is known of these relationships, and in any case the effects of any practicable and feasible changes to current land use development trends in urban areas are likely to be significant only in the longer term.

The Board is closely monitoring the various factors that affect road travel, including population and vehicle ownership trends and the cost and availability of fuel, and takes them into account in its planning activities. For example, in the recent larger planning investigations, the alternatives under consideration have been tested against a range of future travel forecasts, that reflect among other things a range of future fuel costs.

In road design, the standards adopted can affect the amount of fuel required to build new roads or to reconstruct existing roads, and the fuel required to operate vehicles on them. However, in this regard, energy conservation considerations may need to be balanced against other engineering, economic, safety and environmental considerations.

The proportion of liquid fuel used in road construction and maintenance activities is only a small part of the total fuel used by road transport, but there is some potential for energy conservation, and importantly this may be reflected in lower overall costs of construction and maintenance. Aspects that are receiving attention in this regard include the development of substitute binder materials for paving mixtures, the use of waste and marginal materials, recycling existing highway surfacing materials, and improved production and construction and maintenance techniques.

Energy considerations are now an important aspect of all phases of the Board's work, and as appropriate they are considered along with the other relevant engineering, economic and environmental factors.

Linemarking

During the 1978/79 financial year the Board spent $1,824,457 maintaining Statcon markings and extending and maintaining linemarking and pavement markers throughout the State. The length of linemarking maintained by the Board's linemarking machines was as follows:

☐ State highways and freeways — 7,789 km or 25,142 km of equivalent standard stripe.

☐ Other CRB declared or proclaimed roads — 5,924 km or 12,167 km of equivalent standard stripe.

☐ Unclassified roads — 1,645 km or 4,497 km of equivalent standard stripe.

The term "equivalent standard stripe" means a 3 m stripe and a 10 m gap.

The cost of this work was:

☐ $31/km of standard stripe.

☐ $55/km of 75 mm wide solid stripe.

The cost of extending and maintaining the system of raised reflective pavement markers on declared roads was $160,330 and 45,129 reflective markers were laid.

Control of overdimensional and overweight vehicles

In order to maintain safe conditions for road users and also protect both bridges and road surfaces from damage, limits are imposed by law on the width, height, length and weight of vehicles and their loads.

The Board has the responsibility under the provisions of the Motor Car Act, for issuing permits for the movement of overdimensional or heavy vehicles exceeding the legal weight, height, length and width—

(a) on roads declared or proclaimed under the provisions of the Country Roads Act, and

(b) for a journey which includes unclassified roads in two or more greater metropolitan municipalities as defined under the Motor Car Act.

The following table illustrates the number and types of permits issued during the year compared with those issued during financial year 1977/78.

	1977/78	1978/79
Single trip permits	21,021	21,293
Annual permits	3,061	3,139
NAASRA permits*	8,260	26,079
Total number of permits issued	32,342	50,511

*This figure represents the number of permits issued in accordance with the NAASRA recommendations from the study into the Economics of Road Vehicle Limits. The permits will be effective until such time as they are made redundant by new legislation.

The number of offences reported during the year by the Board's twenty-two traffic officers and the four police officers seconded to the Board amount to 6,537. These offences resulted in over $1,043,064 fines and costs which were paid into the Consolidated Fund.

Heavy loads to Jeeralang

A heavy load consisting of a 212 tonne gas turbine (having a gross weight of 336 tonnes) was transported from Melbourne to the State Electricitry Commission's project at Jeeralang in the Latrobe Valley on 28th January, 1979. This was the first of a number of loads to Jeeralang with payloads ranging from 161 to 212 tonnes.

Princes Highway — transportation of the SEC's gas turbine to Jeeralang.

Traffic information services and driver education

The Board continued its practice of issuing weekly Motoring Bulletins to the media and the police, fire brigade and ambulance services to provide information on the location of Board and municipal works which could cause delays in traffic flow. In addition, special snow and flood reports were issued as required, describing road conditions.

The Board published the following brochures during the year to assist drivers:

Driver's Guide to Victoria

Snow Driving, It's An Art (revised)

Snow clearing

Snow clearing of roads to snow resorts was carried out in 1978/79 on the Alpine Road (Mt Hotham), Mt Buffalo Road, Mt Buller Road and Bogong High Plains Road (Falls Creek).

Snow clearing started in May and finished in September with the heaviest falls of snow occurring in July and August.

All night snow clearing was carried out on the Alpine Road on Friday and Saturday nights during the season and was financed by a special State Treasury Grant.

Snow clearing of car parks was carried out at all resorts as a charge against the respective administering authorities or special Country Roads Board/National Parks Service grant in the case of Mt Buffalo.

Five, 4-wheel drive, Aveling Austin grader snow ploughs, three Rolba R1500 snowblowers, two Rolba R400 snowblowers and one Schmidt Unimog multi purpose snow clearing unit were used to carry out snow clearing during the season. Trials of a MAN 4-wheel drive truck fitted with a snow plough blade continued on Mt Buller.

Details of snowfall recorded during the 1978 winter by the Board's snow clearing gangs are shown in the following table.

Snow clearing at Mt Hotham.

Road	Resort	Earliest snowfall	No. of snow days	Cost 1978 season
Alpine Tourists' Road	Mt Hotham	11/5/1978	61	$230,200
Mt Buffalo Tourists' Road	Mt Buffalo	5/6/1978	37	$46,000
Mt Buller Tourists' Road	Mt Buller	5/6/1978	43	$52,000
Bogong High Plains Tourists' Road	Falls Creek	2/6/1978	48	$57,500

(a) Costs do not include clearing of car parks for committees of management.
(b) Night clearing of Mt Hotham is funded by a special State Treasury Grant of $36,200 and is included in the above figures.
(c) Bogong High Plains Road costs are for the first 1.6 km of the road plus 80% of the costs of clearing the balance of the length of the road. The other 20% of costs has been charged to the State Electricity Commission and is not included in the above figure.

Emergency services

The Board provides a free emergency telephone service and assistance to drivers of immobilised vehicles on six major metropolitan traffic routes. These routes are:

Eastern Freeway
Kings Bridge – Queens Way
Mulgrave Freeway/South Gippsland Freeway
Tullamarine Freeway
South Eastern Freeway
West Gate Freeway.

The emergency service extends for 24 hours per day and includes providing assistance for minor mechanical problems, the sale of sufficient petrol to enable the vehicle to be restarted and driven clear of the freeway and also a towing service so that the vehicles can be cleared from the freeway.
The number of calls to the Board's Emergency Service Centre at Head Office has increased from 4,800 calls in the first year of operation in 1975 to 17,303 calls during financial year 1978/79.
Emergency telephones were installed on the Mulgrave Freeway and South Gippsland Freeway between Forster Road, Mount Waverley, and Somerville Road, Hampton Park, during the year.
The Emergency Service Centre permits continuous radio communication with the Board's road maintenance personnel and Traffic Officers outside normal working hours. The Emergency Services Officers are also able to provide up to date information outside normal working hours relating to road conditions especially during floods or bush fires. The following table shows the distribution and types of calls received during financial year 1978/79.

Emergency Services — call analysis (1978/79)

Fault	Total	% of all calls	% of breakdowns
Roadside Emergency Telephone			
Petrol	3,085	17.8	21.1
Tyres	782	4.6	7.8
Radiator	1,202	6.9	17.1
Mechanical	4,227	24.4	42.2
Hoax	678	3.9	5.9
Hazard	300	1.8	2.6
Accident	292	1.7	3.3
Sub Total	10,566	61.1	100.0
Ordinary Telephone			
Other	5,529	31.9	
Hazard	195	1.2	
Traffic Lights	1,013	5.8	
Total	17,303	100.0	

Emergency Services — road analysis (by roads)

Road	No. of calls	%
Tullamarine Freeway	3,175	27.3
Eastern Freeway	3,156	27.2
South Eastern Freeway	1,614	23.9
West Gate Freeway	724	6.2
Kings Bridge/Queens Way	220	1.8
Mulgrave Freeway	2,754	13.6
Total	11,643	100.0

Traffic Signal Co-ordination of regional areas in Melbourne (SCRAM)

In March, 1979, the Board placed an order for two, PDP 11/34 mini computers, and associated equipment, for the new SCRAM system of regionalised traffic signal control. When fully developed each computer will control more than 100 traffic signals to improve traffic flow through a given corridor.
Each of the new computers will co-ordinate traffic signals, via Telecom lines, along a given corridor or region:
- Maroondah Highway, between Ringwood and Blackburn, with other arterial roads in this eastern corridor being added progressively.
- St Kilda Junction and the Nepean Highway, together with Kings Way and other routes in the vicinity.

SCRAM is based on a New South Wales traffic control system and the first computer is expected to be installed on the Maroondah Highway in October, 1979.
The two computers were ordered from the Digital Equipment Corporation of Australia at a cost of $107,000.

The Environmental Studies Section

The role of the Board's Environmental Studies Section is to ensure that the non-engineering aspects of road proposals are properly assessed within the framework of a multi-disciplinary approach, and presented along with engineering and financial considerations so that balanced decisions can be made.

The main functions of the section are:

☐ To undertake environmental studies for planning investigations ranging through corridor studies, route location investigations and traffic management studies.

☐ To give specialist advice when required such as in the review or development of guidelines, standards and policies or regulations which may apply to the Board's activities.

☐ To ensure that the environmental study techniques and procedures used are in line with current practice.

☐ To initiate applied research into problem areas or on special topics which might advance the field of understanding of environmental issues.

The Environmental Studies Section assisted in the preparation of three environment effects statements during the year — Union Road, Surrey Hills; Banksia Street to Bell Street Connection, Heidelberg; Hume Freeway, Euroa.

Union Road, Surrey Hills

In 1974 the Abolition of Level Crossings Committee comprising the Engineer in Chief, CRB, Chief Civil Engineer, Victorian Railways and Chief Engineer, Public Works Department, recommended that the Board be the co-ordinating and construction authority for a direct road connection from Warrigal Road to Union Road, eliminating the railway level crossing at Union Road, Surrey Hills.

This recommendation was based on the predicted traffic delays and accident potential at the level crossing. The proposal was approved in principle by the then Minister of Transport and agreed to by Box Hill and Camberwell City Councils in 1976. Such a road connection would require the acquisition of some houses and shops in the area. Plans for an amendment to the Melbourne Metropolitan Planning Scheme to provide for the proposed connection were placed on public display in May, 1977. A considerable number of people in Surrey Hills were concerned by the proposal and a public meeting was convened by local residents in August, 1977.

Following this meeting, and after discussions with the Ministry for Conservation and the Melbourne & Metropolitan Board of Works, the Board decided to prepare an environment effects statement and to re-examine the need for a road overpass of the railway. Other alternatives including traffic management measures, and the use of the existing Melbourne Metropolitan Planning Scheme provision for the future widening of Canterbury Road were also considered.

These investigations showed that the need to eliminate the Union Road level crossing was not as great as envisaged some years ago. However, the investigations indicate a need to alleviate traffic congestion in Canterbury Road between Warrigal Road and Union Road.

The community was involved in the investigations in various ways. For example:

☐ detailed discussions were held with representatives of Box Hill and Camberwell City Councils, the Surrey Hills Association and the Victorian Railways Board;

☐ a study bulletin was produced and widely distributed in the area;

☐ interviews and discussion with individuals and groups of 6 to 10 people, including household, shopper and shopkeeper surveys;

☐ Board representatives attended a public meeting called by the Surrey Hills Association.

As well as the community involvement outlined above, a considerable amount of data was collected on matters such as:

☐ local history of the area;

☐ land zoning;

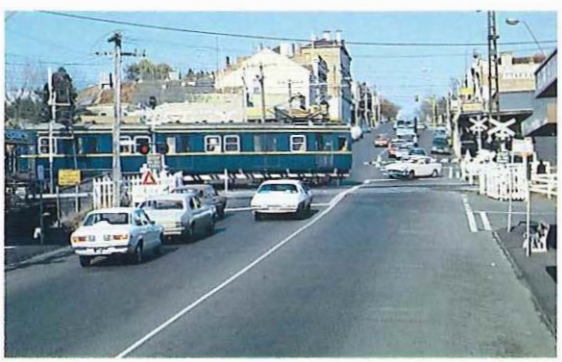
☐ the transport network in the area;

☐ the social profile of the area;

☐ town planning aspects;

☐ various traffic aspects.

The investigations concluded that in view of the relatively short delays and good safety record at the existing level crossing in Union Road, the high cost and environmental effects of an overpass, and the fact that other road improvement alternatives (not involving abolition of the railway level crossing) could satisfactorily handle expected future traffic:



Union Road, Surrey Hills.

(a) there was not sufficient justification to proceed with the grade separation proposals in the foreseeable future;
(b) there was scope for improved traffic operation in Canterbury Road in the study area by the application of low cost traffic management measures and that steps should be taken to implement these as soon as possible; and
(c) the existing planning scheme widening along this section of Canterbury Road should be retained to provide for future improvements to Canterbury Road.
On Friday, 6th April, 1979, the Minister of Transport, the Hon Robert Maclellan, MLA, announced that the proposed elimination of the railway level crossing would not proceed in the light of the Board's further investigations.

Banksia Street to Bell Street Connection, Heidelberg

During the year, the Board continued with a study into ways of relieving traffic congestion in the Banksia Street-Bell Street area of Heidelberg.
Some years ago an investigation, carried out by the Board concluded that a direct road connection was warranted between Banksia Street, south of the Austin Hospital and Bell Street. In October, 1973, the Board informed the Heidelberg City Council of the findings of the investigation and sought the Council's agreement in principle to the proposal for a direct road connection.
At a meeting in February, 1974, the Council deferred any consideration of this connection.
Following meetings of ratepayers and independent consultant studies being carried out, the Council, in July, 1975, agreed to the Board carrying out further investigations into a direct road connection between Banksia Street and Bell Street. Preliminary design plans were prepared in August, 1976, for a proposed road connection through the parkland and a model showing this preliminary proposal was placed on public display.
Public concern was expressed over the proposed connection, and as a result the Director of Conservation in June, 1977, requested the Board to prepare an environment effects statement for the project.
In November, 1977, the Heidelberg City Council agreed in principle with the proposed connection subject to several modifications including a reduction in the road width.
The environmental effects statement examined the Banksia Street-Bell Street corridor and considered the transport, physical, social and environmental aspects of the area in the context of possible road improvements in the corridor to improve the east-west arterial route serving the north-east suburbs and to relieve traffic congestion.
Residents' views were obtained from a series of information discussions with small groups in the community, and from the results of a social impact assessment.
Many alternatives were considered, including a "no build" option, one way street systems and several direct connections.
After assessing the effects on traffic and pedestrian movement on the shopping centre and on properties, cost, noise and landscaping and construction aspects the alternatives for the connection were reduced to two;
(i) a one way street system utilising Banksia Street, Waterdale Road, Bell Street, Burgundy Street and Jika Street; and
(ii) the Board's modified proposal, a direct divided road connection between Bell Street and Banksia Street.
When compared with the Board's modified proposal, the one way street system proposal would result in a longer and less direct path for through traffic, and would have a greater adverse effect in terms of noise, inconvenience to the local circulating traffic, and the road safety problem in the Burgundy Street Shopping Centre.
The advantage of the one way street system was that it could be readily implemented in the short term to provide some immediate relief to the traffic problems in the area.
The statement concluded that the better alternative would be the Board's modified proposal because of:
(a) fewer people directly affected;
(b) less effect on local circulating traffic, including pedestrian movements
(c) less overall effects in terms of traffic noise in the area; and
(d) greatly improved amenity and road safety within the Burgundy Street Shopping Centre.
The draft of the environment effects statement was submitted to the Ministry for Conservation to arrange for its public exhibition.
If, after the statement has been exhibited and considered by the Ministry for Conservation, the Board's modified proposal is adopted, an amendment to the Melbourne Metropolitan Planning Scheme would be necessary. This procedure could take from 18 to 24 months. The Government's approval would then be required to commence construction. The timing of construction would depend on the availability of funds.

Hume Freeway — Euroa Bypass

In examining the impacts of possible routes for the bypass of Euroa the Environmental Studies Section

carried out three major studies. These were:
☐ a social survey of the town's population and business houses;
☐ a noise survey and predictions of the effect of future traffic noise on homes;
☐ a landscape survey of the proposed routes leading to the development of proposals which would make the freeway unobstrusive and blend with the countryside.
The results of these studies were incorporated in the planning procedures for this project.

Numbers and costs of trees and shrubs planted during the 1978/79 financial year.

Divisions	Trees and shrubs	Purchase cost $
Bairnsdale	34	117
Ballarat	800	360
Benalla	1,900	760
Bendigo	6,765	2,230
Dandenong	27,200	9,000
Geelong	2,950	1,571
Horsham	4,000	4,000
Metropolitan	27,606	18,458
Traralgon	3,000	3,000
Warrnambool	5,925	2,825
Projects		
Eastern Freeway	16,750	4,550
Hume Freeway	7,960	2,530
Johnson Street Bridge	196	88
Mulgrave Freeway	10,000	3,450
West Gate Freeway	1,850	1,780
Total	**116,936**	**54,719**
1977/78	139,062	$49,016

St Kilda Junction landscaping

St Kilda Junction was reconstructed almost 10 years ago to overcome the serious traffic problems of the then existing junction.
Previous attempts to improve the aesthetics of the new junction area were not successful because of the harsh environmental conditions. Any trees and shrubs planted in the area are required to withstand the wind that is funnelled along the approach roads, the pollutants from the heavy traffic flows and the coastal environment as well as being able to find sufficient moisture in the large paved area.
A scheme was implemented during the year which appears to be successful in overcoming the problems. The scheme utilises a combination of bluestone walls and decorative bluestone paving with both plane trees and native spotted gums, together with shrubs and ground cover plants planted in large raised planting beds. Tree holes of one cubic metre each have been excavated and filled with fertile soil, and a drip feed irrigation system has been installed.
The landscape treatment is in harmony with the various road elements of the junction and integrates the junction visually with both the plane tree avenue in St Kilda Road and the newer plantations in Nepean Highway.

Bellarine Highway, Leopold.

St Kilda Junction — blue stone wall and newly planted trees and shrubs.

Municipal allocations

Victoria's 212 municipal councils have been allocated $83,160,000 for road works on main and unclassified roads for 1979-80.
This represents $3,535,000 more than for 1978/79. However, in real terms the 1979/80 allocations will result in less work being carried out than in 1978/79 due to rising costs.
The total amount of the applications for funds for 1979/80 received from councils was $186,133,000 but the Board was able to allocate only approximately 45% of this amount.
The table below shows the applications and allocations of funds to municipal councils for 1978/79 and 1979/80.

	1978/79		1979/80	
	Applications	Original allocations	Applications	Allocations
	$000s	$000s	$000s	$000s
Main roads	67,910	38,015	76,014	39,782
Unclassified roads	106,864	41,610	110,119	43,378
	174,774	79,625	186,133	83,160

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 and to facilitate the extraction of forest produce. An amount of $200,000 was authorised to be paid into the Fund by the State Government during 1978/79, increasing the authorised contributions to $1,210,000.
The Board's Divisional Engineers combine with the appropriate Forests Commission Officers to determine the priorities of eligible works.
Allocations for particular works are made by the Board with the agreement of the Forests Commission, but the limited funds available from the fund only enable grants to be made for the most urgent works.
Applications on hand have risen to approximately $520,000.

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 declared as main roads and financed from central funds. Most municipalities in Victoria are visited at approximately six yearly intervals.
These visits include a tour of municipal roads with councillors and council officers, and discussions on local road problems. The visits provide the Board Members with important information about road conditions and developments in the municipality.
During the year the Board made official visits to 32 municipalities: the Cities of Ballaarat, Benalla, Chelsea, Frankston, Melbourne, Moorabbin, Port Melbourne and St. Kilda; the Boroughs of Eaglehawk and Kerang; the Town of Stawell; and the Shires of Avon, Bairnsdale, Ballarat, Bannockburn, Benalla, Cohuna, Corio, Creswick, Dimboola, East Loddon, Gordon, Hastings, Kerang, Korong, Otway, Newham & Woodend, Rosedale, South Gippsland, Stawell, Strathfieldsaye, and Talbot & Clunes.
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 municipal administration and local interests.
During the year the Board received deputations from the following councils:
The Cities of Colac, Footscray, Kew, Knox, Moe, and Traralgon; the Shires of Cranbourne, Kilmore, Metcalfe, Numurkah, Ripon, Walpeup and Werribee.
The Board also received deputations from the Local Government Engineers' Association and representatives of two local committees.
The main topics raised by the Councils 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, road classifications and matters associated with the development of the declared road system.

35th Conference of Municipal Engineers

The 35th Conference of Municipal Engineers, convened by the Board in conjunction with the Local Government Engineers Association of Victoria, was held at the Board's Head Office on 19th and 20th March, 1979, concluding with a technical tour of freeways and major road projects in the metropolitan and outer metropolitan area on 23rd March.
The conference was officially opened by the Hon Robert Maclellan MLA, Minister of Transport.
The general theme of the conference was energy needs for the future, with other papers on contract administration, bridge design, pavement and

drainage construction, and traffic engineering and associated topics. The keynote address — 'Energy Planning' — presented by Professor L A Endersbee, Dean of the Faculty of Engineering, Monash University, set the pattern for a highly informative and successful conference. Approximately 250 Local Government and CRB Engineers attended with representatives from some State instrumentalities and departments.
The Board extends its thanks and appreciation to the Local Government Engineers Association of Victoria for its co-operation in planning the conference, to Professor L A Endersbee, and to all engineers participating, particularly those who presented papers, for contributing to the success of the conference.

Significant works on main and unclassified roads

Main roads

Significant works completed or substantially completed during financial year 1978-79.

Alberton Shire
Tarra Valley Road
Construction of a 3 span bridge over the Tarra River.
Yarram-Traralgon Road
Reconstruction and realignment of 4.3 km.

Bairnsdale Shire
Bulluwaal Road
Construction of a 5 cell culvert and approaches at Waterholes Creek.

Bendigo City
Mandurang Road
Reconstruction of 1.5 km including the Miller Street intersection.

Box Hill City
Canterbury Road
Widening and reconstruction between Elgar Road and Station Street.

Brighton City
North Road
Reconstruction between Beach Road and Asling Street.

Broadford Shire
Broadford-Wallan Road
Reconstruction and realignment of 2.6 km south of Broadford.

Buln Buln Shire
Longwarry-Drouin Road
Reconstruction of 3.8 km.

Camberwell City
Doncaster Road
Reconstruction between Sylvander Street and Greythorn Road.

Cranbourne Shire
Cranbourne-Frankston Road
Reconstruction of 1 km east of Pearcedale Road.

Croydon City
Canterbury Road
Construction of culverts at Croydon main drain and Bungalook Creek.
Mt Dandenong Road
Duplication of 0.6 km.

Dandenong City
Dandenong-Frankston Road
Dupliclation of 1.6 km between Kirkham Road and Greens Road.
Stud Road
Duplication of 0.5 km between David Street and Leonard Street.

Doncaster and Templestowe City
Heidelberg-Doncaster Road
Duplication of 0.6 km between Lillian Street and Derreck Street.

East Loddon Shire
Bridgewater-Serpentine Road
Reconstruction of 3.6 km south of Serpentine.

Eltham Shire
Eltham-Yarra Glen Road
Construction of a roundabout and duplication of the road at the Eltham-Templestowe Road intersection.
Eltham-Yarra Glen Road
Construction of a single span bridge over Watson's Creek.

Flinders Shire
Rosebud-Flinders Road
Construction of a 2 cell culvert at Main Creek.

Frankston City
Cranbourne-Frankston Road
Duplication of 0.7 km between Beach Street and Lindrum Road.

Hastings Shire
Frankston-Flinders Road
Construction of a 3 cell culvert at Warringine Creek.

Healesville Shire
Eltham-Yarra Glen Road
Reconstruction of 1 km between Yarra Glen-Glenburn Road and Yarraview Road.
Healesville-Yarra Glen Road
Reconstruction of 1.2 km near Yarra Glen racecourse.

