60 Denmark Street, Kew 3101

30th September, 1980

The Honourable 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, the Board submits to you for presentation to Parliament the report of its proceedings for the year ended 30th June, 1980.

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 of and work done by its staff and employees throughout the year.

Yours faithfully

T H Russell
M Eng Sc(Hons.), BCE(Hons.),
Dip CE, CE, FIE Aust., FCIT
Chairman

W S Brake
BCE, CE, MIE Aust
Deputy Chairman

N L Allanson
AASA (Senior), JP
Member

G K Cox
LL B, JP
Secretary

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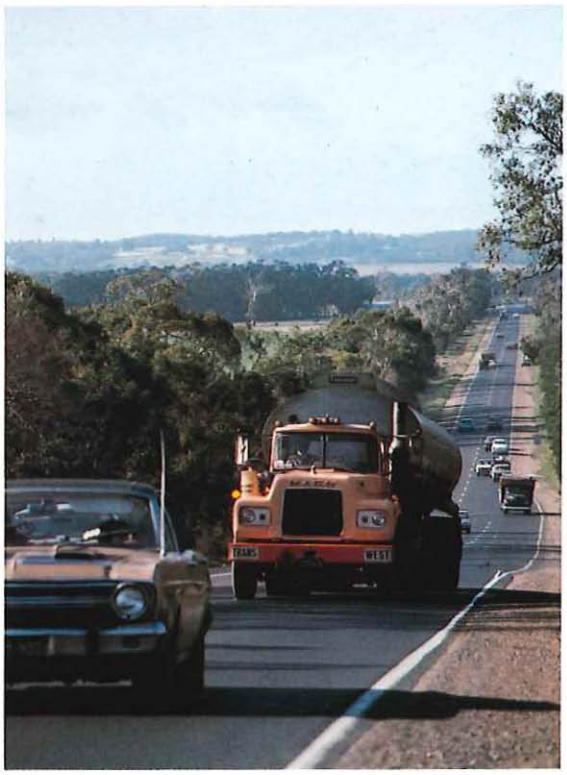


Cover:
The Mulgrave Freeway, looking west towards Hunlingdale Road, opened to traffic between Forster Road, Mount Waverley, and Huntingdale Road, Oakleigh, on Wednesday, 12th December 1979.

Princes Highway East, east of Pakenham — the Princes Highway East between Dandenong and Traralgon was declared a national commerce road in April 1980.

Country Roads Board
Victoria

Sixty-seventh Annual Report for year ended 30th June, 1980.