Municipal roadworks on unclassified roads:

1. Construction of a 5 span bridge over the Hallam Main Drain, Shire of Cranbourne.
2. Reconstruction of 2.5 km of the Whittlesea-Yea Road, Shire of Yea.
3. Reconstruction of 1.6 km of the Woodend-Wallan Road, Shire of Newham and Woodend.
4. Reconstruction of Drummond Street, City of Ballaarat.

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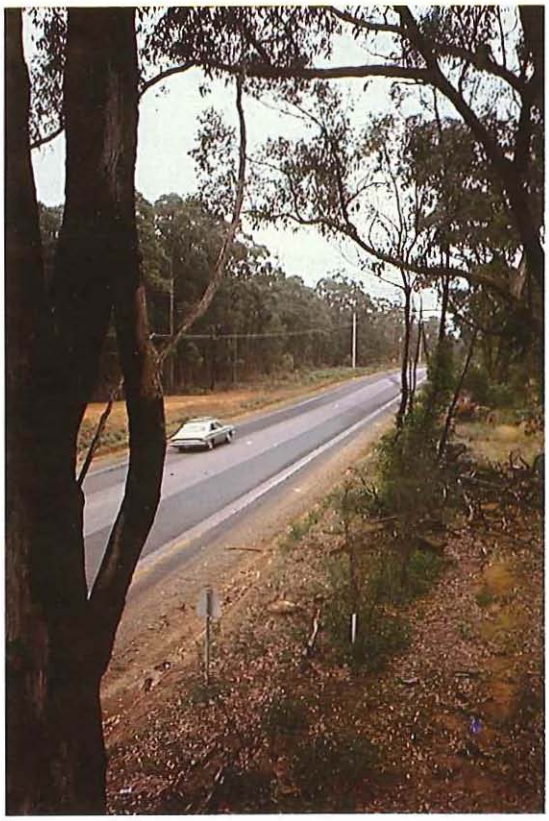

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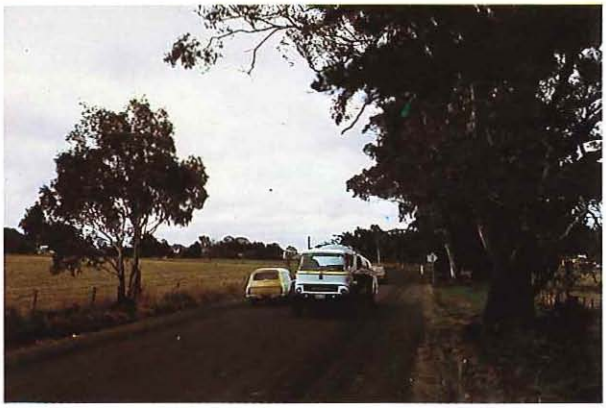

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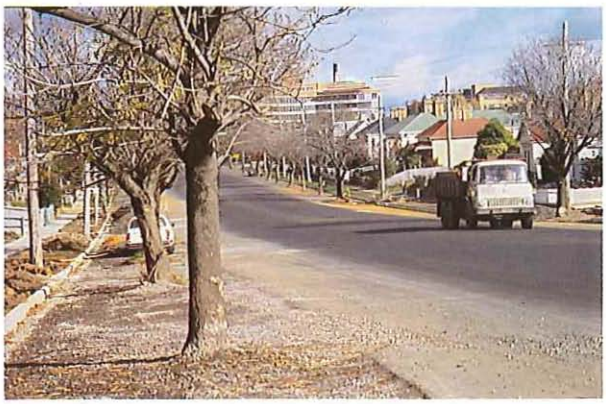


Reconstruction and widening of Princess Street, City of Kew.

Main roads (cont)

KewCity
Princess Street
Reconstruction between Wells Street and Earl Street.

Knox City
Main Ferntree Gully Road
Duplication of 0.9 km between Kathryn Road and Scoresby Road.
Wantirna-Sassafras Road
Reconstruction of the Boronia and Wantirna Roads intersection, Wantirna.

Korumburra Shire
Loch-Poowong Road
Reconstruction and realignment of 1 km.
Poowong-Ranceby Road
Reconstruction and realignment of 3 km.

Kyneton Shire
Trentham Road
Reconstruction of 3.5 km north of Tylden.

Lillydale Shire
Lilydale-Monbulk Road
Reconstruction of the Clegg Road intersection.

Mirboo Shire
Leongatha-Mirboo Road
Reconstruction and realignment of 7.1 km.
Mirboo North-Thorpdale Road
Reconstruction and realignment of 1.4 km.

Moorabbin City
South Road
Reconstruction between the Nepean Highway and Jasper Road.

Morwell Shire
Tyers Road
Reconstruction and realignment of 2 km.

Narracan Shire
Willowgrove Road
Reconstruction and realignment of 1.5 km.

Oakleigh City
Ferntree Gully Road
Reconstruction and widening between Stamford Road and Huntingdale Road.

Pakenham Shire
Healesville-Koo-wee-rup Road
Reconstruction of 1.6 km between Ballarto Road and Ellet Road.

Ringwood City
Canterbury Road
Duplication of 0.3 km between Sunset Drive and Dickasons Road.

Sherbrooke Shire
Wellington Road
Reconstruction at the Belgrave-Gembrook Road intersection.
Olinda-Monbulk Road
Reconstruction of 1.3 km between Red Hill Road and Invermay Road.

South Gippsland Shire
Foster North-Mirboo South Road
Reconstruction of 2.6 km.

Stawell Shire
Navarre Road
Construction of a 5 span bridge over the Wimmera River.

Tambo Shire
Metung Road
Construction of a single span bridge and approaches at Bennetts Brook.

Traralgon City
Tyers Road
Reconstruction of 1 km.
Traralgon-Maffra Road
Construction of a 4 span bridge over the Latrobe River.

Warragul Shire
Warragul-Korumburra Road
Reconstruction and realignment of 3 km.

Waverley City
High Street Road
Reconstruction of 1.1 km between Gallaghers Road and the Dandenong Creek.
Springvale Road
Reconstruction of 1.6 km of the northbound carriageway between High Street Road and Waverley Road.

Whittlesea Shire
Epping Road
Reconstruction of 2 km south of Donnybrook Road.
Main Whittlesea Road
Reconstruction between Cades Road and Donnybrook Road.

Winchelsea Shire
Birregurra-Forrest Road
Construction of 5 culverts, with a total of 23 cells, across the Barwon River flood plain at Birregurra.
Birregurra-Forrest Road
Construction of a single span bridge across Callaghans Creek.

Woorayl Shire
Inverlock-Leongatha Road
Reconstruction of 1.1 km in Leongatha.
Mardan Road
Reconstruction of 2.1 km.

Unclassified roads

Significant works completed or substantially completed during financial year 1978-79.

Alexandra Shire
Glendale Road
Construction of a 3 span reinforced concrete bridge over the Acheron River.

Bacchus Marsh Shire
Fisken Street
Construction of a 3 span bridge over the Werribee River, Bacchus Marsh.

Ballaarat City
Drummond Street
Reconstruction of 0.3 km between Duncan and Macarthur Streets.

Berwick City
Hallam North Road
Reconstruction of 1.5 km between Belgrave-Hallam Road and Heatherton Road.
Robinson Road
Reconstruction of 1.8 km between Narre Warren Road and Halleur Road.

Box Hill City
Station Street
Widening and reconstruction between Kilsythe Avenue and Bronte Avenue.

Broadmeadows City
Broadmeadows Road
Construction between Johnstone Street and Mickleham Road.

Buln Buln Shire
Neerim North
Reconstruction of 1.5 km.

Camberwell City
Stanhope Grove
Widening and reconstruction between Prospect Hill Road and Canterbury Road.

Caulfield City
Inkerman Street
Resurfacing between Hawthorn Road and Orrong Road.

Coburg City
O'Hea Street
Reconstruction between Lansdowne Street and Sussex Street.

Cranbourne Shire
Hallam Road
Construction of a 5 span bridge over the Hallam Main Drain.
Patullas Road
Construction of a 3 span bridge over Lang Lang River.

Croydon City
Colchester Road
Reconstruction of 0.7 km between Lena Grove and Canterbury Road.

Dandenong City
Heatherton Road
Reconstruction of 0.5 km between Cleeland Street and James Street.
Greens Road
Reconstruction of 0.5 km west from Ordish Road.

Diamond Valley Shire
Weidlich Road-Progress Road
Reconstruction between Karingal Road and Heacham Road.

Doncaster and Templestowe City
Tindals Road
Construction of 1.5 km between Harris Gully Road and Heidelberg-Warrandyte Road.

Dundas Shire
Narrow Bridge Road
Construction of a 3 span bridge over Wannon River.

East Loddon Shire
Pyramid-Yarraberb Road
Reconstruction of 5 km north from Prairie Road.

Unclassified roads (cont)

Eltham Shire
Eltham-Greensborough Road
Reconstruction of 0.4 km between Karingal Drive and Rattray Road.
Hurstbridge-Arthurs Creek Road
Construction of a 3 span bridge over Arthurs Creek.

Essendon City
Brewster Street
Resurfacing between Pascoe Vale Road and Napier Street.

Fitzroy City
Holden Street-Bennett Street
Reconstruction between St Georges Road and Park Street.

Flinders Shire
Browns Road
Construction of 2 km west from Trumans Road.

Footscray City
Whitehall Street
Reconstruction between Somerville Road and Francis Street.

Healesville Shire
Myers Creek Road
Reconstruction of 1.7 km south from Healesville-Kinglake Road.

Heidelberg City
Upper Heidelberg Road
Reconstruction between Clauscen Street and Waiora Road.

Kellor City
Kings Road
Reconstruction between Gillespi Road and Taylors Road.

Knox City
Boronia Road
Duplication of 0.6 km between Zeising Court and Scoresby Road.

Korumburra Shire
Timms Road
Reconstruction and realignment of 2.9 km.

Kowree and Wannon Shires
Rocklands Road
Construction of a 4 span bridge over the Glenelg River.

Lillydale Shire
Birmingham Road
Reconstruction of 0.3 km between Greenslopes Drive and Carronvale Road.
Macintyre Lane
Construction of 2.6 km at Lilydale Aerodrome.

Melton Shire
Boundary Road
Reconstruction of 1.6 km west of Hopkins Road.
Centenary Avenue
Reconstruction between Coburns Road and Yuille Street.

Moe City
Haigh Street
Extension of the road and construction of a new bridge over Narracan Creek.

Mordialloc City
Nepean Highway Service Road
Construction of a service road between Warrigal Road and Oak Avenue.

Morwell Shire
Alexanders Road
Reconstruction and widening of 1.3 km.

Nunawading City
Main Street
Reconstruction of 1.2 km between South Parade and Canterbury Road.
Terrara Road
Reconstruction of 0.5 km between Hanover Road and George Road.

Newham and Woodend Shires
Woodend-Wallan Road
Reconstruction of 1.6 km north-east of Woodend.

Oakleigh City
Waverley Road
Reconstruction between Warrigal Road and Huntingdale Road.

Oxley Shire
Carboor-Whorouly Road
Construction of a 3 span reinforced concrete bridge over the Whorouly river.

Portland Town
Port Road (West Boundary Road)
Construction of a 2 span bridge carrying Bridgewater Road over Port Road.

Portland Shire
Winnap-Drik Drik Road
Reconstruction of 1 km at Winnap.

Unclassified roads (cont)

New 2 span bridge on the Violet Town-Dookie Road over the Broken River, Shire of Violet Town.

Preston City
Dunne Street
Reconstruction between Maryborough Avenue and Darebin Creek.

Ringwood City
Eastfield Road
Construction of a single span bridge over the railway.
Wonga Road
Construction of 0.3 km south from Plymouth Road.

Rosedale Shire
Longford-Letts Beach Road
Reconstruction of 3 km.

Shepparton Shire
Ford Road
Reconstruction of 1.8 km.

Sherbrooke Shire
Mahoney Street
Reconstruction of 1 km between Glenfern Road and Main Street.

South Barwon Shire
Marshalltown Road
Reconstruction and widening of 0.5 km west from Barwon Heads Road.

South Melbourne City
Queensbridge Square
Reconstruction and signalisation of the Queensbridge Street/Yarra Bank Road/ Riverside Avenue intersection.

Tungamah Shire
Shepparton-Katamatite Road
Reconstruction of 4.9 km.

Violet Town Shire
Violet Town-Dookie Road
Construction of a 2 span reinforced concrete bridge over the Broken River.

Warragul Shire
Old Telegraph East Road
Reconstruction and realignment of 1.6 km.

Waverley City
Jells Road
Reconstruction of 1.6 km between Ferntree Gully Road and Waverley Road.
Waverley Road
Reconstruction of 0.8 km between Lum Road and Jells Road.

Werribee Shire
Derrimut Road
Reconstruction of 1.6 km between Hogans Road and Sayers Road.

Werribee Shire-Sunshine City
Boundary Road
Reconstruction and widening of 1.1 km between Station Road and Fitzgeralds Road.

Whittlesea Shire
Craigieburn Road
Reconstruction of 1 km east of the Hume Highway.
Merriang Road
Reconstruction of 2.8 km north of Beveridge Road.

Woorayl Shire
Andersons Road
Construction of 1.5 km.
Hills Road
Construction of 1.9 km.

Yea Shire
Whittlesea-Yea Road
Reconstruction and widening of 2.5 km.

Other projects and activities

National Park roads

The State Government again provided loan funds repayable by the Board, amounting to $100,000, 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 the following National Parks:

Brisbane Ranges National Park	Bannockburn and Corio Shires
Bulga National Park	Alberton Shire
Cape Schanck National Park	Flinders Shire
Captain James Cook National Park	Orbost Shire
Ferntree Gully National Park	Sherbrooke Shire
Fraser National Park	Alexandra Shire
Glenaladale National Park	Bairnsdale Shire
Hattah Lakes National Park	Mildura Shire
Holey Plains	Rosedale Shire
Kinglake National Park	Eltham and Whittlesea Shires
Lind National Park	Orbost Shire
Little Desert National Park	Dimboola Shire
Lower Glenelg	Portland Shire
Morwell National Park	Morwell Shire
Mount Buffalo National Park	Bright Shire
Mount Burrowa Pine National Park	Tallangatta Shire
Mount Eccles National Park	Minhamite Shire
Mount Richmond National Park	Portland Shire
Mount Samaria National Park	Mansfield Shire
Organ Pipes National Park	Keilor City and Bulla Shire
Port Campbell National Park	Heytesbury Shire
Tarra Valley National Park	Alberton Shire
The Lakes National Park	Rosedale Shire
Warby Ranges National Park	Wangaratta Shire
Warrandyte National Park	Doncaster and Templestowe City
Wilsons Promontory National Park	South Gippsland Shire
Wingan Inlet National Park	Orbost Shire
Wyperfeld National Park	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 already constructed. The works were carried out either by the Board, the local municipal council or the National Parks Service.

The Government has made loan funds totalling $1,597,000 available for these purposes since 1st July, 1963.

Roads of tourist interest

The State Government provided loan funds totalling $225,000 in 1978/79 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 made by the Board after consultation with the Ministry of Tourism.

The total amount made available by the Government since 1960 is $3,894,000.

Application for financial assistance from these funds are well in excess of the amount available for expenditure.

The Board is required to make an annual payment into the Tourist Fund amounting to 2% of the amount credited to the Country Roads Board Fund in the previous year from receipts under the Motor Car Act. An amount of $1,519,563 was paid during the year.

The Tourist Fund is administered by the Ministry of Tourism.

National Association of Australian State Road Authorities

The National Association of Australian State Road Authorities (NAASRA) is an organization of the Road Authorities of the six States and the Commonwealth Department of Housing and Construction, and also the Northern Territory Department of Transport and Works which was admitted on 17th May, 1979.

The members of NAASRA are the heads of the various authorities.

The Association was established in 1934, as the Conference of State Road Authorities, and adopted its present name in 1959.

NAASRA aims to provide a central organization where, by co-operative effort, a uniform approach to the development and improvement of the national road system can be achieved. Over the years, this co-operation has permitted the Association to co-ordinate and rationalize road and bridge design standards, construction and maintenance practices, and road research projects, and also to gather and publish the facts about Australia's principal roads and their financing. From these activities, NAASRA has developed a national approach to Australia's road problems.

The technical work of NAASRA is performed by the

Principal Technical Committee (consisting of the chief engineering officers of the authorities) and a number of standing and ad hoc committees on which the Board is represented. NAASRA's views on such matters as the Commonwealth's 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 T H Russell is a member. This group advises ATAC, the meeting of Ministers of Transport, which determines policy. The following NAASRA meetings were held during the year:

- 60th (Annual Meeting) Adelaide, 6th and 7th November, 1978, attended by Mr R E V Donaldson, the then Chairman.
- 61st (Intermediate Meeting) Melbourne, 17th May, 1979, attended by Mr T H Russell, Chairman, Mr W S Brake, Deputy Chairman and Mr N L Allanson, Member.

Items considered by NAASRA during the year included:

1 Admission of Northern Territory Department of Transport and Works to NAASRA.
2 International organizations and conferences.
3 Commonwealth road funds legislation.
4 State roads legislation.
5 Road surveys.
6 Road vehicle limits.
7 NAASRA study of road maintenance standards, costing and management.
8 NAASRA data bank systems.
9 Uniform road statistics.
10 Co-ordination of road research.
11 International training courses.
12 NAASRA publications.

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 Housing and Construction, the Secretary of the Commonwealth Department of Transport, and the Executive Director of ARRB.

Up to 10% of the ARRB's annual expenditure is borne by the Commonwealth Department of Housing and Construction. 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 States Grants (Roads) Act 1977.

The objective of the Board is to co-ordinate, encourage and arrange continuing research into problems associated with road and traffic in Australia, i.e. research into road planning, location, design, construction and maintenance, traffic operation and road safety.

The Directors 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, the then Chairman, who at the time was also Deputy Chairman of ARRB, attended the 37th Directors' meeting of ARRB at the Highways Department, Adelaide, on 9th November, 1978. The present Chairman, Mr T H Russell, attended the 38th meeting held at the Australian Road Research Centre, Vermont, on 15th and 16th May, 1979.

Technical conferences for the wider dissemination of the results of research and the exchange of knowledge are held biennially. The Ninth Conference was held in Brisbane in August 1978.

Several CRB engineers are members of ARRB Technical or Specialist Committees, and CRB officers are involved in some of the ARRB research projects.

Co-operation with Army Reserve

The Board continued its sponsorship, with other Victorian Government instrumentalities, of Royal Australian Engineers Supplementary Reserve units of the Australian Army Reserve. These sponsoring authorities undertake public works akin to military engineering tasks and the Supplementary Reserve units provide the means of using the civilian knowledge and skills of members to military advantage. With complementary training in purely military subjects a nucleus of army engineers is thereby developed for rapid expansion in time of defence emergency. The units sponsored by the Board are the Headquarters 22 Construction Regiment and the 107 Plant Squadron (Heavy).

The 1978 annual camp was held in October at the School of Military Engineering, Casula, New South Wales, where members took advantage of the school's specialist instructors and facilities to develop their individual and collective skills in military engineering. Training included many aspects of modern military bridging equipment and techniques as well as advanced training in specialized topics for officers and senior NCOs. The movement of members interstate was effected in RAAF Hercules transport aircraft.

In May, 1979, Lieutenant Colonel G R Hunt ED, the Board's Specification and Contracts Engineer, completed his term as Commanding Officer of the regiment and was succeeded by Lieutenant Colonel P M Hosking ED, the Board's Property Officer.

The plant squadron is commanded by Major E G Renton, an engineer in the Works Sub-branch.

At 30th June, 1979, thirteen members of the Board's staff were officers of 22 Construction Regiment.

Public relations

The Board continued to pursue the policy of informing the public of its functions and works. The Public Relations Section prepared news releases, publications, audio-visual productions and displays as mediums for carrying out this activity.

Publications

In May, the awards of the Australian Institute of Management (NSW Division) for annual reporting were announced, and the Board received a Bronze Award for its 65th Annual Report 1977-78. The award was made in the Public Administration Division, Public Administrative Units.

During the year, the Board issued the following publications and pamphlets:

CRB News, Nos. 39, 40, 41.
Drivers' Guide to Victoria (two editions).
Truckies' Guide to the Advisory Truck Route
Hume Freeway, Seymour-Euroa.
Colouring Book (reprint).
Snow Driving . . . It's An Art.
Information Bulletin, Surrey Hills.
Information Brochure, Banksia Street to Bell Street Connection, Heidelberg.

Audio Visual Productions

During the year four short video productions were made for public exhibition:

Roadscape — a Moving Environment.
The West Gate Freeway.
Latrobe Terrace, Geelong.
Snow Driving . . . It's An Art.

Vandalism campaign

During the summer months the Board conducted an anti-vandalism campaign, using news releases, CRB News and car tidy bags to bring to the public's attention the problem of roadside vandalism.

The campaign was based on a survey by the Board's Divisional Engineers, which showed that the cost of vandalism to the Board and municipal councils was approaching $½ million each year.

The campaign was launched jointly by the Minister of Transport, the Hon Robert Maclellan, MLA, and the Chairman of the Board, Mr T H Russell at a news conference in December.

Information bulletins

The Board continued the practice of issuing regular information bulletins on major projects. During the year bulletins were issued on the Nepean Highway widening project between Elsternwick and Moorabbin and the West Gate Freeway project, South Melbourne.

The information bulletins are issued to residents, councils, Members of Parliament and the media, and outline current progress on the project concerned.

Personnel

The Board's personnel strength as at 30th June, 1979, was as follows:

Technological staff (professional)	618
Technical staff	524
Administrative staff	772
Supervisory staff — Field	177
Depot	76
Clerk of works	82
Construction and maintenance personnel	2170
Workshop and depot personnel	643
Total	5062

During the year the Board continued to examine carefully all requests for staff recruitment and staff replacement in accordance with its policy of as far as possible restricting the total number of staff employed by the Board to the number employed as at 18th May, 1978.

The Board engaged 20 young people during the year as part of the Commonwealth Government initiated Special Youth Employment Training Programme. This programme encourages the development of job skills in young people between the ages of 15-24 years who have been unemployed for at least four months. The young people engaged were given on-the-job training for a maximum period of four months, mostly in field positions.

The Board was also able to provide one hundred school students with work experience under the Work Experience Act 1975, in clerical, technical and field positions. The Act was introduced by the State Government in January, 1975, to enable students over thirteen years of age to be provided with work experience for up to twelve days in any one term. The State Education Department reimbursed to the Board the salaries paid to the students.

Apprenticeships

Twenty-five new apprentices were employed during the year in the trades of motor mechanics (17), structural steel fabrication (1), landscape gardening (2), painting and decorating (1), fitting and turning (1), auto electrics (1) and electrical mechanics (2). The total number of apprentices in training at 30th June 1979, was:

Motor mechanics	72
Structural steel fabrication	5
Carpentry and joinery	7
Painting and decorating	4
Electrical mechanics	3
Cooking	1
Automotive electrics	2
Landscape gardening	4
Lithographic printing	2
Instrument making and repairing	1
Fitting and machining	2
Plumbing and gasfitting	2
Total	105

Training and development

As in previous years, the Board provided a comprehensive inservice training programme for its staff at all levels based on annual assessment of training needs. Courses covered technical subjects such as road design, traffic engineering and quality control, and also management principles and skills.

During the year a post graduate scholarship was awarded to a Board officer for a Masters degree in Transportation Engineering at the University of California in pavement design.

During the year officers attended the following external training courses:

- The Traffic Planning and Control Course (University of New South Wales).
- The Construction Management Course (University of New South Wales).
- The Advanced Course (Australian Administrative Staff College).
- The Management Development Course (Australian Administrative Staff College).

A study leave scheme and job rotation programme for professional, technical and administrative staff were conducted to assist staff development.

Industrial relations

The Board's relationships with trade unions during the year continued to be generally satisfactory.

The Board was represented in a large number of cases before the Australian Conciliation and Arbitration Commission. The more important cases included claims for increased rates of pay and condition improvements in the two building trades awards — the National Building Trades Construction Award and the Building Construction Employees and Builders Labourers Award. The Board was represented by its Industrial Relations Officer on a national committee of seven employer representatives responsible for negotiations with the unions concerned.

Another important case concerned the Transport Workers' (General) Award where the Transport Workers' Union sought a wage increase of $8 per week. Several stoppages over this claim directly affected the Board's operations. These matters were unresolved at the end of the financial year.

A dispute with the Australian Workers' Union resulted in a stoppage by Board's employees at the Mulgrave Freeway Project. The issue involved both rates of pay and demarcation between members of the Australian Workers' Union and the Federated Engine Drivers' and Firemen's Association. Both matters were resolved to the satisfaction of all parties.

The Board provided advice on industrial relations matters to the West Gate Bridge Authority over the

eighteen months prior to the opening of the bridge. During the year a new item of highly sophisticated road construction plant, the C.M.I. Autograde, was put into operation by the Board. Prior to purchase of the autograde, discussions were held with the Austalian Workers' Union in relation to the effect of the autograde upon employment levels. The A.W.U. was assured that the new plant would not directly reduce the number of jobs available to A.W.U. members, and the Union agreed to co-operate with the Board in the operation of the autograde.

Superannuation for wages employees
On 30th March, 1979, the Premier, the Hon R J Hamer, ED, MP, announced the establishment of a new superannuation scheme which will enable approximately 2,800 wages employees of the Board who were not at that time eligible to contribute to the State Superannuation Scheme, to receive superannuation benefits. The new scheme provides improved benefits over and above the existing retiring gratuity scheme.

Award coverage
Details of Federal Awards to which the Board is a respondent party and the number of its personnel covered by these Awards as at 30 June, 1979, are as follows:

Award	No. of employees
Australian Workers' Union Construction and Maintenance	1772
Building Construction Employees and Builders Labourers	134
Carpenters and Joiners	11
Engine Drivers and Firemen	2
National Building Trades Construction	79
Metal Trades	333
Transport Workers General	310
**Country Roads Board Salaried Staff*	1680
Municipal Officers (Country Roads Board) Senior Officers	19
Professional Engineers (Country Roads Board, Victoria)	511
Professional Engineers (Country Roads Board, Victoria) Senior Engineers	21
Total	4872

The remaining employees are covered by Victorian Wages Board Determinations.
*Formerly titled the Municipal Officers (Country Roads Board).

Salaries payment by cheque
During the year, the Board introduced a system of payment of staff salaries by cheque or bank transfer in addition to the previously existing system of cash payment of staff salaries. The new system was introduced in order to reduce security risks associated with cash payment of staff salaries. The new system was introduced with the agreement and co-operation of the staff and staff associations.

Issue of safety footwear
During the year, with the agreement of employee unions, the Board implemented a scheme which will provide free safety footwear and protective clothing to all field, depot and workshop employees.

Occupational health
The Board purchased a portable diagnostic audiometer during the year for the testing of certain employees' hearing ability. The audiometer is of assistance to the Board in meeting its obligations under the Health (Hearing Conservation) Regulations, which came into operation on 1st January, 1979.
From May, 1978, to October, 1978, the Board conducted an immunisation programme against poliomyelitis and influenza. The Board's medical staff carried out the inoculation of personnel at the Head Office complex and at Syndal whilst for personnel elsewhere in the State arrangements were made with local medical practitioners. The response of personnel to this programme resulted in 977 personnel being immunised against influenza and 1361 against poliomyelitis.

Retired Persons' Association
During the year a CRB Retired Persons Association was formed. The association elected its office bearers, drew up a constitution and arranged functions to bring together as many retired Board personnel as possible.

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

Name	Position	Location	Length of service (years)
Donaldson, R E V	Chairman	Board	33
Hughes, E T	Depot Foreman	Bendigo Division	45
Cambridge, C J	Superintendent of Works	Horsham Division	43
Jackson, F W	Pipe Testing Officer	Bridge Sub-Branch	42
Albert, S G	Patrolman	Geelong Division	39
Beston, W B	Mobile Crane Driver	Mechanical Sub-Branch	36
Davey, L G	Carpenter	Secretary's Branch	34
Godkin, H	Superintending Draftsman	Title Survey Division	31
Lingard, N J	Patrolman	Bendigo Division	31
Horan, (Miss) E M	Senior Machine Operator	Geelong Division	30
Proudfoot, D G	Controller of Stores	Central Stores Syndal	30
Wilson, A C	Stock Inspector	Ballarat Division	29
Glisovic, M	Owner Truck Driver	Benalla Division	27
Ward, F E	Overseer	Horsham Division	27
*Jervies, C W	Cleaner/Gardener	Warrnambool Division	26
Mikolajczak, F	Plant Operator	Traralgon Division	26
Cornwall, R W	Rail Car Tanker Attendant	Bairnsdale Division	24
*Harkings, G	Overseer	Traralgon Division	24
*Masters, H E	Experimental Officer	Materials Research Division	24
Gange, P H	Engineer	Plans and Surveys Division	23
*Gunn, G E	Engineer	Warrnambool Division	23
Harris, L G	Carpenter	Ballarat Division	23
Selzer, P F	Overseer	Traralgon Division	23
Duffey, W J	Workshop Supervisor	Bridge Sub-Branch	22
Somerville, K	Storeman	Bairnsdale Division	22
Morris, J C	Patrolman	Bairnsdale Division	21
Debono, S	Fitter	Mechanical Sub-Branch	20
*Hoskin, V	Truck Driver	Dandenong Division	20
McIntyre, A A	Bitumen Worker	Bendigo Division	20
Robe, C	Patrol Assistant	Geelong Division	20

*Deceased

Legislation affecting the Board

Legislation enacted or in the process of being enacted during the year, which affected the Board included the following:

Country Roads (Amendment) Act 1978

This Act which came into operation on 1st December, 1978, made a number of amendments to the Country Roads Act 1958. The principal amendments:

(a) provided for the Board to administer the Country Roads Act and exercise the rights, powers and authorities and discharge the duties conferred or imposed by that Act or any other Act, subject to both general and specific directions of the Minister of Transport;

(b) extended the Board's by-law making powers regarding the preservation and protection of land owned by the Board;

(c) amended and clarified the street lighting provisions already contained in the Act;

(d) extended to main roads the Board's powers to impound unattended livestock; and

(e) increased various penalties under the Act.

The Board's by-law making powers were extended to give the Board greater power to control activities on land which it owns. Previously, the Board was unable to make by-laws regulating the use of land purchased or acquired by it for road purposes, until such time as a road had been constructed on that land and the road had been declared. As a result, the Board had been experiencing problems by reason of persons using construction sites or land acquired for future roadworks for various recreational activities and other types of activities which caused inconvenience to nearby residents, mainly through the noise which they produced. In addition, these activities at times resulted in damage to plant and interfered with works.

Section 72 of the Country Roads Act provides that the costs of installation, operation and maintenance of street lighting on State highways and main roads are to be shared equally between the Board, the electric supply authority and the municipal council concerned. Some queries had arisen as to whether or not certain costs, in particular, the costs of improving existing lighting installations, should be included in the cost sharing scheme. The amendments to Section 72 made by the Country Roads (Amendment) Act 1978 made it clear that all costs relating to the installation, operation and maintenance of street lighting on State highways and main roads are to be shared, provided that the costs have first been approved by the Street Lighting Committee.

The Board previously had power to impound unattended stock on State highways, freeways, and tourists' roads, but not on main roads. This had given rise to some problems where the Board's Stock Inspectors were unable to deal with unattended stock on main roads in circumstances where it was apparent that such stock could stray on to State highways. The amendment overcame this problem by extending to main roads the Board's power to impound unattended stock.
Most of the penalties provided for in the Country Roads Act were fixed many years ago and with the inflation which has occurred over recent years, it was appropriate that these penalties be increased. Most of the penalties were increased by 100%.

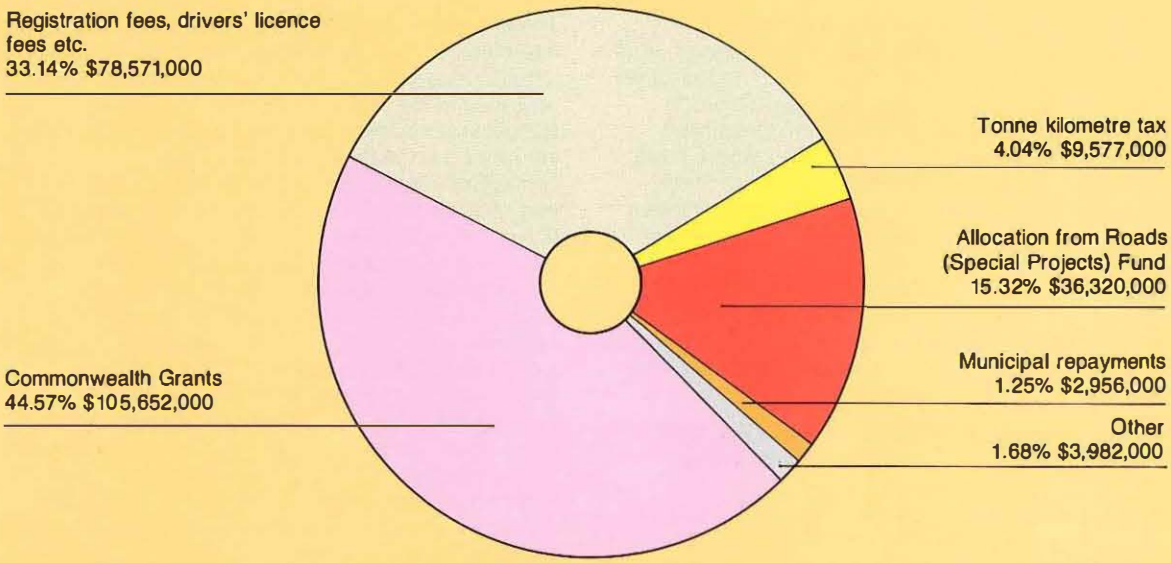
Country Roads (Borrowing Powers) Act 1978
This Act came into operation on 5th December, 1978.
The Act amended the Country Roads Act 1958 by authorising the Board to borrow sums not exceeding $100 million by the issue of inscribed stock or debentures, and to permit the Board to obtain a bank overdraft not exceeding $5 million. The amendment enables the Board to have access to wider forms of finance to provide a greater flexibility in road funding.

Business Franchise (Petroleum Products) Act 1979
This Act was passed during the Autumn Session of Parliament and came into operation on 1st September, 1979.
The Act was passed with the object of replacing the revenue lost through the abolition of road maintenance charges, the decision to abolish these charges having been made by all mainland States following the emergency associated with blockades by transport operators.
On 27th April, 1979, the Australian Transport Advisory Council (ATAC) comprising Commonwealth and State Transport Ministers, considered the question of alternative funding for roads following the abandonment of the road maintenance charges. At that meeting it was decided to form a working party of officers representing each State to consider means of replacing road maintenance charges. The Board's Chairman, Mr T H Russell, was appointed by ATAC to convene the Working Party.

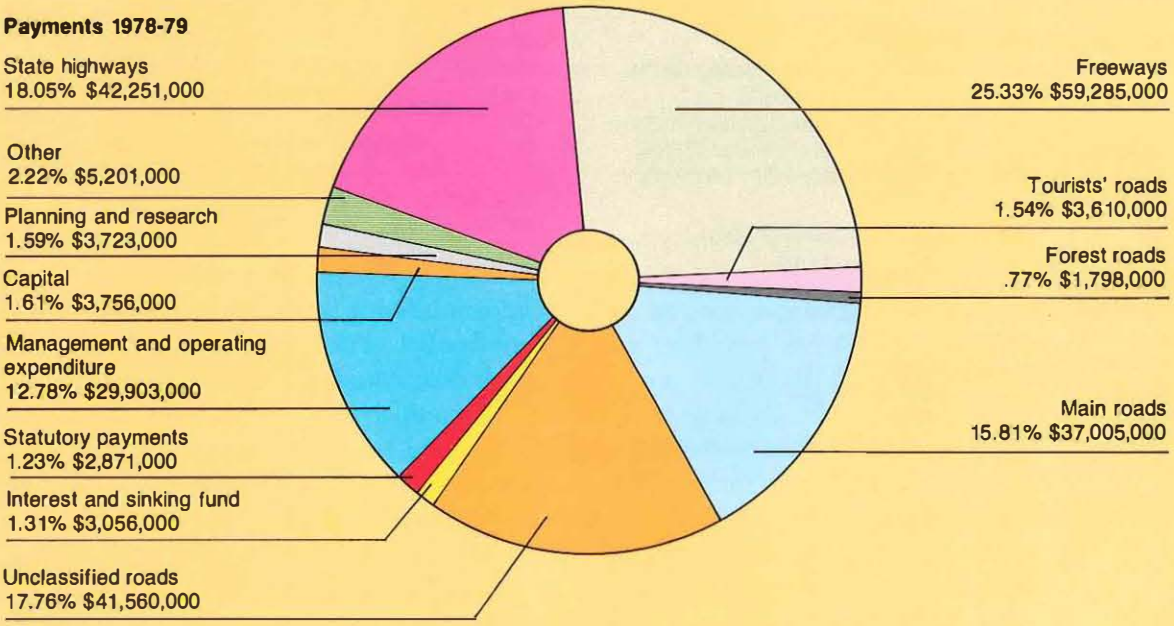
The Working Party reported generally that the alternative to road maintenance charges should be a levy on road fuels imposed by the Commonwealth on behalf of the States or alternatively, that a franchise licensing of persons selling fuel should be introduced in the States and Territories.
As the Commonwealth did not agree to imposing a levy on road fuels on behalf of the States, the State Government adopted a franchise licensing system and the Act provided for the raising of revenue by a licence fee payable by persons who carry on petroleum wholesaling or retailing in Victoria. As from 1st September, 1979, the Act requires petroleum wholesalers to hold a licence, the monthly licence fee being $50, together with the payment of an amount of 4.5% of the value of motor spirit and 7.1% of the value of diesel fuel sold by the licence holder in the course of intra State trade during the month, two months prior to the month to which the licence relates. Petroleum retailers are also required to hold a licence for which an annual fee of $50 is paid on a similar basis to the fee applicable to the petroleum wholesaler's licence, except that the ad valorem fee does not apply to fuel purchased by a petroleum retailer from a licensed petroleum wholesaler.
The Act also established a "Roads and Special Projects Fund" into which is to be paid an amount equal to the licence fees collected under the Act after deduction of costs of administration. The Act provides for moneys in the Roads and Special Projects Fund to be paid to the Country Roads Board Fund and to the Transport Fund as determined by the Minister of Transport with the proviso that the amount paid to the Country Roads Board Fund in each financial year shall not be less than one quarter of the amount credited in licence fees under the Act during the financial year or $10 million whichever is the greater and that the minimum amount so paid shall be available for road maintenance.

Finance

Receipts 1978-79



Payments 1978-79



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 $238,861,286. The funds were derived from:

State sources	131,406,010
Commonwealth sources	105,652,109
Balance brought forward from year 1977/78	1,803,167
	$238,861,286

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 for 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 States Grants (Roads) Act 1977, Transport Planning and Research (Financial Assistance) Act 1977.
- 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 1978/79 compared with 1977/78.

Item	1977/78	1978/79
Receipts from State sources	$	$
Fees under the Motor Car Act less cost of collection	75,978,153	78,570,895
Commercial Goods Vehicle Act	9,817,988	9,577,183
Municipalities contributions	2,890,536	2,955,935
Loan funds — See 31 CR Act 6229 State loans	325,000	325,000
Loan funds — See 31A CR Act 6229	—	1,000,000
Special grant from State treasury	581,000	463,000
General receipts	1,923,860	2,194,451
Allocation from Roads (Special Projects) Fund	33,456,293	36,319,546
	124,972,830	131,406,010
Balance brought forward at 1st July	792,920	1,587,490
	125,765,750	132,993,500
Receipts under Commonwealth grants for roads		
National highways	29,000,000	31,015,000
National commerce roads	3,800,000	3,341,000
Urban arterial roads	28,900,000	30,852,000
Urban local roads	3,600,000	4,628,000
Rural arterial roads	11,100,000	11,871,000
Rural local roads	19,000,000	20,321,000
Minor traffic engineering and road safety improvements	2,270,000	2,457,000
Balance brought forward at 1st July	—	215,677
	97,670,000	104,700,677
Traffic engineering and road safety	8,855	48,609
Receipts under Transport (Planning & Research) Act 1974	14,573	—
Receipts under Transport Planning & Research (Financial Assistance) Act 1977	1,286,666	1,118,500
	1,301,239	1,118,500
Total funds available for expenditure by the Country Roads Board	224,745,844	238,861,286

Matching Commonwealth Grants for roads

The Commonwealth States Grants (Roads) Act 1977 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 1980 is necessary for each State to qualify in full for the total amounts of the Commonwealth grants to be made under the States Grants (Roads) Act 1977. 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.

Victoria's quota for the year 1978/79 was $132,187,000.

Expenditure

Expenditure in the form of cash payments during the financial year amounted to $234,018,975, leaving a balance of $4,842,311 to be carried forward into financial year 1979/80.

The following table shows expenditure incurred by the Board including that from the Roads (Special Projects) Fund, in the years 1977/78 and 1978/79.

Item	1977/78	1978/79
	$	$
Construction and maintenance of roads and bridges	182,486,681	189,709,980
Capital expenditure (plant, workshops, offices, etc.)	3,121,769	3,756,467
Planning and research	2,817,237	3,722,626
Salaries operating accounts and other administrative expenditure	29,101,827	30,902,815
Statutory payments to Traffic Authority Fund, Transport Regulation Fund and Tourist Fund etc.	2,422,112	2,868,424
Interest and Sinking Fund payments	2,993,051	3,058,663
Total	222,942,677	234,018,975

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 1978 expenditure on the normal program of main roads works in financial year 1977/78 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	$18,708,174
Expenditure from Commonwealth funds	9,186,316
Expenditure from proceeds of tonne/kilometre tax (Commercial Goods Vehicles Act)	6,445,884
	34,340,374
Amount of Country Roads Board Fund expenditure apportioned to councils	2,879,299

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 1978/79 compared with 1977/78 was as follows:

	1977/78		1978/79	
	CRB	Council Contribution	CRB	Council Contribution
	$	$	$	$
Patrol maintenance	2,567,219	1,159,647	2,618,805	1,170,682
Construction, reconstruction and other maintenance	35,728,625	8,511,193	36,999,851	8,594,563
Total	38,295,844	9,670,840	39,618,656	9,765,245

Municipal councils were not required to contribute towards the cost of works involving an expenditure during the year of $106,943,000 on State highways, freeways, tourists roads and forest roads (including expenditure from the Roads (Special Projects) Fund).

Appendix 1

Special projects

Projects financed in whole or part from the Roads (Special Projects) Fund, during the financial year.

Project No.	Name and Descriptions
24	Eastern Freeway — Construction of a multi-lane freeway from Alexandra Parade, Collingwood to Thompsons Road, Bulleen.
33	Princes Freeway — Construction of a new bridge over the Snowy River at Orbost and realignment of approaches.
38	Outer Ring Route (F5 Freeway) — Land Acquisition from Dalton Road, Thomastown to Heidelberg Road, Greensborough.
40	Princes Freeway — Construction of a second carriageway between Moe and Hernes Oak.
41	Princes Freeway/Princes Highway — Construction of dual carriageways between Morwell and Traralgon.
42	Bass Highway — Improvements between Lang Lang and Dalyston.
43	Princes Freeway — Bypass of Drouin and Warragul.
44	Tullamarine Freeway — Construction of interchange at Essendon Airport and conversion of Lancefield Road to Freeway.
46	Omeo Highway — Improvements between Omeo and Mitta Mitta.
47	Calder Highway — Improvements between Harcourt and Bendigo.
48	Princes Highway East — Duplication through Pakenham and improvement of Army Road intersection.
49	Goulburn Valley Highway — Construction of a bridge over the Goulburn River At Trawool.
50	STATCON — The installation of stop signs, give way signs and traffic signals throughout the State.
51	Bellarine Highway — Construction of duplicate carriageways and new bridge at Fenwick Gully, Wallington.
52	Great Ocean Road — Reconstruction from Marengo to Calder River.
54	South Gippsland Freeway — Construction of road and bridge at Hampton Park.
55	Arterial Road Extension of the Eastern Freeway between Thompsons Road, Bulleen and Doncaster Road, Balwyn North.
56	Latrobe Terrace — Construction of multi-lane highway, between Hope Street and Settlement Road, Geelong.
57	Mornington Peninsula Freeway — Construction of multi-lane freeway between Eel Race Drain, Seaford and Springvale Road, Keysborough.
58	Nepean Highway — Construction of multi-lane highway between Cochrane Street, Elsternwick and South Road, Moorabbin.
59	Calder Freeway — Bypass of Keilor between Erebus Street and west of Keilor-Melton Road.
60	Princes Highway East — Construction of multi-lane highway between Hawthorn Road and Waverley Road, Malvern.
61	Western Highway — Construction of four-lane highway between Princes Highway and Ashley Street, Sunshine.
62	Princes Freeway — Construction of bypass of Berwick.
63	Princes Highway East — Improvements between Tonghi Creek and Bluenose Creek, Shire of Orbost.
64	Princes Highway East — Improvements between Rankins and east of Jones Creek Road, Shire of Orbost.
65	Omeo Highway — Improvements between Sarsfield and Bruthen.
66	Cann Valley Highway — Improvements between Weeragua and NSW border.
67	Mallacoota Tourists' Road — Improvements between Halls Creek and Mangans Lane.
68	Sunraysia Highway — Improvements between Bet Bet Creek and Lamplough.
69	Murray Valley Highway — Improvements at Killara and construction of bridges over Kiewa River.
70	Midland Highway — Improvements between Reef Hills and Barjarg south of Benalla
71	Murray Valley Highway — Improvements between Wood Wood and Piangil.

Appendix 1 cont.

Project No.	Name and Descriptions
72	Phillip Island Tourists' Road — Improvements between Anderson and the Nobbies.
73	Hamilton Highway — Improvements between Bruce Creek and west of Inverleigh.
74	Wimmera Highway — Improvements between Rupanyup and west of Marnoo.
75	Henty Highway — Princes Highway West — Improvements between Portland North and Bolwarra deviation.
76	Henty Highway — Improvements between Heywood and Branxholme.
78	Jeeralang North Road — Reconstruction at access to new quarry at Jeeralang North.
79	Route E6 — Construction of duplicate carriageways from Eastern Freeway to Harp Road.
80	Westgate Freeway — Land Acquisition from Graham Street to St Kilda Road.
81	Princes Highway West — Reconstruction from east of Bellbird to east of McKenzie River.
82	Henty Highway — Construction of duplicate carriageways between Mt Bainbridge Road and Rowes Corner.
83	South Eastern Freeway (Malvern Section) — Land Acquisition.

Appendix 2

Motor Registrations

Registrations under the Motor Car Act during 1978/79 totalled 2,308,701 an increase of 1.5% over the total for the previous year.

Vehicle	Financial year 1977/78		Financial year 1978/79		Increase	Decrease
Private						
New	121,125		126,585			
Secondhand:						
Re-registered	58,915		57,702			
Renewed	1,489,284		1,515,604			
		1,669,324		1,699,891	30,567	
Commercial and hire						
New	16,579		15,794			
Secondhand:						
Re-registered	5,823		5,907			
Renewed	135,221	157,623	134,698	156,399		1,224
Primary producers' trucks and tractors						
New	4,168		5,153			
Secondhand:						
Re-registered	2,864		3,167			
Renewed	80,773	87,805†	78,912	87,232*		573
Trailers		311,997	316,113		4,116	
Motorcycles		46,845	48,205		1,360	
Licences under the Motor Omnibus Act		871	861			10
Totals		2,274,465		2,308,701	36,043	1,807

† Includes 43,512 no-fee tractors
* Includes 43,303 no-fee tractors

Appendix 3

Statement of receipts and payments

for year ended 30th June 1979 (Adjusted to nearest dollar)

Country Roads Board

		Country Road Board Fund Act 6222 road maint. A/C							
		Act 6229		State Loan Funds	Roads (Special Projects) Fund	States Grants (Roads) Act 1977	Transport Plan. & Res. (Fin. Asstnce.) Act 1977	C'wealth Traffic & Road Safety Improvement Trust Account	Total
Receipts									
Balance as at 1st July 1978		1,587,490				215,677			1,803,167
Motor Car Act 1958 (No. 6325)									
Motor Car Registration Fees	85,409,207								
Drivers Licence Fees	2,611,236								
Drivers Licence Testing Fees	523,530								
Trailer Registration Fees	2,494,215								
Learner Drivers Permit Fees	541,539								
Examiners Licence Fees	9,404								
Sale of Log Books	18,923								
Motor Driving Instructors Licence Appointment and Testing Fees	3,049								
Motor Driving Instructors Licence Fees	10,305								
	91,621,408								
Less: Cost of Collection	13,050,513	78,570,895						78,570,895	
Municipalities Contributions									
Permanent Works — Main Roads	128,270								
Maintenance Works — Main Roads	2,827,665	2,955,935						2,955,935	
Fees — Commercial Goods Vehicles Act No. 6222 Road Maintenance A/C			9,577,183					9,577,183	
Public Works and Services Act No. 9210		463,000						463,000	
Fines — Country Roads Act No. 6229		14,548						14,548	
General Receipts		2,179,903						2,179,903	
State Loan Funds — Act No. 6229 Sec. 31				325,000				325,000	
Loans — Act No. 6229 Sec. 31A		1,000,000						1,000,000	
Allocation — Roads (Special Projects) Fund					36,319,546			36,319,546	131,406,010
Commonwealth Grants									
State Grants (Roads) Act 1977						104,485,000		104,485,000	
Transport Plan. & Res. (Fin. Asstce.) Act 1977							1,118,500	1,118,500	
Traffic & Road Safety Improvement								48,609	48,609	105,652,109
		$86,771,771	9,577,183	325,000	36,319,546	104,700,677	1,118,500	48,609	238,861,286

Road Expenditure										
Main Roads	— Construction and Reconstruction	12,787,788			623,193	9,607,178		38,041	23,056,200	
	Maintenance	6,934,149	7,014,986						13,949,135	37,005,335
State Highways	— Construction and Reconstruction	1,338,203		325,000	12,565,945	11,416,690		2,686	25,648,524	
	Maintenance	12,127,062	2,562,197			1,913,172			16,602,431	42,250,955
Freeways	— Construction and Reconstruction	8,802,824			13,517,903	33,733,874			56,054,601	
	Maintenance	2,087,685				1,142,961			3,230,646	59,285,247
Tourists' Roads	— Construction and Reconstruction	783,810			656,214	243,386			1,683,410	
	Maintenance	1,926,160							1,926,160	3,609,570
Forest Roads	— Construction and Reconstruction	447,867				297,002			744,869	
	Maintenance	1,052,719							1,052,719	1,797,588
Unclassified Roads	— Construction and Reconstruction	8,471,215			1,060,816	24,057,342		7,882	33,597,255	
	Maintenance	1,332,768				6,105,696			7,428,464	
Contribution to Melbourne & Metropolitan Tramways Board Tram Tracks Reconstruction		534,739							534,739	41,560,458
Rail/Road Bridges Protection		563,318								563,318
Metropolitan Bridges						501,844				501,844
State Intersection Control (STATCON) Programme					745,308					745,308
Murray River Bridges & Punts		565,899								565,899
Traffic Line Marking		1,824,458								1,824,458
Statutory Payments										189,709,980
Interest and Sinking Fund — State Loans	3,056,163									
Sinking Fund Contribution — Act 6229 Sec 31C	2,500									
Traffic Authority Fund	759,782									
Tourist Fund	1,519,563									
Transport Regulation Fund	589,079	5,927,087								5,927,087
Planning & Research		2,604,126					1,118,500			3,722,626
Investments — Temporary — Act 6229 Sec 39A		1,000,000								1,000,000
Capital Expenditure										
Plant Replacement and Additions	2,857,298									
Buildings, Workshops, etc.	899,169	3,756,467								3,756,467
Management & Operating Expenditure		7,816,075			7,150,167	14,936,573				29,902,815
		$82,674,419	9,577,183	325,000	36,319,546	103,955,718	1,118,500	48,609		234,018,975
Balance available to the Board as at 30th June 1979		$4,097,352				744,959				4,842,311

Auditor General's Certificate

The accounts of the Country Roads Board for the year ended 30th June 1979 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, 25th September 1979.

R. G. Cooper, Chief Accountant, 19th September 1979

Appendix 4

Loan Liability to the Government of Victoria

as at 30th June 1979

	Main Roads etc.	Developmental Roads	Total
	$	$	$
Permanent Works			
Main roads	16,730,322.16		16,730,322.16
State highways	19,604,304.20		19,604,304.20
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	755,205.92	585,619.54	1,340,825.46
Total amount borrowed	40,319,316.61	13,437,134.63	53,756,451.24
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	3,690,247.61		3,690,247.61
National debt sinking fund	9,990,613.69	9,123,485.06	19,114,098.75
Consolidated fund	65,313.51		65,313.51
	14,487,989.68	10,526,423.81	25,014,413.49
Loan liability at 30th June 1979	25,831,326.93	2,910,710.82	28,742,037.75

Appendix 5

Works executed on behalf of Commonwealth and State Government Authorities

for the year ended 30th June 1979 (Adjusted to nearest dollar)

Departments	Description of works	Expenditure	
Commonwealth			
Department of Housing and Construction	Access roads to various Commonwealth establishments		1,774
Victoria			
Melbourne and Metropolitan Tramways Board	Roadworks associated with the East Burwood Tramway Extension	300,000	
Ministry of Tourism	Additional snow clearing on the Alpine Road to Mt Hotham	35,000	
Ministry of Transport	Grade separated level crossing projects, etc., charged to the Transport Fund	5,076,730	
Ministry of Transport	Grade separated pedestrian crossings charged to State Treasury, Municipalities and Transport Fund	54,000	
Port of Melbourne Authority	Repairs to upgrade the structure of Centenary Bridge, Port Melbourne	345,915	
Premier's Department	Roadworks in connection with Wonderland and Sundial Road, Stawell Shire	300	
State Electricity Commission	Roadworks to enable the movement of heavy loads to Loy Yang power station	189,460	6,001,405
State Treasury	Improvements to various roads adjacent to State Forests to facilitate the extraction of timber and charged to Municipalities Forest Roads Improvement Fund	107,181	
State Treasury	Restoration works on roads and bridges damaged by floods	3,300,595	
State Treasury	Restoration works on roads and bridges damaged by bushfires in Bairnsdale Shire	144,670	3,552,446
			$9,555,625

Appendix 6

Loans raised by the Country Roads Board

Under Authority of Country Roads Act No. 6229 Sec 31A (Borrowing Powers)

Loan No.	Lender	Type of Loan	Interest Rate	Due Date	Amount $
1.	State Insurance Office	Inscribed Stock	9.5%	30th March 1989	500,000
2.	The National Bank of Australasia Ltd.	Inscribed Stock	9.3%	15th June 1994	500,000

Temporary Investments — Country Roads Act No. 6229 Sec 39A

Invested with	Type of Investment	Interest Rate	Due Date	Amount $
The National Bank of Australasia Ltd.	Term Deposit	9.0%	29th August 1979	500,000
State Savings Bank of Victoria	Term Deposit	9.1%	15th September 1979	500,000

Sinking Fund Contribution — Country Roads Act No. 6229 Sec 31C

Invested with	Type of Investment	Interest Rate	Due Date	Amount $
The National Bank of Australasia Ltd.	Term Deposit	7.5%	26th September 1979	2,500

Engineer in Chief's Report

Country Roads Board
Melbourne

The Chairman

I submit herewith my Report for 1978/79. The Report deals with those activities within the Engineer in Chief's Branch which are considered to be of general or specific technical interest.

K G Moody
Engineer in Chief

Contents

Procedures for Developing Major Road Proposals

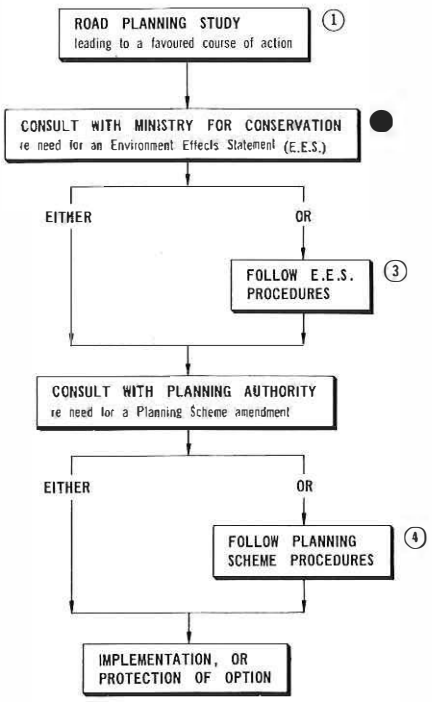
The procedures for developing major rural and urban road proposals may involve environment assessment and/or planning scheme amendment procedures in addition to the road planning study itself. As shown in Figure 1, the basic steps involved in developing major road proposals include:

☐ the road planning study — leading to the selection of a favoured course of action;

☐ consultation with the Ministry for Conservation on the need for further environmental documentation. This usually leads to decisions that no further documentation is required (at this stage), or that an Environment Effects Statement should be prepared in accordance with the Guidelines prepared by the Ministry for Conservation under the provisions of the Environment Effects Act 1978;

☐ consultation with the relevant Planning Authority to decide on the need or otherwise for an amending Planning Scheme;

☐ if, after completion of the above steps, early construction is contemplated, decisions are then made about the timing and possible staging of construction. All necessary Planning permits are obtained, any other statutory requirements are all satisfied, and all necessary agreements are obtained, before construction commences.



NOTES
① See Figure 2 for more detail
② May occur early in the road planning study. Some studies may be designed around E.E.S procedures
③ See Figure 3 for more detail
④ See Figure 4 for more detail

Figure 1.

The Road Planning Study

The road planning study is outlined in Figure 2. The first step is the study design. This includes:

☐ preparation of a statement of objectives.

☐ definition of the study area.

☐ setting up the basic study organisation.

☐ specifying the general study procedures.

When defining the study area, it may prove necessary (particularly in the larger urban area studies) to define a main study area within which feasible alternatives are likely to be located, and a larger or extended study area or areas for certain of the investigations, such as traffic surveys, and social and environmental studies. The extent of the study area (or areas) needs to be kept flexible, and to be reviewed as the investigations proceed.

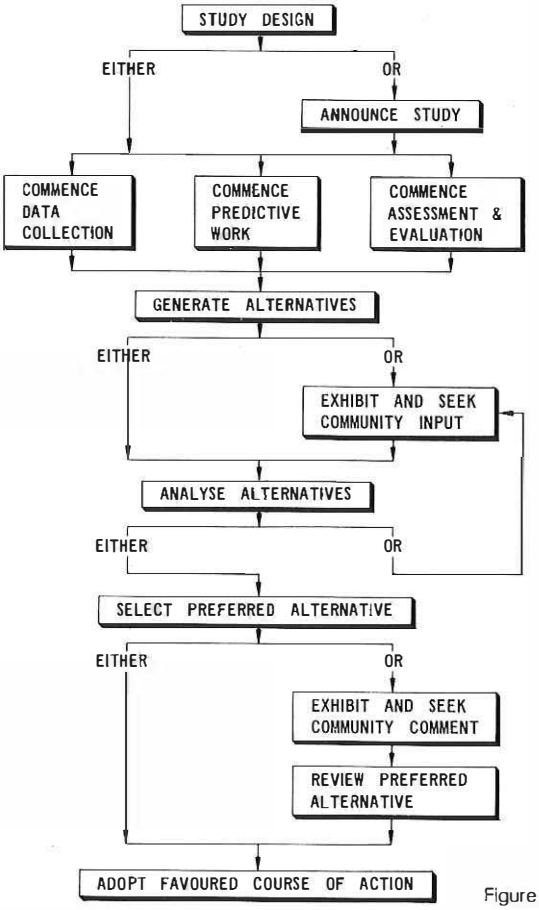


Figure 2.

The study organisation should effectively involve all the relevant authorities, representing regional and local interests, including transportation, planning, environment and conservation, and local authorities. It should also provide for the appropriate level of community participation.
The study procedures are designed to consider the relevant natural and social environmental aspects along with the engineering, economic and broader planning factors by a comprehensive and systematic planning process. These procedures should provide for:

- ☐ the early identification and analysis of all the relevant issues and effects, including those perceived by the community, the concerned authorities and the interest groups.
- ☐ the examination of a wide range of alternatives, including the 'do-nothing' alternative.
- ☐ the need for the proposed course of action to be clearly established and documented, with consideration of the role of the various modes of transport as appropriate.
- ☐ a suitable framework for evaluation, presenting information on all the relevant factors and issues in a concise and readily understandable fashion.
- ☐ adequate documentation of the study and its results.

The study itself includes data collection, predictive work, assessment of need, the generation of alternatives, and their assessment and evaluation, leading to the selection of a favoured course of action.

Consultation with the Ministry for Conservation
During the course of road planning studies, discussions are held with the Ministry for Conservation on the need for further environmental documentation. Depending on the nature and extent of the road planning studies that have been carried out, the extent of community participation, the available documentation, the environmental issues, and the degree of controversy (if any) surrounding the proposal, it may or may not be necessary to prepare an Environment Effects Statement.
If an Environment Effects Statement is prepared, the guidelines issued by the Ministry for Conservation under the provisions of the Environment Effects Act 1978 are followed. Once the Statement is prepared, it is publicly exhibited by the Ministry for Conservation, and comment invited direct to the Ministry. On receipt of comment, the Ministry makes an assessment of the Statement and the comment received. This assessment is then referred to the Board, which takes it into account when making final decisions. The procedure is summarised in Figure 3.
The Ministry's assessment is an additional input to the decision making process — it does not provide the decision.

Planning Scheme Amendment
A Planning Scheme Amendment is often required as the result of a road planning study. In these cases, the relevant Planning Authority is requested to initiate the amending Planning Scheme (see Figure 4). Procedures for dealing with amending Schemes are set out in the Town and Country Planning Act.

Major Planning Studies
Major planning studies on which the Board's staff have been involved during the year include the following:

Hume Freeway
Euroa Section
Following extensive investigations of alternative routes, with the involvement of the Euroa Shire Council, relevant authorities and the general public, the Board has favoured the adoption of a southern by-pass of the Township of Euroa for the ultimate development of the Hume Freeway.
An Environment Effects Statement was prepared which documented the environmental effects of the route favoured by the Board and the various alternatives considered. After public display, the Ministry of Conservation prepared an assessment of the Statement.
A government decision is now awaited on the route to be adopted.

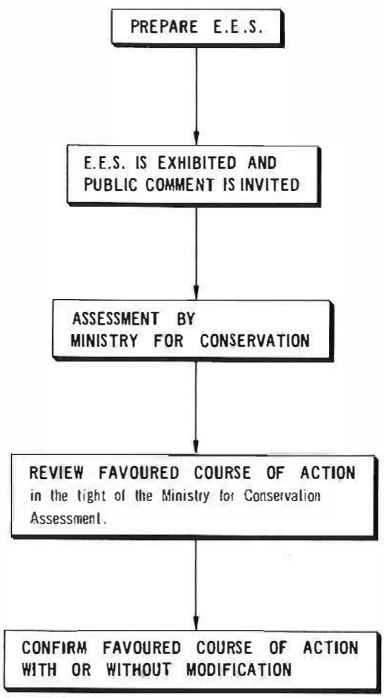


Figure 3.

Baddaginnie to Bowser Section
The Board has previously developed proposals for a favoured route for the development of this section of the Hume Freeway including by-passes of Benalla and Wangaratta. Plans and a summary report have been publicly distributed as a basis of comment. The next stage of the project will be the final adoption of a route and detailed design.

Albury-Wodonga Section
In conjunction with the New South Wales Department of Main Roads, the Board is currently conducting planning investigations for a proposed freeway link across the Murray River to connect the Wodonga By-pass and the Albury Relief Route. A connection between this proposed freeway and the existing Murray Valley Highway to serve the Baranduda area also forms part of the project. To date three alternative alignments (see Figure 5) have been identified for investigation and preliminary evaluation.
In late May 1979, the Board issued a progress report entitled "Progress Report on Planning Investigations" to the Commonwealth Minister for Transport, relevant State Ministers and Members of Parliament, relevant councils and appropriate authorities. The report indicated that two of the alternative alignments (2 & 3) were the most suitable for further investigation. The report also presented a resumé of the future planning investigations considered necessary by the Board to obtain agreement to a favoured scheme.
Planning investigations of alternative alignments 2 and 3 are continuing with emphasis on the preliminary design, interchange locations and the connection to the Murray Valley Highway. Traffic estimates will be revised to take into account the latest expected trends in the development of Albury-Wodonga.

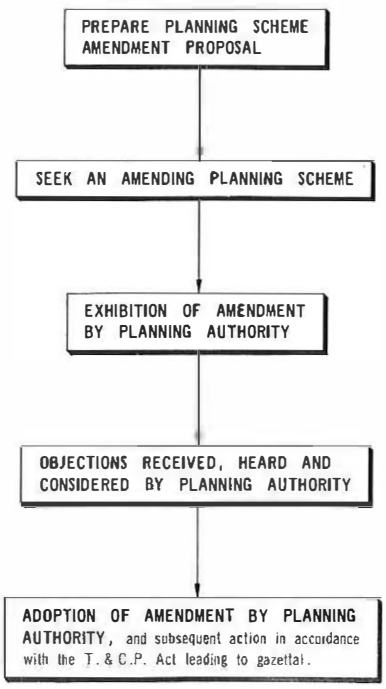


Figure 4.

Princes Freeway

Pakenham and Tynong Section
Preliminary layout plans and a summary report of the scheme favoured by the Board for the ultimate development of this section to freeway standards have been publicly displayed and comment invited.

Morwell Section
Following the development of a suitable scheme over many years, preliminary layout plans for an ultimate freeway by-pass of Morwell were forwarded to the Morwell Shire Council for agreement. The plans provide for increased separation between the freeway and the residential development by the

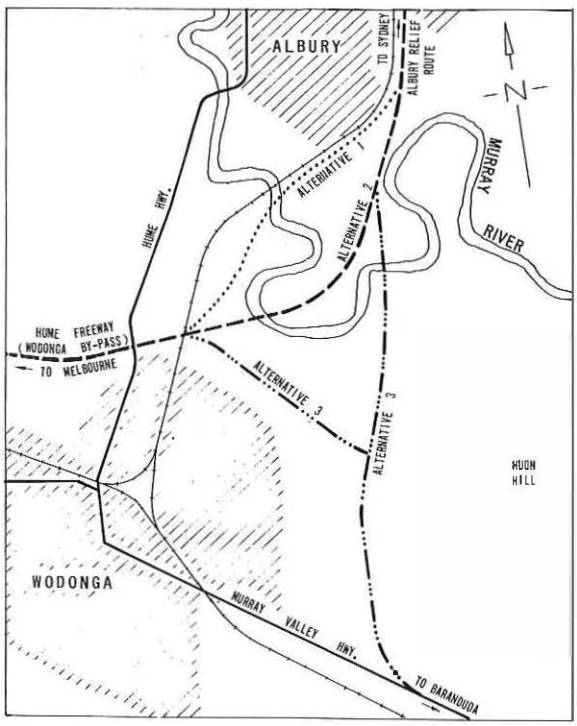


Figure 5: Alternative alignments to be investigated for the Hume Freeway, Albury-Wodonga Section.

adoption of a narrower formation width for the initial four lane construction.
Extension of Commercial Road to the Midland Highway, south of the freeway, was examined in conjunction with the proposed freeway. The Commercial Road extension will provide a direct link from the State Electricity Commission's installations at Morwell to the Loy Yang development.

Traralgon Section
Preliminary layout plans and a summary report outlining the Board's favoured route for the ultimate freeway by-pass of Traralgon have been publicly distributed as a basis for comment. The route favoured by the Board has been developed taking account of various factors including the effect on private property and the areas which are likely to be required for the extraction of brown coal.

Calder Freeway
Planning has proceeded on the ultimate development of the Calder Highway between Melbourne and Bendigo including future freeway by-passes of Gisborne and Kyneton and the possible future development to freeway standards of the highway between Keilor and Diggers Rest.

The Road Inventory System
In 1972 the Board conducted a full scale survey of the facilities and conditions of the road network as part of the Australian Roads Survey 1969/74. The data collected at that time has been formed into a computer-based information bank. The data is being revised on a regular basis through the CRB's Continual Road Inventory Survey Program (CRISP). The program includes keeping the information up to date from office records as changes to the network occur, and a rolling program of field surveys to check the validity of the data which is currently stored. The field checks are designed to cover the network of arterial roads at least once in 5 years, and are performed by a field survey team using an instrumented road survey vehicle.
The main uses of the data bank are:
☐ to provide factual information about the road system at any time (e.g. seal width, traffic volumes).
☐ to provide a base for financial and strategic planning for road system development.

Capabilities of an Instrumented Road Survey Vehicle
The use of an instrumented vehicle in road surveys commenced in 1971 as part of the Board's involvement in the then current Australian Roads Survey.

Since then the instruments used for determining road geometry (both horizontal and vertical), physical attributes of the road, roadside features, and road traffic conditions have been progressively improved. The various instruments now used include:
☐ Radius meter — a displacement transducer, attached between the tie-rod and the chassis, which converts the movement of the tie-rod and thus the angle through which the front wheels are turned into an electrical output. This output is registered on a meter, and the reading is later converted into an effective radius by a simple relationship.
☐ Lateral accelerometer — an accelerometer measures acceleration along the line of its major axis. The accelerometer is mounted on the rear axle of the vehicle, thereby eliminating effects of body roll. The measurement of sideways acceleration (G-force) is recorded as the car traverses a horizontal curve.
☐ Grade meter — an accelerometer is used to measure grade by placing it vertically, and relating the percentage of acceleration due to gravity to percentage of grade. The grade is recorded with the vehicle stationary, ensuring that the effect of vehicle acceleration is eliminated.
☐ An odometer (accurate to 0.01 km) is used to locate the start and end of grades, curves, and other features.
☐ Survey speedo — an accurate speedometer is used when making an inventory of the horizontal alignment of roads.
☐ Vertical curve sight screen — a see-through sighting screen mounted on the vehicle in front of the driver is used to obtain the "effective radius" of vertical curves.
Other "on-board" facilities include:
☐ Compass, to determine magnetic bearing of major straights between curves.
☐ Barometer, used to determine intermediate heights between points of known altitude.
☐ Micro-fiche reader, for the field checking of structure records which are stored on micro-fiche.
☐ Two-way radios to provide communication between the vehicle and personnel involved in checking structures.
☐ Electronic clock/stopwatch, used in travel time surveys.
☐ Measuring wheels, for width and length measurements.
☐ Vertical-height staff, for measurement of overhead clearance.
The instruments are currently used to calculate:
☐ Safe speed for horizontal curves. An estimate of superelevalion is obtained from measured values of radius, survey speed and lateral acceleration. The safe speed is then estimated from the estimated value of superelevation and an assumed friction factor.

□ Stopping Sight Distance of vertical curves.
A simple formula relates the reading of the vertical curve sight screen, effective vertical curve radius and Stopping Sight Distance.

□ Horizontal and vertical alignment. By combining (a) and (b) and adding gradients, lengths of curves and grades, reference altitudes and latitude/longitude, a reasonable picture of the horizontal and vertical alignment is achieved.

As well as these items, considerable attention is paid to other parameters, such as seal and formation widths, parking, intersection details, street lighting details, abutting land use, pavement ratings and other data associated with the traffic carrying capacity of the road network.

It is proposed that in the near future the vehicle will be used to keep regular records on items, other than the physical parameters mentioned above, affecting the road network. An example is travel time. It is also possible that the vehicle could be used to check or specify advisory horizontal curve speed signs for individual curves or groups of curves. These checks could be useful at locations of major accidents, particularly if combined with grade and other checks.

The ARRB is developing new instruments for road inventory which will enable all parameters to be calculated in the field. Advantages of this system will be field evaluation of curve speed signs, and the ability to identify, in the field, requirements for barrier lines over vertical curves.

Traffic Volume Maps

As part of the Road Inventory System, the Board has collected information on traffic volumes on roads throughout Victoria. This information has been obtained from the following sources:

The CRB annual March census.
CRB counts obtained in various studies in designated areas.
Road Safety and Traffic Authority.
Victorian municipal councils.
Melbourne and Metropolitan Board of Works.
Ministry of Transport.

The traffic counts obtained from these sources have been recorded using a mixture of machine and manual methods and are of varying date and duration. Extensive records have now been obtained for the period since the introduction of METCON in 1975.

A book of 48 maps has now been prepared showing the estimated annual average daily traffic volume (AADT) for 1978 for roads in the Melbourne Statistical Division. The maps are produced in four colours and are at a scale of 1:40,000.

Work is proceeding on the compilation of similar maps showing the estimated 1979 AADT for Geelong, Ballarat and Bendigo Statistical Districts and rural Victoria.

Outdoor Recreation Travel Study

In conjunction with seven other authorities the Board is involved in the organization, conduct and financing of an outdoor recreation study in Victoria. The participating bodies are:

Country Roads Board
Department of Youth, Sport and Recreation
Ministry for Conservation
Ministry of Transport
Port Phillip Authority
Flinders Shire Council
Upper Yarra Valley & Dandenong Ranges Authority
Western Port Regional Planning Authority.

The broad aims of the study include an examination of the outdoor recreation usage of both the transport system and the recreation sites and the determination of factors which most influence the choice of outdoor recreation activities and locations.

The study data were obtained from a household survey and a site survey in the Shire of Flinders. In the household survey 1,732 residents of 788 households located in the Metropolitan Statistical Division were interviewed. The data collected included socio-economic characteristics, data on activity participation and locations during a twelve-month period in 1977 and the participants' attitudes to the activities and sites as well as the attributes of the latter. The site survey conducted in January 1978 in the Shire of Flinders collected more specific data on participation in outdoor recreation activities and the participants' attitudes.

The collation and analysis of the study data was performed by a consultant under supervision. The data analysis concentrated on the outdoor recreation activities and sites within Mornington Peninsula and the Shire of Flinders in particular. Similar analysis can be performed on the remainder of the data covering all of Victoria.

The major conclusions include the high dependence on the motor vehicle for outdoor recreational travel, the relatively low correlation of income with types of activities pursued, the high correlation of levels of education with the choice of improved or natural sites and the relative consistency of recreation activity choices throughout the life span of participants.

The major benefit from the study is the establishment of a large data bank on outdoor recreation pursuits and needs of people in Victoria. The latter makes it possible to examine the important aspect of behavioural travel, previously unavailable in Victoria.

Development of routes for the Eastern approaches to the West Gate and Johnson Street Bridges

During 1976 a major traffic study carried out in South Melbourne and Port Melbourne revealed that a series of traffic management improvements were desirable on the existing arterial road network to accommodate the flow of traffic expected after the opening of West Gate and Johnson Street bridges and until the completion of the West Gate Freeway to Kings Way.

After a review of the proposals by a committee of representatives from Port Melbourne, South Melbourne and St Kilda City Councils, the Road Safety and Traffic Authority and the Board, implementation of traffic management measures commenced in May 1978.

The Advisory Truck Route was developed through the northern area of South Melbourne to facilitate the movement of heavy trucks between the bridges and the Kings Way-Queens Road route in time for the opening of Johnson Street bridge in August 1978.

Traffic management measures along the route cost $615,000 and included:

- ☐ Installation of new traffic signals at seven intersections.
- ☐ Remodelling of existing traffic signal installations at two intersections.
- ☐ Linking of traffic signals along Clarendon Street, Market Street and York Street into the Kings Way radio controlled system.
- ☐ Construction of a roundabout at Normanby Road/ Clarendon Street (see Plate 1).
- ☐ Asphalt surfacing to strengthen pavements and improve riding qualities along local streets incorporated in the route.
- ☐ Introduction of parking restrictions, clearway conditions and turning bans.
- ☐ Conversion of existing streets to one-way traffic flow.
- ☐ Provision of an extensive advisory signing system.

Other works to improve the traffic capacity and to prevent infiltration of through traffic into residential areas were carried out at the intersections of Graham Street/Bay Street and Montague Street/City Road/ York Street before the opening of West Gate Bridge in November 1978.

At the intersection of Queensbridge Street, Yarra Bank Road, Riverside Avenue and Maffra Street, the installation of traffic islands, new traffic signals, and improved street lighting has reduced delays on the most direct route between the new bridges and the South Eastern Freeway.

Plate 1: An aerial view of the roundabout at the Normanby Road/ Clarendon Street intersection, South Melbourne.

Further improvements were progressively implemented along Queens Road to improve the capacity of this section of the Princes Highway East. Additional advisory signs were erected throughout the area after agreement with the local councils had been reached. The improvements included signs along the advisory truck route which was extended along the Nepean Highway to Mordialloc to discourage trucks from using Beach Road.

Footway on masonry arch bridge over the Barwon River on the Princes Highway at Winchelsea

The masonry arch bridge over the Barwon River on the Princes Highway West at Winchelsea, was built in 1867 and has been classified by the National Trust.

In 1930 a steel and timber footway was attached to the downstream face of the structure. However when a duplicate bridge was constructed in 1970 on the downstream side of the old bridge it became necessary to relocate the footway.

Because of the importance attached to the form and appearance of the masonry arch bridge, the aesthetic appeal and serviceability of a number of alternative proposals were evaluated before it was decided to attach the footway to the upstream side of the masonry structure.

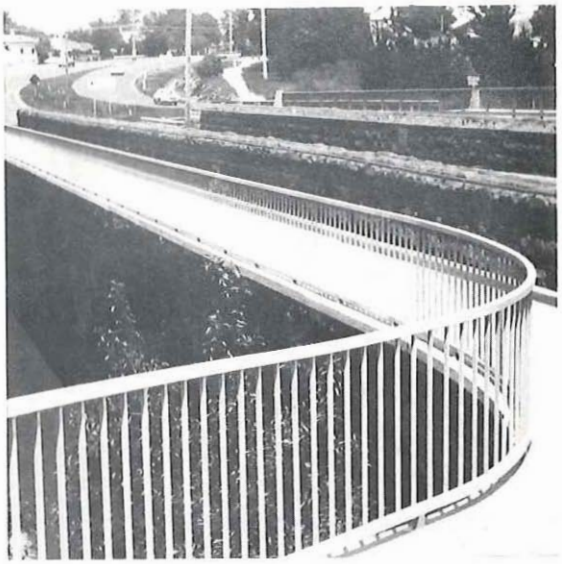
The arrangement finally adopted comprises reinforced concrete slabs supported on precast reinforced concrete cantilevers which pass through the spandrel walls of the masonry bridge. The precast concrete cantilevers are anchored in reinforced concrete blocks cast beneath the road pavement. Steel handrailing is of the same form as that used currently on pedestrian bridges.

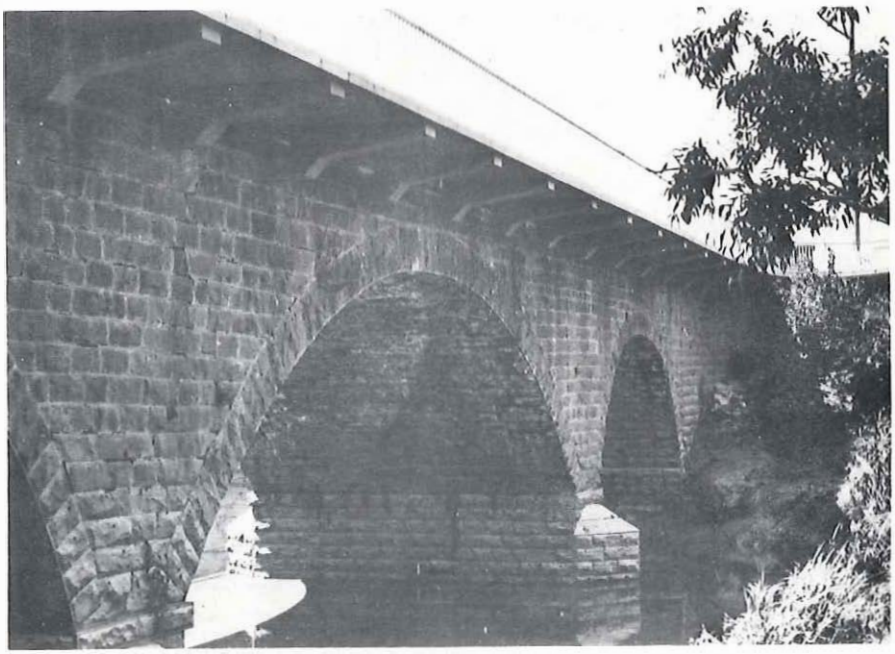
The footway slabs and the cantilevers supporting them were proportioned to be unobtrusive, and the concrete was shaped, coloured and sandblasted to achieve harmony with the masonry of the old bridge. Construction of the footway was carried out at a total cost of $120,000.

Slab-Linked Box Culverts

Reinforced concrete slab-linked box culverts have been used to replace a number of rural bridges. In these structures reinforced concrete inverted "U" crown units are placed on cast in place reinforced concrete base slabs and alternate internal cells are formed by reinforced concrete slabs spanning

Plates 2 and 3: Two views of the footway on the masonry bridge over the Barwon River.





between adjacent crown units (see Figure 6). The slabs are retained in position by keepers cast in place against each end and tied to the crown units by projecting reinforcement.
Cost savings of the order of 15% to 20% can be achieved through the use of slab-linked culverts as compared with the cost of conventional multi-cell concrete box culverts. Standard slab-linked culvert units with spans within the range 1800 mm to 3000 mm are currently being developed.

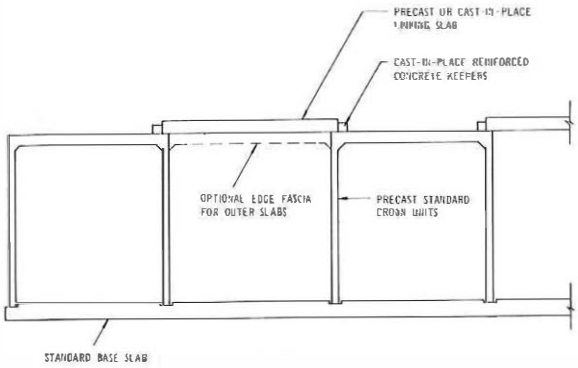


Figure 6: Typical cross section of slab-linked box culverts.

Transport of heavy loads to Latrobe Valley

The State Electricity Commission of Victoria is undertaking extensive development of power generation facilities in the Latrobe Valley, particularly at Jeeralang and Loy Yang. This development involves transport of transformers and generator components weighing up to 350 tonnes to these areas from Melbourne.
The transport of these loads by rail was investigated but found to be impractical because of limited clearances at platforms and structures. Further studies showed that movement by road was feasible, and that the cost of increasing the load capacity of certain structures along the proposed routes was acceptable to the Commission; planning is therefore proceeding on this basis.
The loads involved will be transported on a special vehicle imported from Italy. The tare of the large trailer is expected to be about 210 tonnes, so that when the 350 tonne load is added the gross mass will be 560 tonnes, carried on 24 axles each of 8 tyres (see Figure 7). The mass of the loaded transporters will be established accurately by use of a large capacity weighbridge which has been installed in Lorimer Street, Port Melbourne for that purpose.

The load capacity of structures on the proposed route has been checked. Pipe culverts and structures with spans up to 4 metres have proved to be generally satisfactory but longer structures will require strengthening or replacement. Several structures under construction were modified to take the increased loads and in other cases separate structures will be built in locations suitable for later incorporation into the carriageways of the Princes Freeway.
Movement of these very large vehicles also introduces problems associated with road geometry. At some intersections poles have been shifted and kerbs have been modified; gradelines have also been improved to provide adequate clearance beneath the transporter. Because of the low travel speeds of these vehicles provision must be made to allow other traffic to pass or overtake them at reasonable intervals on two-lane two-way carriageways.

A retaining wall surface treatment for the English Street Interchange on Tullamarine Freeway

A new off-form finish pattern was recently developed for the surface treatment of retaining walls on the English Street Interchange on the Tullamarine Freeway.
Depression of the roadway below natural surface level by approximately 7 metres required the

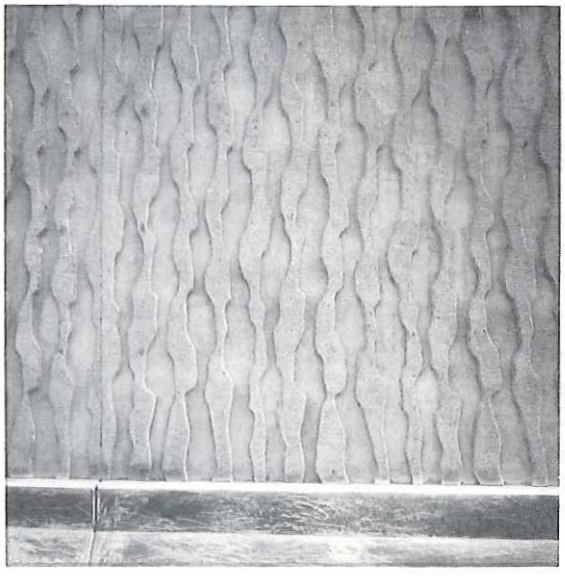
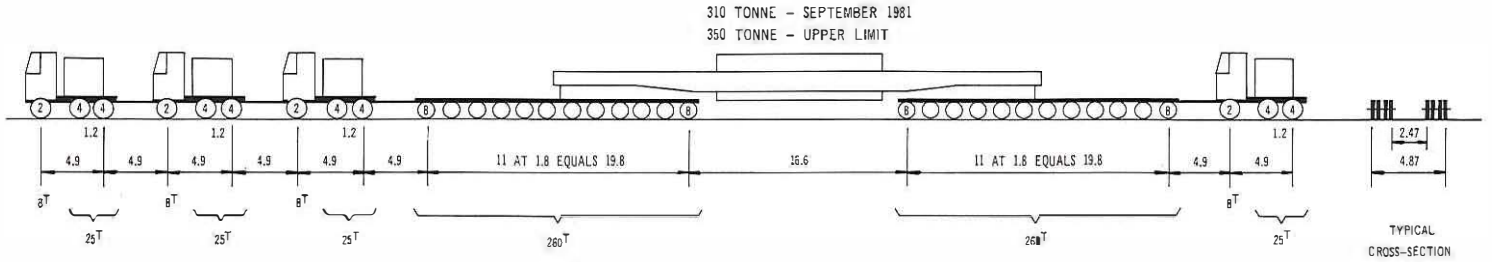
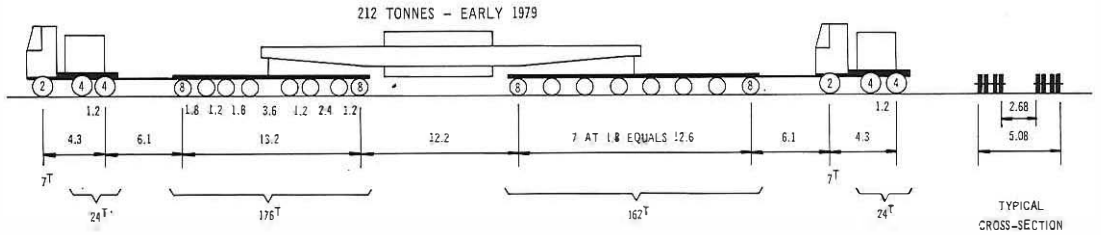


Plate 4: The surface treatment on the English Street Interchange retaining walls.



210 TONNE TARE PLUS 310 TONNE PAY LOAD EQUALS 520 TONNE GROSS

LOY YANG LOADS



126 TONNE TARE PLUS 212 TONNE PAY LOAD EQUALS 338 TONNE GROSS

JEERALANG LOADS

Figure 7: The arrangement of vehicles to transport heavy loads from Melbourne to Loy Yang and Jeeralang. (All measurements in metres.)

construction of two major retain walls adjoining one of the bridge abutments. These walls have a maximum height of 7 metres and a combined total length of 170 metres featuring the new surface treatment.
The wall pattern was produced using dense, fine bead vertical polystyrene strips 50 mm thick attached to the plywood timber forms with an adhesive.
The strips were hand cut in the factory using a template and hot wire and a random pattern was produced on the wall by suitable arrangement of the strips.
During construction, the polystyrene was firstly glued to the clean, dry, horizontal plywood surface of the formwork. The formwork shutter was then lifted into its vertical position and fixed in place, and the concrete cast without the use of formwork stripping oils. Perfect compaction of concrete was essential to assure a good strip some 48 hours later.
The raised concrete surfaces of the pattern were then bush hammered to a medium standard, exposing the aggregate. The depressed surfaces produced when the polystyrene was removed required no further treatment to achieve the desired effect.
The cost of providing a finish such as this is about $15 per square metre of wall face over and above the cost of conventional finish.

Cement treated aggregate backfill for walls

The use of cement treated aggregate as a drainage layer and backfill material behind reinforced concrete retaining walls and abutment walls was first investigated and used at the Greensborough railway level crossing abolition project.
Tests were carried out using 20 mm aggregate and cement contents ranging from 1-10% by weight. Results indicated that a cement content of 3-4% (by weight) and a water content of 3-3.5% (by weight) produced the best results. All mixes were highly permeable. Unconfined compression strength tests carried out on a mix with a cement content of 4% (by weight) and water content of 3.5% (by weight) gave results of 0.6 MPa at 24 hours, and 1.1 MPa at 7 days.
A fabric filter was placed on the floor and walls of the excavation to prevent migration of fine material into the aggregate mass and cement treated aggregate was placed in layers approximately one metre deep by means of a "flow control truck". Provision was made for thermal movement of the structure by placing a 25 mm thick sheet of polystyrene immediately behind the abutment wall.

A comparison of costs between the use of cement treated aggregate and the original proposal of a 2% cement treated 20 mm graded crushed rock revealed no significant savings in the supply and placement costs at the Greensborough project. However, the use of this material resulted in the construction programme being shortened by six weeks with a resultant saving of $40,000 on the project.

West Gate Freeway Bridges

The elevated sections of the West Gate Freeway (South Melbourne Section) will be founded mainly on large diameter piles socketed into mudstone bedrock. The piles range in diameter from 1.1 m to 1.5 m and are required to carry design loads of 4.3 MN to 11 MN.

The Design and Performance of Rock Socketed Piles

The method developed to design the piles, discussed broadly in the 1977/78 Report, has been based on linear elastic theory and empirical corrections to allow for the non-linear behaviour of real piles. The basis of the linear elastic method of pile design is well established, and it has been necessary only to extend the various design curves to cover the range of parameters applicable to rock socketed piles and Silurian mudstone. However, the performance of rock socketed piles at design settlements is not simply linear elastic: there is usually a significant amount of yielding down the side and minimal yielding at the base of the piles. An investigation has been carried out to evaluate these problems.
More than 40 test prototype piles were constructed and loaded to failure, and a design method which allows for the non-linear characteristics has been developed. The test piles ranged in diameter from 100 mm to 1500 mm and embedment ratios (depth/diameter) of 0 to 22 were examined. The tests were made in mudstone varying from highly weathered to slightly weathered and with joint frequencies ranging from 0 (intact rock) to 100 joints/m (highly jointed) which generally represents the mudstone along the route of the West Gate Freeway.
The various side resistance and base resistance test piles have revealed several characteristics which are important to the design of piles socketed into

mudstone. The side resistance tests made in sockets 1 m to 1.5 m diameter indicated that:

- provided the roughness of the socket wall exceeds 20 mm and there is no remoulded or weakened rock on the walls the load-settlement response will show a peak load at relatively small displacements and subsequently less than 10 per cent loss of capacity at large displacements. Smoother sockets may lead to a significant reduction in the peak and residual capacity, however normal drilling techniques, e.g. bucket augers, in highly to moderately weathered mudstone have been found to naturally produce a roughness of 20 mm or more.
- tests made in sockets which had been roughened to produce a roughness of about 100 mm indicated that the increase in roughness did not significantly alter the side resistance.
- tests on piles cast under bentonite suggested that the bentonite reduced the peak side resistance by less than 10 per cent when compared with piles cast against wet socket walls.

Typical load-settlement curves illustrating these points are shown in Figure 8.

End-bearing tests made at the bottom of drilled sockets showed that:

- the mode of failure of piles which were embedded less than one pile diameter into the mudstone was likely to be dramatic, whereas piles embedded more than two diameters always exhibited a gradual yielding and subsequent gradual increase in capacity with further displacement. It was found that the increase in pile capacity continued to settlements of at least 30 per cent to 50 per cent of the pile diameter. The minimum embedment of the West Gate Freeway piles is two diameters which is sufficient to ensure the work strengthening characteristic.
- very large end-bearing pile capacities may be mobilized at working settlements, for example tests on 1 m diameter piles in moderately weathered mudstone indicated base pressures of 6 to 7 MPa for settlements of less than 10 mm.

The typical load-settlement curves shown in Figure 9 illustrates this.

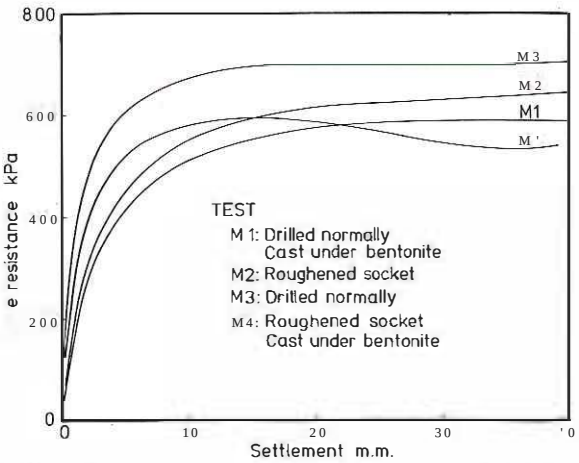


Figure 8: Results of typical side resistance tests in moderately weathered mudstone.

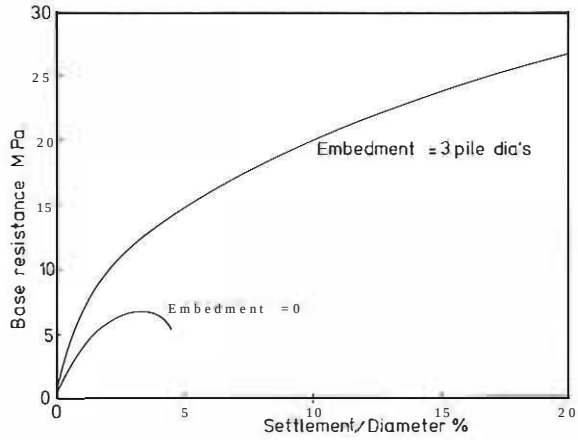


Figure 9: Results of typical end bearing test in moderately weathered mudstone. Pile embedment of 2 or more pile diameters is sufficient to ensure a work strengthening characteristic.

Resistance of piles to lateral loads

The piles supporting this structure are required to accommodate lateral loads arising from vehicle braking, creep and shrinkage of concrete, temperature movements in the superstructure, and to a lesser extent, wind, and they will be subject to large bending moments during the construction process. At most locations, the base rock is overlain by soft alluvial sediments.

Because of the lack of reliable information regarding pile and ground behaviour, a test programme was undertaken in which four 1500 mm diameter reinforced concrete and steel-encased piles at South Melbourne were subject to lateral load applied at various levels. The depth of soft soil through which the piles extended to mudstone was about 35 m. The piles were loaded, two at a time, using a

prestressing cable system, and tilt and deflection were recorded by precise survey methods. Two piles were equipped with strain gauges grouted into 100 mm diameter steel ducts passing down through the interior of the piles and these permitted the variation of pile bending moments with depth to be determined.

A data logger was used to scan all gauges sequentially at specified time intervals. The electrical output from each instrument was transmitted through a telephone line data link to a mini-computer located at Kew. This information was analyzed using a specially written computer program, and the processed results sent back to the site by telephone line.

Figures 10, 11 and 12 show ground level deflections, tilts and typical bending moments down the pile induced by a load of 300 kN applied 2.4 m above the level where the pile entered the ground.

The results of the testing program revealed that the piles deflected less than 20 per cent of the values calculated using approximate methods. The designed proportion of reinforcement required to resist pile bending stresses was found to be more conservative than necessary and a reduction of reinforcement for future piles has been planned.

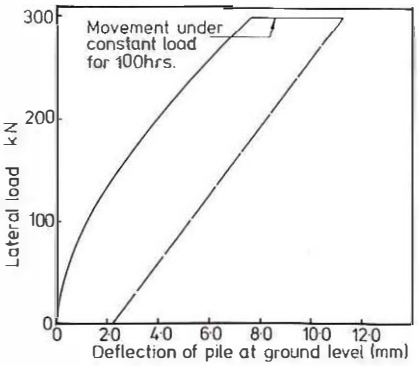


Figure 10: Load-deflection plot for pile

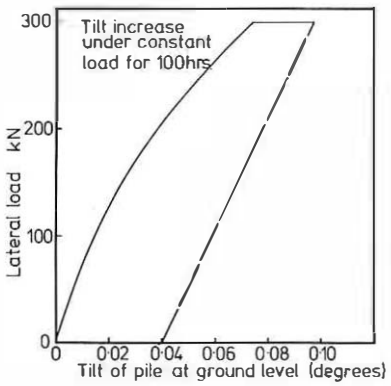


Figure 11: Load-tilt plot for pile.

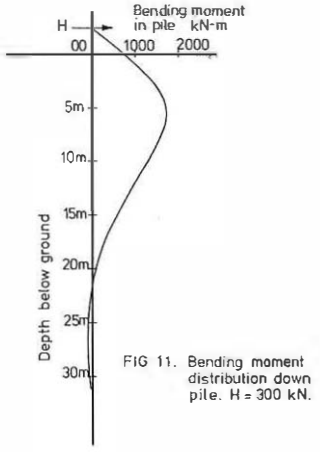


FIG 11. Bending moment distribution down pile. H = 300 kN.

Figure 12: Pile bending moment v. depth.

Terrestrial Photogrammetry for Engineering Survey

Ground survey methods for gathering planimetric and relief detail may be supplemented or largely replaced by a ground-base photogrammetric technique under certain site conditions.
Research undertaken by a Board officer in the Surveying Department, University of Melbourne, has indicated that the method is a viable alternative to ground survey.
The technique makes use of photography taken with a high quality camera mounted on a theodolite. The camera is set up at stations of known co-ordinates, and the area of interest is covered by photographs from the different stations, each photograph being taken so that two or three identifiable points of known co-ordinates will be included. By placing the developed photos in a special stereoplotter, an operator may plot the imaged horizontal detail and any vertical information as required. A developed digital method allows the same imagery to be recorded in a computer data file.

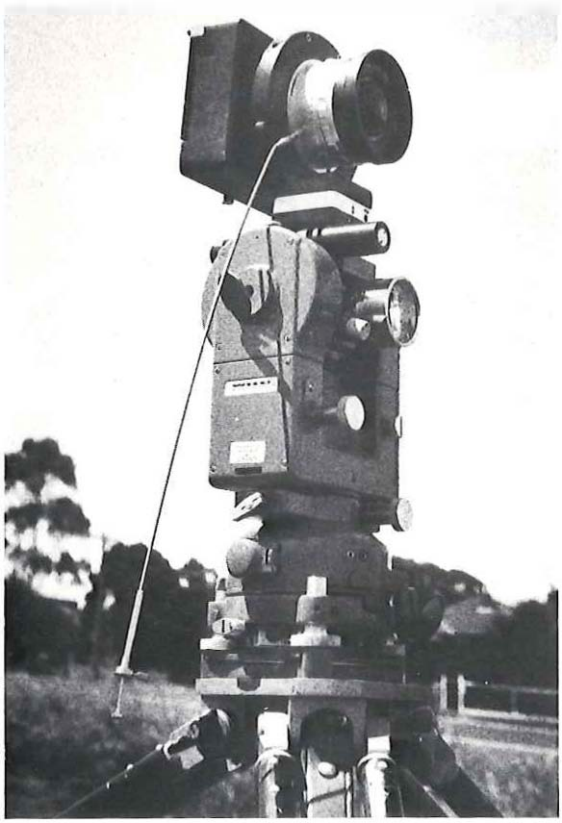


Plate 5: Theodolite mounted camera used in terrestrial photogrammetry.

This "digital terrain model" may be used for either computer plotting of selected features to any desired scale of any part of the data area, or as a three-dimensional model for typical road design applications.
Several practical research projects undertaken have revealed that the technique is more successful when the photographed site rises away from the camera station, the camera stations are placed in elevated positions, few photographs are required to cover the site, and parts of the site are not hidden by vegetation or other obstruction.
The method can be used to obtain survey information on busy roads without undue hazard.
The photography provides a permanent record from which required information may be extracted at any time.

Autograde TS 500

During the past few years it has become apparent that the construction of heavy duty pavements could be improved by the use of automated equipment.
The use of this type of equipment would enable a more accurate grade and cross section to be produced at a better production rate than by conventional methods.
After investigation the Board decided to purchase an Autograde TS 500 machine built by CMI Corporation USA. The machine was delivered and commissioned in February 1979.
The Autograde TS500 is a dual lane machine 8.5 m wide capable of trimming and spreading to this width in standard form. Using mouldboard extensions either side allows the machine to spread up to a total width of 15.7 metres.
The unit consists of a main frame, 8.5 m x 3.1 m, which houses the operating controls, power unit, hydraulic systems, cutter and spreading augers and mouldboard. The main frame is carried by four legs on crawler tracks mounted at each corner. The total weight of the machine is 52 tonnes.
The power unit consists of a 280 kW diesel engine driving five hydrostatic systems and ancillary equipment. One hydrostatic system is used to propel the machine giving an operating speed from 0-18 m/min, the remaining four hydrostatic systems are used to drive the cutting and spreading augers.
Elevation and line of the machine are controlled automatically by electronic sensors mounted on the main frame and running along a string line placed approximately 1.5 metres from the left hand side of the machine. Two sensors are used to control front and rear elevation on the left hand side of the machine. The sensors actuate solenoid valves, which direct hydraulic oil to rams mounted between

Plate 6: The Autograde TS 500 machine on the Hume Freeway.

the main frame and the track legs. Steering of the machine is controlled by two sensors which control front steering and rear steering respectively.
Cross slope of the machine is maintained by raising or lowering the right hand side of the unit in relation to the left hand side. The cross slope is controlled by two electronic sensors mounted on tubes, one between the front legs and one between the rear legs. These sensors use a pendulum which senses the difference in level between the two sides. The cross slope can be controlled so that level and cross slope are maintained to within close tolerances.
The machine has two basic functions, namely, to spread premixed material to a predetermined profile and secondly, to trim a compacted surface to the same tolerance.
When used in a spreading role, the material is delivered by truck either to a receiving hopper fitted to the front of the machine or to a windrow proportioning box.
The material is spread transversely by two sets of augers, and final profile is determined by a mouldboard blade. Both augers and mouldboard are adjustable at either side of the machine and in the centre of the machine.

When used in a trimming role the compacted surface is cut by an auger fitted with 100 cutting teeth, followed by two mouldboards. The surface to be trimmed must be moist to suppress dust. Excess material can be moved out through openings in each side of the machine by the augers and left in windrows for removal. Excess material can also be removed through openings in the centre of the rear mouldboard onto a reclaimer belt and loaded into trucks. Again, the rear mouldboard makes the final strike off maintaining the level required. The life of cutting teeth depends on the nature of the surface to be trimmed.
Performance to date has indicated that material can be spread at up to 600 cubic metres loose per hour, and that trimming at up to 180 metres per hour is feasible.
Considerable support plant including rollers, wetmix plant, wetmix transport vehicles, etc. is needed to ensure uniform daily output and minimum costs.
The construction sequence adopted has been to spread and commence consolidation (on previously trimmed layer where applicable) on the first day, to complete compaction second day, to test third day and follow on the fifth day with the subsequent layer. The machine is therefore operating over a 3 km length at anyone time.

A check of final surface levels over one completed section of pavement indicated that the level of the final surface varied by + 10 mm to −15 mm with a mean level of +0.4 mm and standard deviation of 6.6 mm from the design profile.
A more accurate longitudinal profile between design stations and virtual elimination of transverse swings also results compared to conventional placing with effective control at design stations only.
The cost of wetmixing the crushed rock, including water supply and supervision, has averaged $1.60 per cubic metre loose. Costs to spread, compact and trim the pavement to close tolerances have been in the order of $1.60-$2.00 per cubic metre loose compared with $3.00-$4.00 per cubic metre loose with more conventional equipment, leading to lower total pavement construction cost.
Apart from directly costed savings, increase in output also reduces total construction period, and reduces overhead costs. Large well organized projects planned for use of Autograde are essential if the potential for total cost reduction is to be fully realised.

Statistically-based Compaction Control

Hume Freeway (Seymour to Euroa)

Statistically-based specifications for earthwork and pavement construction have been in use on this project for about 1½ years. This approach acknowledges the inherent variability in both materials and testing whereby a number of individual test results on a section of road will exhibit a spread of values approximating the statistical standard distribution.
For a given area of work, called a lot, six randomly spaced compaction tests are performed and from these is calculated the mean ($\bar{X}$) giving the level of results, and the standard deviation (S) giving the variability of the results. A characteristic value (C) which will not be met by a given proportion of the results (defectives) is then determined from:
$C = \bar{X} - kS$
where k is a multiplier dependent on the number of tests in the lot and the proportion of defectives adopted.
On this project multipliers of 1.0 for earthworks and 1.5 for pavement have been used in specifications, corresponding to 18 per cent and 10 per cent defectives respectively. These limits have been assessed by past experience as an acceptable standard of construction for high-class roads.
Acceptance of the lot is based on achieving the following characteristic relative compaction:
Earthworks C ≥ 99% Standard Compaction
Pavement (sub-base) C ≥ 98% Modified Compaction
Pavement (base) C ≥ 99% Modified Compaction
Lots with characteristic relative compactions less than those values listed above are either accepted after additional rolling without further testing or reworked and submitted for retesting. A plot of individual test results taken from 83 lots of common fill along a particular section of freeway is shown in Figure 13. These individual results come from lots which were accepted either without any additional rolling or with additional rolling but not retested. A similar set of individual results in pavement sub-base and base is presented in Tables 1 and 2. These tests have been rounded to the nearest whole per cent of standard or modified compaction as appropriate.

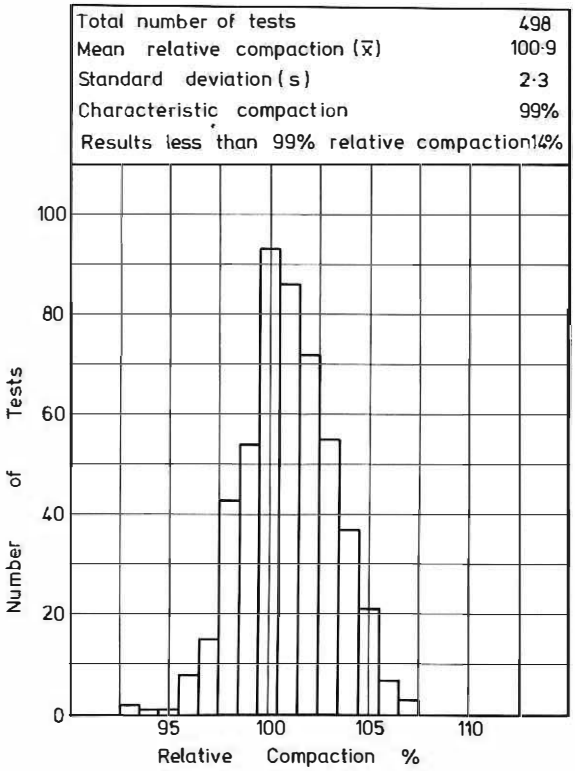


Figure 13: Density testing in common fill.

The chart and tables indicate the average quality and spread likely to result over a job from use of statistically-based compaction acceptance criteria. This approach has tended to unify the interpretation of test results and the action taken by engineers supervising different contract and direct labour works, and will enable common standards of construction to be established throughout the Board

for classes of road having similar quality requirements. Nevertheless, refinements are still being made with the method as experience is gained in its use.

Table 1:
Density Testing in Pavement Sub-base

Relative Compaction %	97	98	99	100	101	102	103	104	105	106	107
No of Tests	4	12	19	36	43	21	17	8	4	6	1

Total Number of Tests	171
Mean Relative Compaction ($\bar{X}$) for all above results	101.0
Standard Deviation (S) for all above results	2.0
Specified Minimum Characteristic Relative Compaction	98%
Results less than 98% Relative Compaction	2%

Table 2:
Density Testing in Pavement Base

Relative Compaction %	97	98	99	100	101	102	103	104	105	106	107
No of Tests	1	3	11	14	16	30	20	11	11	7	1

Total Number of Tests	125
Mean Relative Compaction ($\bar{X}$) for all above results	102.1
Standard Deviation (S) for all above results	2.1
Specified Minimum Characteristic Relative Compaction	99%
Results less than 99% Relative Compaction	3%

Mulgrave Freeway (Forster Road to Huntingdale Road)

A 150 mm thick coarse crushed rock sub-base of 40 mm nominal size was placed on the freeway carriageways and ramps of this project using two compaction techniques.

About half of the material was placed in a single layer using a Bomag 210 self-propelled three-wheel steel wheeled vibrating roller of 10 tonnes static weight. This roller has provision for variable frequency and amplitude of vibration with the direction of vibration being always in the direction of travel (reversing automatically on removal of the roller). A Siemens nuclear meter was used to check density and moisture content. After trials the rolling pattern comprised three coverages at full amplitude followed by seven at half amplitude, the frequency being unchanged and within the range of 1,800-2,000 cycles/minute.

The other half of the sub-base was placed in two equal layers using a 10-12 tonne mass three-wheel steel wheeled self-propelled roller. The lower layer was given eight coverages and the upper layer was covered ten times.

In each method, several passes of a light self-propelled multi-wheeled pneumatic tyred roller was also used to tighten the layer surface. Similar outputs were obtained with the two methods, averaging about 500 tonnes daily.

The specified minimum compaction was 98 per cent of the laboratory standard vibratory method and a statistically-based method was used to control the work. Six tests were performed for each lot and acceptance was based on the characteristic value for each lot ($\bar{X} - 0.9S$) meeting the specified relative compaction (corresponding to 20 per cent defectives). Only one lot failed acceptance at first testing and required further compaction. Similar compaction results were obtained for the two construction methods used as noted from the overall parameters given below:

single layer placement $\bar{X} = 101.1\%$, $S = 2.7$
two layer placement $\bar{X} = 100.5\%$, $S = 2.1$

For the Springvale Road to Forster Road section of the Mulgrave Freeway, which was constructed earlier by contract, the average of all compaction results on similar material in the same position in the pavement was 98.8 per cent. Statistically-based control was not being used at the time.

Use of in-situ materials in lower pavement layers

Construction of the Hume Freeway between Seymour and Euroa has been designed to provide the following pavement composition:

Surfacing — Bituminous Seal
Base — 200 mm of Class 2A crushed rock in two layers
Sub-base — 200 mm of Class 3 crushed rock in two layers
Subgrade — Selected material with a California Bearing Ratio greater than 8 of thickness depending upon subgrade conditions, availability of material and method of construction.

Subgrade conditions encountered along this section to date have required up to 200 mm of selected material to comply with design requirements. Sedimentary material from cuttings was the most readily available material meeting the specified requirements; however, it has been found under certain conditions that these materials do not always perform well and care in selection and construction is required.

The following selected materials have been used with success to date:

Project 6 — Avenel to Tubbs Hill Section
Material Type — Silty sandstone
Texas Ball Mill — Range 56 to 79, average 69
Plasticity Index — Range 3 to 7, average 5

Although this material is relatively soft, its sandy nature has resulted in a high laboratory California Bearing Ratio being achieved even with moisture contents in excess of optimum (see Figure 14).

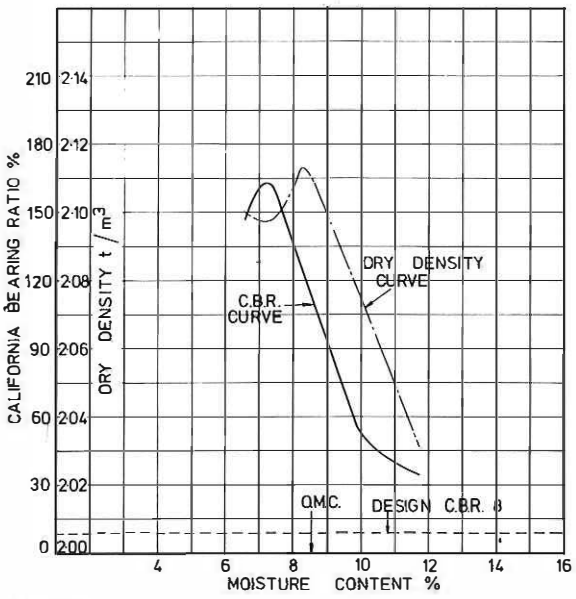


Figure 14:

Crushing was not required as ripping by Caterpillar D8 bulldozers produced a well graded product with maximum size around 150 mm. The material was stockpiled in order to confirm material characteristics.
On the basis of this information and the availability of material, two 150 mm compacted layers were adopted. Each layer was compacted using an 815 Caterpillar self-propelled tamping compactor, a V36 vibrating smooth drum roller and a 35 tonne self-propelled multi-wheel pneumatic tyred roller. To achieve best density results it was found that moisture content should generally be over optimum before compaction and continual grader spreading was necessary during the compaction stage.
In some instances overworking occurred when attempting to achieve the required standard of compaction, resulting in a significant reduction in the bearing strength of the material. In these cases the material was removed and replaced with fresh selected material. Generally, a dense, tight, almost impermeable layer was achieved.

The following results are indicative of the as-constructed properties of the material:

Table 3:

Period of Soak (Days)	0	4	7	9	15	21
In-situ Soaked California Bearing Ratio	108	40	41	20	29	40

Table 4:

Sieve Size (mm)	53	37.5	26.5	19	13.2	9.5	4.75	2.36	0.425	0.075
% Passing	100	95	88	81	77	73	66	62	55	32

The above California Bearing Ratio results of less than 40 were recorded in areas consisting of finer material.

Project 5B — Hughes Creek to north of Upton Road
Material Type — Silty Sandstone
Texas Ball Mill — 45 to 60, average 55
Plasticity Index — Range 6 to 13, average 10
This material was much harder than that used on Project 6; however, it was possible to win the material satisfactorily with a Caterpillar D9 bulldozer producing a reasonably well-graded product with maximum size around 200 mm. Initially, the material nominated as selected material was stockpiled followed by testing to confirm this judgment.
Crushing was not necessary as the material could be adequately compacted using an 825 Caterpillar self-propelled tamping compactor, a V36 vibrating smooth drum roller and a 35 tonne self-propelled multi-wheel pneumatic tyred roller. In the initial stages of compaction a similar technique of grading and watering as used on Project 6 was adopted; however, the material was found to be sensitive to moisture and it was necessary to restrict the moisture content to not more than optimum in order to avoid instability of the layer.
Two layers were constructed totalling 325 mm. Allowance is made for a surface trimming of the top 25 mm to remove the fine tilth of moisture sensitive material prior to crushed rock placement. No material was rejected due to excessive breakdown and the following after-compaction sieve analysis is typical of the as-constructed layer:

Table 5:

Sieve Size (mm)	75	53	37.5	26.5	19	13.2	9.5	4.75	2.36	0.425	0.075
% Passing	100	98	92	83	74	65	57	43	36	25	19

Results of in-situ California Bearing Ratio testing carried out on this material after heavy winter rains ranged from 29 to 90, with an average of 60.

Project 5 — North-East Rail to Hughes Creek Section
Material Type — Slightly metamorphized shale, mudstone, siltstone
Texas Ball Mill — Range 30 to 52, average 42
Plasticity Index (spalls) — Range 5 to 9, average 7
In view of the harder rock nominated as selected material, crushing was necessary. A 50 mm nominal maximum size before placement was specified which permitted a reduction in the overall thickness to 225 mm compacted in two layers. A two stage jaw crushing plant has been installed and the following results were obtained from the stockpiled product:

Table 6:

Sieve Size (mm)	75	53	37.5	19	4.75	2.36	0.425	0.075
% Passing	100	95	80	57	30	24	18	13

Plasticity Index: Range 10 to 23, average 16.

Asphalt overlay on Hume Freeway: Wallan to Broadford

The placement of this asphalt overlay was commenced in March 1978, and was completed between October 1978 and February 1979. A total of 218,500 tonnes of asphalt was required with 140,000 tonnes being laid in the latter period. The work was performed under five separate contracts by two contractors. High daily production rates were required to ensure completion in favourable weather and minimize the number of cold joints both transversely and longitudinally. The carriageway on which surfacing was proceeding was closed to normal traffic on week-days during working hours (generally 7.30 am to 5.30 pm Monday to Friday) to enable high output with safe conditions for workmen, the travelling public, and delivery trucks. Normal traffic was returned to the former Hume Highway during temporary closure, and working areas and haul routes of the two asphalt contractors were co-ordinated.
High production rates made it necessary to produce and stockpile most of the crushed stone aggregates required for asphalt production ahead of mixing. Advance stockpiling and testing of these aggregates ensured continuity of suitable supply, freed plant supervisors to concentrate on production control and problems, and enabled the asphalt mix design to be based on known aggregate gradings. Routine inspection and sampling of quarry sources before and during aggregate production and of the production at asphalt plants was undertaken to minimize the likelihood of unsatisfactory material.
Final acceptance was based on sampling at the point of delivery on the road.
Each contractor used two asphalt pavers in echelon for normal paving, between them covering the width of the two traffic lanes and the median shoulder. The left shoulder was placed separately a day or two later or late in the day after completion of the two-lane section.
Some trial sections were laid off site before commencement to check production and compaction arrangements. Trial sections of asphalt were placed on site at the commencement of each asphalt surfacing contract. Each trial section was about 700 m long which permitted several roller patterns to be used. Nuclear densometers were used to determine the optimum number of passes required for each type of roller. Cores were cut at selected points and were used to determine the relative compaction of each section and also to calibrate the nuclear densometers. The contractors then used nuclear densometers to monitor daily compaction procedures. Cores cut from the pavement were used for acceptance testing and it was found that in the majority of cases for layers greater than 60 mm nominal thickness there was good correlation with the nuclear densometer, but this was not so with layers of 35 mm nominal thickness.
One contractor used a combination of vibrating tandem steel wheeled rollers and rubber tyred rollers, while the other used conventional static weight tandem rollers and rubber tyred rollers.
Statistically-based acceptance criteria have demonstrated the importance of promptness and consistency in applying the compactive effort after laying. Density requirements were generally found to be achieveable with care on the base layer (60 mm of size 26) but could not be obtained consistently on the surface course (35 mm of size 14). A review of results of density testing on asphalt placed in the metropolitan area and the Hume Freeway (Wallan-Broadford) has shown that the thickness of the asphalt mat has a major influence on the level of compaction that can be regularly achieved. Accordingly, it is proposed that separate acceptance levels will be set for layer thicknesses greater than and less than 50 mm in future specifications.

Some segregation problems occurred with the large nominal size material (26 mm) used for the base layer and no completely successful solution was found although different operating techniques and modified mix designs were used. An occasional problem with incomplete coating of asphalt components, mainly with fine aggregate, was found on one contract usually on resumption after wet weather. After extensive investigation and off-site trials, it appeared that the filler used (a cement works flue dust) gave rise to the problem, and when a hydrated lime filler was substituted no further trouble occurred.

Asphalt permeability has been checked both in the field and in the laboratory on cored cylinders, and the results were generally satisfactory. Deflection testing carried out at intervals before overlay and repeated since completion of asphalt surfacing has also shown satisfactory results.

Mornington Peninsula Freeway: Wells Road Project

Transport and Compaction of Overwet Fill Material

The formation fill of the Mornington Peninsula Freeway — Wells Road Project consists predominantly of a fine clayey sand (some 400,000 m³ solid) won from the flood plain of the Carrum Outfall Drain, otherwise known as Patterson River.

As this flood plain is regularly inundated the typical in-situ moisture content of the material is 30 per cent, however preconstruction tests indicated that with sufficient aeration optimum moisture contents of 15 per cent to 20 per cent could be achieved in three days.

To win the wet material, 35-tonne dump trucks were loaded by 2 cubic metres capacity hydraulic excavators. Within the excavation area this plant operated from a central haul track that was maintained above the normal flood level. Swamp dozers were used to push material from the edges of the excavation to loading points along the central haul track and to trim the excavation to a shape suitable for rowing sports.

At the fill site the dumped material was immediately rough spread by swamp dozer. The wet clayey sand could not be placed in layers thinner than 300 mm without losing the bond with the previously compacted layer, i.e. holding the material in position was only achieved by leaving a sufficient mass of it uncut. At this stage, plant other than the swamp dozer was unable to travel on the fresh fill, however within 48 hours sufficient drying had occurred to commence ploughing. This was carried out with a heavy (400 kg per blade) disc harrow towed by a 200 hp 4WD tractor. With this particular equipment, penetration was limited to 150-200 mm. The top half of the layer was then windrowed by power grader to allow the bottom half of the layer to be aerated with the disc harrow. Compaction was subsequently carried out by 30-tonne self-propelled tamping feet compactors.

Supply, Spreading, Compaction and Properties of Langwarrin Sandstone

A ripped sandstone has been used almost exclusively as the Class 3 sub-base on the project. Apart from its lower supply cost the product has other benefits which place it at an advantage over other available materials:

- ☐ it is readily compacted — 4 to 6 passes of a drawn 5 tonne vibrating roller and a 10-12 tonne three point static roller have been found on this project to be sufficient to compact a 150 mm layer placed over dune sand select fill to a weatherproof condition. A further 4 to 6 passes of the static roller usually produces densities greater than the specification limit,
- ☐ it exhibits high strength — a 1,000 metre length of freeway carriageway finished only to sub-base level carried 7,500 passes of loaded 35 tonne dump trucks this past summer requiring only normal maintenance,
- ☐ the surface does not slurry when overwet and therefore can be worked on immediately after rain.

Characteristic properties of this material are shown in the chart below:

Table 7:

Sieve Size (mm)	75	53	37.5	26.5	19	13.2	9.5	4.75	2.36	0.425	0.075
% Passing	100	97	93	87	80	71	64	51	43	31	16

Texas Ball Mill — 38
Plasticity Index — 6
Lineal Shrinkage — 19
Maximum Dry Density — 2.23 t/m³
Optimum Moisture Content — 7.6%

Plate 7: Hydration of quick lime — Princes Highway East of Trafalgar.

Stabilization using quick lime

On the Princes Highway at Trafalgar, quick lime was used to stabilize a very weak subgrade and allow construction to proceed satisfactorily through the late autumn and winter period.

The general area is poorly drained and low lying. As work proceeded to shape the formation, tracked vehicles had great difficulty moving over the area. Two very weak areas were excavated and backfilled with a stiff clay. Field moisture contents of over 20 per cent were common.

To increase bearing capacity, 3 per cent quick lime to a depth of 300 mm was added to the material. Quick lime was delivered in bulk and spread by shovel and rake. A small pneumatic tyred front end loader was used where possible to speed the spreading.

Clouds of steam rose during hydration of the quick lime (see Plate 7) and within the hour the surface had firmed enough to allow the loader to move readily over most of the area to complete the spreading of quick lime. The rotary mixer was then able to readily move over the area except at one or two locations.

In the weakest areas the stabilized material was cut to one side and the stabilization process repeated. Cement stabilization of the top 300 mm followed using 4 per cent cement. It was noticed that a section, where quick lime and cement were added the same day, exhibited markedly high CBR values. The use of quick lime enabled an important job to proceed despite very difficult site conditions. It also enabled the pavement sub-base and base (total 450 mm crushed rock) to be placed during the spring and summer.

Resheeting — using a large rotary mixer

Resheeting works on the Princes Highway near Trafalgar were carried out in April 1978 using a large rotary mixer to break up the asphalt surfacing and mix it with the underlying pavement material. Pavement investigations indicated that the thicknesses of various pavement materials under the asphalt were variable. These included fine crushed rock, gravel and Macadam and also the original sprayed seal which had been regulated prior to the asphalt being applied.

The procedure adopted was to mix the asphalt surfacing with the in-situ material to a depth of 150 mm to produce a uniform sub-base layer. A base course layer of 175 mm of 20 mm fine crushed rock completed the pavement depth required. Deflection testing had been carried out and a comparison of asphalt overlay to resheeting showed the latter to be the more economical solution.
Before mixing commenced the surfacing was ripped and rolled with a vibrating sheepsfoot roller to give initial break-up of the larger asphalt pieces. Two passes of the mixer (BROS B-L SPRM — 8A) was sufficient to produce a well-mixed material. During subsequent shaping and compaction some larger asphalt pieces became obvious (generally less than 150 mm across) and these were removed by hand.
The grading of the mixture produced closely followed the limits specified for 40 mm crushed rock base and readily compacted. The bitumen in the old asphalt was still lively to a small degree and this was a factor in the ease of compaction experienced.
The benefits of the mixing process compared to removing the asphalt are seen as savings in time and materials resulting in lower cost and minimal delays to traffic. The job area was approximately 6,000 m² and mixing was completed in one day.
Unfortunately, heavy rain fell before the mixed material could be entirely shaped, compacted and covered with the base course layer. This gave rise to problems with the material being overwet and difficult to dry out.
A primerseal was applied and, although some patching has been required since, the majority of the job has given good service. A final seal will be applied in the 1979/80 season and the pavement condition will continue to be monitored to assess its performance in comparison with the earlier resheeted sections where the surfacing was removed.

Quality Control and Plant Mixed Quarry Products

The Plant Quality Control Sub-section of the Materials Research Division inspects and tests crushed rock products, asphalt and structural concrete at the supplier's plant during the production of materials. This service is provided on request for CRB direct and funded works within the Melbourne metropolitan area. At times, when capacity permits, it is possible to extend the service to non-Board funded works, and approximately forty municipal councils seek the Board's assistance in this regard. Occasionally the service is extended for CRB direct works outside the Melbourne metropolitan area.
The quality control testing is carried out in laboratories provided at each mixing plant by a field staff of 18 Clerks of Works. This allows detection of non-specification materials before delivery to the construction site and enables plant adjustments to be made so that production complies with the specification prior to supply.
A charge, based upon the quantity of material produced under supervision, is made to cover the cost of on-site supervision. Currently, this charge is 35c per tonne for crushed rock, stabilized crushed rock and asphalt, and $2 per cubic metre for premixed concrete.
Quality control involves the following processes.
Testing commences with an assessment of the inherent properties of the source rock in the quarry face. Source rock quality is determined by a geologist sampling the working quarry faces at regular intervals of time. The rock types sampled are classified using appropriate laboratory tests and reference samples of each rock type are distributed to all mixing plants using materials from that source. These reference samples are used by the Clerk of Works to determine the quality of different classes of materials which may occur in the materials being supervised. Each quarry face is also inspected at regular intervals to ensure that the material types present are consistent with those previously sampled.
It is current practice for quarries which are frequent suppliers of materials to metropolitan mixing plants to be covered by sampling investigations at least once every four months and inspections every other month: the less frequently used quarries are sampled at least once every six months and inspected every second month: the more infrequently used quarries are sampled at least annually with inspections on a three-monthly interval. There are eight quarries in the first category, eight in the second category, and seven in the third category.

The final products are checked for quality at the mixing plant by the Clerk of Works who visually checks the quality of ingredient materials, the adequacy of batching and mixing and the quality of the final product. Spot check testing of the final product for compliance with specification requirements is carried out at frequent but random times during production. Material supplied from stockpiles is further tested to ensure uniformity and compliance.
If test results have been satisfactory and the load is not obviously deficient in some aspect, the Clerk of Works will endorse the delivery docket. The endorsement of the docket is not intended in any way to imply that the load has been accepted nor that it complies with all specification requirements. It is stated in Board specifications that testing and inspection of materials at the mixing plant and the endorsement of delivery dockets does not affect the right of the engineer or his representative to reject material should it prove to be not in conformity with the specification at a later stage up to the issue of the Certificate of Final Completion.
The total quantity of material supervised at the point of production by Clerks of Works attached to the Plant Quality Control Sub-section during 1978/79 is shown tabulated in Table 8.

Table 8:

	Material Quantities		
Material	CRB Direct Works	CRB Funded Works	Sundry Debtor Works
Concrete (m^3)	8,426	443	—
Asphalt (tonnes)	263,059	148,773	286,589
Crushed Rock (tonnes)	109,586	25,578	86,494

Assessment of Rock Durability

Crusher Fines

Some quarry operators are unable to produce sufficient crusher fines to satisfy market demand and the transport of fines from one site to another is a common occurrence. Difficulty has been experienced in determining the quality of such material and consequently an investigation to develop a test suitable for assessing the quality and durability of fine aggregates was undertaken. This has resulted in a degradation test method which can be carried out in the quality control laboratories at each quarry or plant supplying material in accordance with the Board's Specification for Roadworks.
The investigation procedures included a study of the mode of degradation of aggregates produced from the different igneous and metamorphic rock types commonly quarried. Currently specified laboratory test methods as well as microscopic and X-ray diffraction techniques were used to categorize the physical properties and the mineralogical components of the different rock types.
A degradation test was then developed to assess the quality and durability of fine aggregates. This test is performed on a fine, pregraded test sample, which includes material ranging in size from 4.75 mm to 0.425 mm. The washed and predried sample is shaken for 20 minutes in a sand equivalent test cylinder filled with water to the 100 mm graduation. The degraded sample is then washed over a 75 mm sieve and the fines collected and flocculated and allowed to settle for 20 minutes. The floc height then gives a measure of the quality and quantity of fines produced during the degradation procedure. A poor test result can indicate either the presence of highly expansive clay minerals within the aggregate particles, excessive mica-like minerals in the rock mineralogy, a weak intergranular bond between the component minerals, or that the rock is excessively soft and abrades readily.
It is expected that this test method when used in conjunction with currently specified test limits (Sand Equivalent, Plasticity Index and Particle Size Distribution) will provide a simple and effective method of assessing the durability of crusher fines.

Source Rock

A reappraisal of the Board's source rock durability requirements has been undertaken as a result of recent work by Dr W F Cole of the CSIRO. This work initially involved a study of the durability of some green basalts in the Melbourne areas. It was demonstrated that these particular basalts performed satisfactorily when used in concrete, although the material is excluded by current CRB specifications. This study was then extended to a wider group of rocks and resulted in the development of a classification of potential durability based on minerology and texture.
The Board has been participating in these studies along with representatives from the quarrying industries and other interested authorities. A clay mineralogist was recently appointed to the Board's staff, and these investigations will be continued in order to incorporate the results of the developments into specifications.

Bituminous Surfacing

Extent of Work

Table 9 shows that 4,897 km of all types of bituminous surfacing work was completed in 1978/79 compared with 5,088 km in 1977/78. The length of roadway treated decreased by 191 km and the area treated decreased by approximately 650,000 m².

In 1978/79 the length of sealed pavement on the Board's declared system increased by 33 km and the length on unclassified roads increased by 538 km, as shown in Table 10. Reconstruction of existing sealed pavements and the restoration of the seal coat amounted to 594 km of the declared system, 2.5 per cent of the sealed length, compared with 1.6 per cent in 1977/78.

Retreatment on declared roads amounted to 1,598 km (6.7 per cent of the sealed length), compared to 1,697 km (7.2 per cent) in 1977/78.

Cost of Work

The average unit costs for sprayed work done by the Board's seventeen bituminous surfacing units are shown in Table 11. The average overall cost of all types of sprayed work was 72 cents per square metre compared with 64 cents in 1977/78, an increase of 12 per cent. The variation in costs of the major elements of sprayed bituminous surfacing since 1971/72 is shown in Figure 15.

The average cost per tonne of asphalt supplied and laid was approximately $24.20 per tonne in the Melbourne and Geelong areas, and approximately $31.60 per tonne in other areas of the State. The average cost per tonne was $27.19, compared with $24.39 in 1977/78.

Table 9:
Bituminous Surfacing Work Completed

Category of road and plant used	1977/78		1978/79	
	km		km	
Work on roads to which the Board contributed funds:				
(a) CRB declared roads:				
Board's plant	2,179		2,046	
Municipal plant	119		98	
Contractors' plant	269		223	
		2,567		2,367
(b) Unclassified roads:				
Board's plant	1,731		1,750	
Municipal plant	243		208	
Contractors' plant	215		203	
		2,189		2,161
Sub-total:		4,756		4,528
Work done for other Authorities by the Board's plant (No Board contribution for these works):				
Municipalities	322		359	
State instrumentalities	10		9	
Commonwealth works	0		1	
		332		369
Totals		5,088		4,897

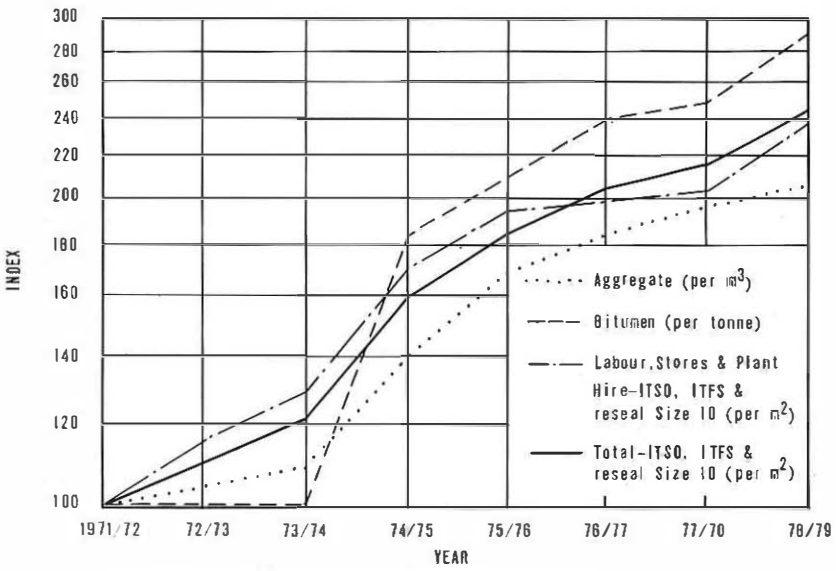


Figure 15: Indices of unit cost of major elements of sprayed bituminous surfacing. Base: 1971/72 = 100.

Table 10:
Bituminous surfacing work on various categories of roads to which the Board contributed funds during 1978/79

Type of work	State Highways	Freeways	Tourists' and forest roads	Main roads	Total Board's declared system	Unclassified roads	Totals
	km	km	km	km	km	km	km
Initial treatments:							
Extensions to sealed system							
Sprayed work	—	—	12.50	19.82	32.32	534.33	566.65
Plant mix work	—	0.72	—	—	0.72	3.69	4.41
Reconstruction of lengths of previously sealed pavements							
Sprayed work	79.56	2.31	6.95	207.02	295.84	249.12	544.96
Plant mix work	2.41	1.68	—	10.25	14.34	34.57	48.91
Widening of existing sealed pavements							
Sprayed work	57.72	13.92	0.61	47.08	119.33	88.90	208.23
Plant mix work	4.37	3.42	—	5.40	13.19	2.40	15.59
Duplication of existing sealed pavements							
Sprayed work	15.84	1.30	—	—	17.14	0.95	18.09
Plant mix work	2.25	—	—	2.57	4.82	1.75	6.57
Final seal							
Sprayed work	74.71	13.86	9.24	115.55	213.36	215.05	428.41
Plant mix work	4.38	48.93	—	3.93	57.24	8.30	65.54
Retreatments							
Sprayed work	606.10	4.21	60.40	893.58	1564.29	996.82	2561.11
Plant mix work	12.00	11.88	0.37	9.75	34.00	25.12	59.12
Totals	859.34	102.23	90.07	1314.95	2366.59	2161.00	4527.59

Types of Work

Sprayed work (initial treatments and retreatments) was again the principal type of work, amounting to 95.5 per cent of the total length of the work.
The plant mix work completed in 1978/79 was 200 km, i.e. 4.5 per cent of the total distance and 8.3 per cent of the total area.
The 1978/79 expenditure on plant mix works was equivalent to 38 per cent of the total expenditure on bituminous surfacing. For the plant mix work a total of 446,700 tonnes was supplied and spread by contractors.

Table 11:
Average costs of sprayed bituminous surfacing done by CRB plant
(on roads to which the Board contributed funds during 1978/79)
(Costs in cents per m²)

Item		Nature of work: ITP&S Size 13 & over	ITP&S Size 10	ITP&S Size 7	ITP&S Size 5 & Sand	ITP&S 2 Appln. Seal	ITSO & Reseal 2 Appln.	Primerseal	ITSO&ITFS & Reseal Size 13	ITSO&ITFS & Reseal Size 10	ITSO&ITFS & Reseal Size 7	ITSO&ITFS & Reseal Size 5 & Sand	BSRS Reseal Size 13	BSRS Reseal Size 10	Surface Enrichment
Square metres costed		1,252,100	1,380,600	59,600	18,200	39,500	28,700	1,594,300	3,435,100	8,107,400	6,409,800	897,300	245,800	325,900	290,200
Material	Cents	57.4	55.2	47.5	36.8	121.8	73.0	40.7	47.4	37.8	32.0	32.3	58.0	51.3	11.3
	%	51.1	55.0	57.6	53.7	60.7	58.8	56.4	56.5	54.9	55.7	60.0	47.5	49.9	58.5
Stores	Cents	5.0	3.3	3.0	3.5	5.6	4.1	2.4	3.1	2.6	2.0	1.7	3.6	5.2	0.4
	%	4.4	3.3	3.6	5.1	2.8	3.3	3.3	3.7	3.8	3.5	3.2	2.9	5.1	2.1
Plant Hire	Cents	20.3	16.3	12.1	10.6	28.5	19.2	11.6	12.7	10.9	9.1	7.6	20.9	18.4	2.8
	%	18.1	16.3	14.6	15.5	14.2	15.5	16.0	15.1	15.8	15.9	14.1	17.1	17.9	14.5
Labour	Cents	29.7	25.5	20.0	17.6	44.7	27.8	17.6	20.7	17.6	14.3	12.2	39.8	27.8	4.8
	%	26.4	25.4	24.2	25.7	22.3	22.4	24.3	24.7	25.5	24.9	22.7	32.5	27.1	24.9
Totals	Cents	112.4	100.3	82.6	68.5	200.6	124.1	72.3	83.9	68.9	57.4	53.8	122.3	102.7	19.3
	%	100	100	100	100	100	100	100	100	100	100	100	100	100	100

ITP & S indicates "Initial Treatment Prime & Seal" ITSO indicates "Initial Treatment Seal Only"
ITFS indicates "Initial Treatment Final Seal" BSRS indicates "Bitumen Scrap Rubber Seal"

Materials

Aggregate
The total quantity of covering aggregate used was approximately 248,000 cubic metres on sprayed work undertaken by the Board, and 37,000 cubic metres on sprayed work undertaken by municipalities and contractors. Table 12 details the average prices of aggregates over the last five years and illustrates that the average price in 1978/79 was $0.77 per cubic metre higher than the average price in 1977/78.

Table 12:
Average price of aggregate for bituminous surfacing
(in roadside stacks)

Material Prices/cubic metre	74/75	75/76	76/77	77/78	78/79
	$	$	$	$	$
Screenings	9.31	11.19	12.66	13.00	14.11
Gravel	9.24	11.36	12.55	11.97	12.09
Sand	3.06	5.23	4.89	6.40	7.07
Scoria	5.38	6.51	6.41	21.38	7.80
Average price all aggregate	9.13	11.01	12.42	12.92	13.69

Bitumen
In 1978/79 the Board purchased 35,500 tonnes of bitumen by contract from four suppliers at a cost of $4,748,000 (an average of $133.75 per tonne). The cost of bitumen since 1973/74 has almost tripled, as shown in Figure 15.

Truck Mounted Aggregate Spreader

For many years sealing aggregate used in bituminous surfacing work has been spread with a belt spreader developed by the Board in the 1930s. Whilst this machine achieves a very uniform spread with a minimum of waste, it is very slow in operation and costly to maintain. The main factor in this regard is the time taken to couple and uncouple the machine from a succession of trucks loaded with aggregate to be applied to the road surface. Development work to overcome these problems has been proceeding for some years. General prototype machines incorporating desirable features of the existing machine but having the ability to be permanently equipped on each truck have been developed and tested in the field, and the latest, which incorporates many novel features, was field tested during the summer of 1979 (see Plate 8). This unit has a spreading width of 2.5 m; the spreader is connected to the body of a truck by a mounting frame and locks immediately under the truck tailgate.

The truck body is fitted with special baffle plates which can be removed, to prevent the load from slipping towards the rear when the body is tipped. This is necessary to ensure that the spreader is not overfed and to avoid instability of the truck.

The spreader is raised for travelling and this allows the truck to be used for normal towing purposes. The aggregate is metered by means of a rotating rubber covered drum powered by a hydraulic motor mounted within the drum. Power is supplied from a hydraulic pump coupled to the power take-off of the truck's gear box. Control is provided to both sides of the unit for starting and stopping the spreader rotation which is independent of the moving of the truck. The original belt spreader depended on the movement of the unit to actuate the spreading. A metering gate provides uniform distribution of aggregate across the full width of the spreader but cutoff plates allow spreading widths less than the 2.5 m.

The field tests are encouraging and it is expected that this unit will result in faster, cheaper and more accurate application of aggregate in bituminous surfacing work.

Plate 8: Truck mounted aggregate spreader

Plate 9: Prototype pavement marking removal unit

Removal of Highway Pavement Marking

The high cost of maintaining the current line removal machine together with the high noise generated in operation has led to investigations into alternative means of removing unwanted road markings.

Tests have been performed with blasting machines which direct a high velocity grit into a road surface, but they were found to be less than satisfactory, especially because of the noise factor as a portable machine of this type required an engine driven generator to power the unit. Minimal damage to the road surface resulted, but removal of markings was many times slower than the current abrasive techniques.

Recent experiments have been carried out using an oxygen-enriched LP Gas flame supplemented with additional excess oxygen supplied from an independent head. The high temperature achieved accelerates oxidization and decomposition of the paint and results in removal of unwanted markings with minimal damage to the underlying pavement. The most important feature is that the machine operates with no more noise than a conventional oxy-acetylene burner, thereby making the system suitable for night use in built-up areas.

The experimental removal unit is light, simple and easy to operate. It comprises a trolley to which is attached the burner equipment with the two heads located approximately 40 mm above the pavement (see Plate 9). Oxygen and LP Gas is supplied through hoses from cylinders carried by a support vehicle. A wire bristle broom is used to remove oxidized paint particles which still adhere to the pavement.

Test results on both asphalt and surface sealed pavements are encouraging. It has been found that even thermoplastic markings are more readily removed with the burner technique used in conjunction with the existing mechanical line removal plant.

Traffic Signals

Traffic Signal Systems

The Board decided during the year to adopt the NSW-based traffic signal co-ordination system SCATS (Sydney Co-ordinated Adaptive Traffic System) for two regional signal linking systems in the Melbourne metropolitan area. The system is based on the use of micro-processor type local controllers co-ordinated by regional mini-computers each with a capacity to control up to 200 intersections. These regional masters are capable of being monitored via a Metropolitan monitoring computer.

In recent years, various smaller scale systems have been installed in connection with major road works in some areas of metropolitan Melbourne. These are generally incompatible with each other and as such cannot be incorporated in an overall corridor/area control scheme.

There are two major reasons for adopting this new system. Firstly, the system has a dynamic response to local fluctuations in traffic flows; secondly, control is exercised by local and regional controllers and expensive fall back computer hardware is not required. Other advantages of the system are that the software developed by the New South Wales Department of Main Roads is available, and the system is amenable to staging and expansion in the future. System performance and faults at all levels can be remotely monitored.

Figure 16 shows the system hierarchy and communications in simplified form.

Investigations have been directed toward the definition of corridors and regions within the metropolitan area where linking of signals could be advantageous, and toward an assessment of priorities for the various local areas and regions.

It is proposed that, initially, systems based on the Maroondah and Nepean Highways respectively be linked during 1979-80. Two mini-computers and peripherals have been ordered for delivery in late 1979. Monitoring/testing facilities are being established at the Board's Syndal Depot.

One regional computer will be installed at Blackburn to control linked traffic signals along Maroondah Highway through Ringwood and Blackburn. This system can be progressively extended along arterial roads in this area as required.

Planning has commenced for a second regional computer to be installed at St Kilda Junction to provide control for linked systems on Kings Way and other routes in the vicinity, and to control signals on the Nepean Highway route after the highway is widened between Cochrane Street and South Road.

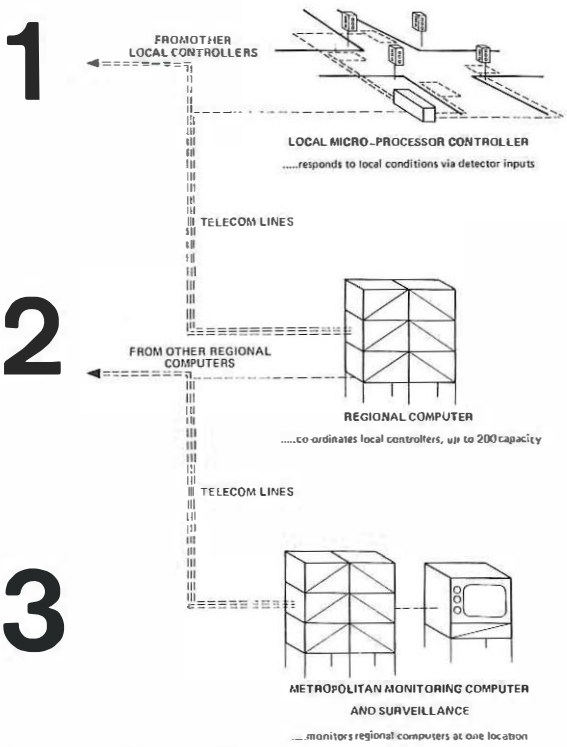


Figure 16: Traffic signal linking — simplified system hierarchy and communications

The mini-computers used are Digital Equipment Corporation's PDP 11/34 central processing units with two removable floppy disc units for mass storage, 64K words of memory and real-time hardware clocks. The computer communicates with the local intersection controllers via leased Telecom lines. A communication processor which decodes messages from the master computer and encodes status and responses to the master is housed in the controller. Fall-back modes in case of computer or communications failure include "lamps off or flashing", "isolated operation" and "cableless link" operation. The latter is the normal fall-back mode as it provides a reasonable linking system in its own right by the utilization of programme built into the controllers.

The system software will be written in MACRO 11 assembler language and enables the following functions to be performed by the system:

At local controller level

☐ detection of traffic information via detectors.

☐ transmission of traffic information and controller status.

☐ traffic control at the intersection level — "microscopic" control.

At master level

☐ information processing for optimum control strategy and signal parameters.
☐ processing of keyboard commands and data entry.
☐ generation of control messages in accordance with information processed above.
☐ transmission of control messages to intersection controllers.
☐ display of accumulated traffic data for surveillance and intervention.
☐ storage of accumulated traffic data for off-line generation of system reports.

Maintenance of Traffic Signals on State Highways

As from the beginning of 1978/79, the Board assumed financial responsibility for the maintenance of all traffic signals on State highways. This commitment involves approximately 350 sets of signals in Victoria, of which some 235 are in the metropolitan area of Melbourne.

Future maintenance of traffic signals by the Board will be undertaken by a combination of contract and day labour. All fault maintenance will be covered by contract whereas accident damage, globe replacement and hardware maintenance will be carried out by field maintenance staff. During the year, there were in excess of 2,100 fault calls and approximately 150 accident damage repairs to traffic signals on State highways in the metropolitan area. The expenditure in the metropolitan area on traffic signal maintenance for 1978/79, including power supply, was approximately $440,000.

Full operational details of all signal installations are being collected as an aid in determining measures required to upgrade the equipment and the standards of fault detection.

Route Traffic Management

A greater emphasis is being placed on improving the traffic capacity of the existing arterial road network. This is necessary to cater for growth of traffic on the many routes where there is little immediate prospect of increasing the capacity by major road improvements or the contruction of relief routes.

There is however little point in improving traffic flow at one intersection if it merely adds to congestion at the next. Accordingly, the policy has been adopted of examining traffic flow along the whole length of major arterial roads with the objective of ensuring capacity balance at all sections. Some of these measures are:

☐ linemarking at intersections to provide additional sheltered right-turn lanes by narrowing lane widths. In the case of four-lane roads, remarked as five lanes (commonly called a "five-lane treatment") the use of a separate lane for right-turning vehicles benefits through traffic. Lane widths as narrow as 2.7 metres for through lanes and 2.5 metres for right-turn lanes have been used where cars comprise the bulk of traffic.
☐ channelization of intersections to direct vehicles to use desirable paths. Priority can be better defined, the number of conflict points reduced, and undesirable movements prevented.
☐ upgrading of traffic signals. Old signals may need to be modernized to make them traffic responsive and capable of handling more movements. Linking of signals to allow traffic progression may be desirable. Some unsignalized intersections may need to have signals installed.
☐ improvements to the road surface, particularly in kerb lanes. Paving over a wide bluestone channel, raising a pit cover or reducing crossfall may be necessary to entice drivers to use the outer lane.
☐ moving obstructions. Sometimes the relocation of a utility pole from the kerb is all that is necessary to attract motorists to effectively use a kerb lane.
☐ improvements to signs and linemarkings. Improved guidance to motorists results in smoother, more orderly traffic flow.
☐ turn bans at some intersections. Interference to through traffic can be reduced.
☐ parking controls. Road capacity is greatly dependent on parking arrangements, particularly in the vicinity of intersections. Parking too close to an intersection may discourage traffic from using the kerb lane. The introduction or extension of clearway conditions may be appropriate in such cases.
☐ introduction of off-centre or reversible lane operations. This is an extreme measure which may be necessary in special circumstances.

A number of route traffic management studies have been completed and others are in progress. Some of the routes which have been examined are the Princes Highway East between St Kilda and Oakleigh, Canterbury Road between Camberwell and Box Hill, and the Nepean Highway between Gardenvale and Moorabbin, the latter as a short-term improvement prior to the widening of this section.

Intersections on Rural Roads with Wide Medians

A new form of treatment has been developed for intersections on rural roads with divided carriageways and wide medians. The treatment requires side-road drivers to slow down and also minimizes the risk of wrong-way movements down one-way carriageways of the major road (see Figure 17). The traffic islands and signing give excellent indications of the location, layout and priorities at the intersection.

This form of treatment will be used at a number of locations along the Hume Freeway where the volume of traffic using the side road does not warrant grade separation. The designed layout will give safe operating conditions at the intersections until such time as conversion to full freeway conditions becomes necessary.

Roundabouts

Roundabouts have been used as a form of intersection treatment for many years but, with the emphasis given over the past two or three years to the improvement of safety at intersections, an increasing number of roundabouts have been designed and constructed in Victoria.

When designed by the correct principles, roundabouts have excellent operating characteristics and are able to cater for a wide range of traffic volumes with limited delay to traffic. Roundabouts have flexibility to cope with hourly, daily, or seasonal changes in traffic patterns with safety.

Because of these characteristics, roundabouts are being designed and installed in a number of differing urban and semi-urban situations. These situations include:

- intersections on urban arterial roads to reduce delays, rationalize priorities, increase capacity and improve safety.

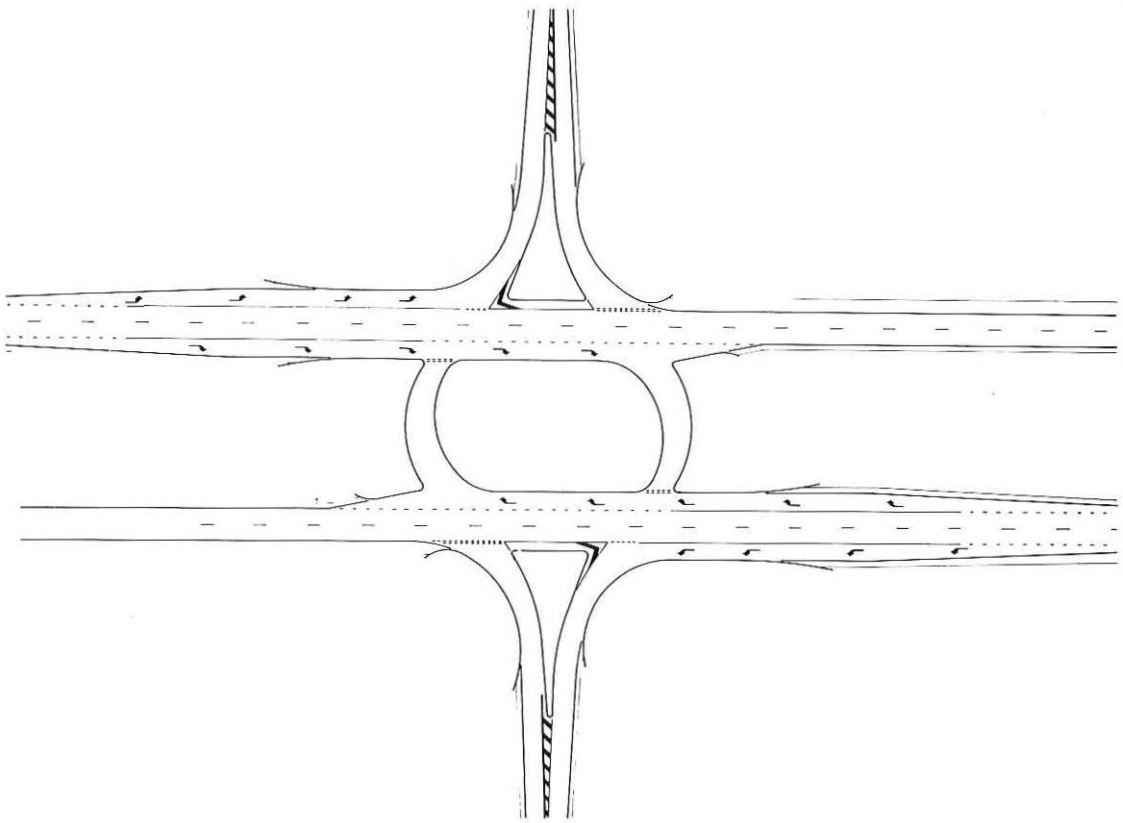


Figure 17: Layout of the intersection treatment for rural roads with wide medians

☐ intersections on local streets to control speeds, improve safety, and clarify right of way between conflicting traffic.
☐ semi-rural intersections to rationalize priority and improve safety.
Roundabouts operate on the basis of an approaching driver selecting a gap in the circulating flow around the central island. The low relative speeds between vehicles and their flat approach angles account for the good safety characteristics of the treatments. This operation also enables the capacities, degrees of saturation and delays at roundabouts to be calculated on the basis of gap acceptance theory.
In the design of roundabouts, a number of principles are important: firstly, the layout should be such that approaching drivers have a clear view of their path through the intersection and can appreciate where to give way; secondly, the layout should be such that drivers cannot traverse the intersection at high speed. This can be achieved if no vehicle path (assumed to be two metres wide) through the intersection has a radius greater than 100 metres. This corresponds to a maximum speed of about 50 km/h.
Other important aspects of roundabout design are the provision of splitter islands, ensuring that pedestrians and commercial vehicles are catered for, and the provision of some form of street lighting. These and other aspects of roundabout design are set out in the Board's Technical Bulletin No 30 entitled "Guidelines for the Design and Installation of Roundabouts".

Investigations to Evaluate the Effect of the Eastern Freeway

The Board has carried out a number of investigations throughout the Eastern Freeway Corridor to monitor the various effects of the freeway on travel patterns and the environment. Some details of these studies are:

Traffic Counting

A "before and after" traffic counting programme was carried out at more than 200 different locations throughout the corridor and the western approaches area and a report was published.
The most significant conclusion of the survey was that the opening of the freeway has not resulted in a major increase in the total traffic volumes in the corridor as there were only about two per cent additional trips. It has however resulted in a diversion of traffic from Heidelberg Road, Johnston Street, Victoria Street, High Street and Doncaster Road onto the freeway. Traffic has decreased in residential streets in many areas, but volumes have increased on approach roads to the freeway.

Travel Times

The opening of the Eastern Freeway has resulted in significant reductions in travel times for traffic in the corridor. The greatest reductions, ranging from two to eighteen minutes (depending on the route and time of day) apply to those using the freeway, but time savings of up to five minutes are apparent on parallel routes.

Origins and Destinations

In August 1978, approximately 35,000 questionnaires were distributed at Heidelberg Road, Johnston Street, Victoria Street and the Eastern Freeway at Gold Street and east of Hoddle Street, to obtain information concerning the origins and destinations of traffic using these routes together with other related characteristics. The most significant result of the survey is the large number of freeway users who have origins and destinations in the areas of Collingwood, Fitzroy and Carlton. The percentage varies throughout the day but is approximately 28 per cent during the peak hour.

Public Transport

The MMTB has been monitoring its tram and bus services throughout the corridor since the freeway was opened to traffic. Conditions for the public transport services have generally improved and with the exception of the West Preston tram route, the peak hour trip times on all tram routes have decreased. In addition, freeway and arterial road bus services from the Doncaster area have improved and bus patronage on these services has increased

by 24 per cent. However, some problems are still experienced at some intersections in Fitzroy and Collingwood and measures to overcome these problems are under examination.
It has not been possible to determine the effect of the freeway on road safety using actual accident statistics because insufficient time has elapsed since opening to allow statistically significant figures to be obtained. However, by applying typical accident rates to the road network in the area, and using travel count information, it is estimated that over 60 casualty accidents will be saved each year as a result of construction of the freeway. The community's savings in preventing these accidents amounts to over one million dollars annually.

Noise Levels
Following the opening of the freeway, a noise monitoring programme was developed in consultation with the EPA, to examine the existing noise levels in Alexandra Parade and Princes Street in the Cities of Collingwood, Fitzroy and Melbourne. Between March and July 1978, L_{10} (18 hour) noise levels were measured one metre from the facade of residences at seven locations along the route. The results showed that:
- in Alexandra Parade between Gold Street and Brunswick Street, the current L_{10} (18 hour) noise levels are generally 72 dB(A). This figure represents an increase of 4-5 dB(A) following the opening of the freeway.
- in Alexandra Parade between Brunswick Street and Nicholson Street, the L_{10} (18 hour) noise level is 75 dB(A), an increase of 1 dB(A).
- in Princes Street between Nicholson Street and Lygon Street, the L_{10} (18 hour) noise level is generally 75 dB(A), an increase of 1 db(A).

The measured noise levels were also compared with noise level predictions calculated using the Calculation of Road Traffic Noise (CORTN) model and it was found that this prediction method gave values an average of 2½ dB(A) higher than the measured levels.

Air Quality
An air quality monitoring station has been established in Alexandra Parade to measure the level of four traffic related primary pollutants—carbon monoxide, nitric oxide, nitrogen dioxide and particulate lead. Initial results indicate that the pollution levels for carbon monoxide, nitric oxide and nitrogen dioxide are well below the draft standards currently proposed by the Environment Protection Authority. The particulate lead leavels are higher than the EPA recommended ambient lead levels but it is expected that the ambient lead levels in the general urban area surrounding the Eastern Highway would generally not exceed the draft EPA objectives. The monitoring will be continued until September to complete a six-month monitoring programme.

Safety
Details of the increase/decrease of accident occurrence, the accident frequency rate and the days lost per million man-hours worked are shown in the following tables:

Table 13:
Accidents in the 1978/79 year compared with 1977/78

Type of Injury	1977/78	1978/79	Decrease	Increase
Back strains	141	133	8	—
Burns and scalds	15	23	—	8
Burns to eyes	7	1	6	—
Fatal injuries	0	0	—	—
Foreign body in eyes	48	47	1	—
Fractures	19	23	—	4
Head injuries	14	11	3	—
Lacerations and wounds	70	74	—	4
Multiple injuries	1	0	1	—
Occupational diseases	21	17	4	—
Sprains and strains	66	66	—	—
Miscellaneous	73	100	—	27
	475	495	23	43

Table 14:
Trend in accident frequency rate and the days lost per million man-hours worked for seven-year period 1972/73-1978/79 (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	1977/78	1978/79
Total man-hours worked (million)	9.05	8.75	9.06	8.55	8.37	7.84	7.89
Lost time accidents	355	315	380	397	411	475	495
Accident frequency rate per million man-hours	39	36	42	46	49	61	63
Days lost (excluding fatalities)	2,051	1,998	2,222	2,375	2,601	2,576	2,839
Resultant days lost per million man-hours (excluding fatalities)	226	228	245	277	310	329	359
Number of fatalities	0	0	1	0	1	0	0
Total days lost (including fatalities)	2,051	1,998	8,222	2,375	8,601	2,576	2,839
Total resultant days lost per million man-hours (including fatalities)	226	228	904	277	1027	329	359

Publications

The following papers by officers in the Engineer in Chief's Branch were presented or published in the 1978/79 year:

"Problems Associated with Minimum Energy Design"
B Addis, Bridge Design Engineer
Presented at the Australian Road Research Board Workshop on Minimum Energy Design of Culvert and Bridge Waterways, Melbourne, December 1978

"Hydraulic Design of Crossing at Six Mile Creek, Bulgana Road, Shire of Stawell, Victoria"
B Addis, Bridge Design Engineer
G Walter, Engineer, Bridge Design Division
Presented at the Australian Road Research Board Workshop on Minimum Energy Design of Culvert and Bridge Waterways, Melbourne, December 1978

"Use of Rubber in Bituminous Surfacing"
J D Bethune, Asphalt Engineer
Presented at the Ninth Australian Road Research Board Conference, Brisbane, August 1978

"Determining Road Priorities at a Statewide Level"
G J Both, Transport Economist, Advance Planning Division
Presented at the Second Conference, Road Engineering Association of Asia and Australasia, Manila, Philippines, October 1978

"Replacement of Motor Vehicle and Driver Charges by Additional Fuel Tax"
G J Both, Transport Economist, Advance Planning Division
Presented at the Fifth Australian Transport Research Forum, Sydney, April 1979

"Raised Reflective Pavement Markers: Installation, Performance and Specification"
K D Freeman, Engineer, Traffic Engineering Division
E N Vincent, Engineer, Materials Research Division
Presented at the Ninth Australian Road Research Board Conference, Brisbane, August 1978

"Bituminous Surfacing – Sprayed Work"
W P Holtrop, Engineer, Asphalt Division
Presented at Surface Treatment Seminar, Jakarta, Indonesia, November 1978

"NAASRA Study of Road Maintenance Standards, Costing and Management – Some Significant Developments"
J R Jordan, Study Team Leader, NAASRA Road Maintenance Study
P J Mulholland, Study Team Member
(On secondment from the CRB)
G Logue, Study Team Member
Presented at the Ninth Australian Road Research Board Conference, Brisbane, August 1978

"Assessing the Specular Reflecting Effect of Wet Road Surfaces"
G W Knox, Engineer, Materials Research Division (Retired)
B R Fleming, Engineer, Materials Research Division
Published in *Australian Road Research*, Vol 8, No 3, September 1978

"Introductory Remarks to Pavement Management Systems II"
P J Mulholland, Study Team Member, NAASRA Road Maintenance Study (On secondment from the CRB)
Presented at the Ninth Australian Road Research Board Conference, Brisbane, August 1978

"Surface Drainage During Construction"
P T Nash, Engineer, Mulgrave Freeway Project
Presented at the Australian Road Research Board Pavement Surface Drainage Symposium, Sydney, May 1979

"Porous Friction Courses – Current Status"
J J Rebbechi, Assistant Asphalt Engineer
Presented at the Australian Road Research Board Pavement Surface Drainage Symposium, Sydney, May 1979

"Traffic Noise – Its Effect on Road Design"
R E Saunders, Leader, Environmental Studies Section
Presented at the Society of Automotive Engineers — Australasia Seminar on Noise and Vibration Control, Melbourne, November 1978

"An Approach to Traffic Noise Studies"
R E Saunders, Leader, Environmental Studies Section
G W Jameson, Scientific Officer, Materials Research Division
Presented at the Ninth Australian Road Research Board Conference, Brisbane, August 1978

"The Management of Urban Corridor Roading Studies"
R T Underwood, Chief Planning Engineer
Presented at the Ninth Australian Road Research Board Conference, Brisbane, August 1978

"Urban Road Planning – Some Current Considerations"
R T Underwood, Chief Planning Engineer
Presented at The Annual Engineering Conference, Institution of Engineers, Australia, Perth, April 1979

"A Trial Installation of Corner-cube Delineators: Calder Highway, Gisborne to Woodend"
E N Vincent, Engineer, Materials Research Division
Published in *Australian Road Research*, Vol 8, No 3, September 1978

"Commercial Vehicle Costs and Charges: A Study of Separable Pavement Costs"
J R Webber, Assistant Advance Planning Engineer
G J Both, Transport Economist, Advance Planning Division
I R Ker, Economist, Office of the Director-General of Transport, Western Australia
Presented at the Ninth Australian Road Research Board Conference, Brisbane, August 1978

"Commercial Vehicle Surveys"
J R Webber, Assistant Advance Planning Engineer
Presented at the Ninth Australian Road Research Board Conference, Brisbane, August 1978

"Online Information Retrieval Systems: Implications for Australia, 1979"
C J Wherry, Librarian in Charge
Presented at a meeting of the ARI/IRRD Participants Group, Melbourne, May 1979

"Experience with Hydrostatic Transmissions on Construction Plant"
J B S Wilson, Engineer, Mechanical Sub-branch
Presented at the Society of Automotive Engineers — Australasia Heavy Construction Plant Conference, Melbourne, December 1978

Also published in 1978/79 was:
Technical Report No 64 — Energy and Road Transport

Staff

As at 30th June 1979, personnel in the Engineer in Chief's Branch numbered:

Technological Staff (Professional)	618
Technical Staff	524
Administrative Staff	386
Supervisory Staff — Field	177
— Depot	76
Clerks of Works	82
Construction and Maintenance	2,170
Workshop and Depot	643
	4,676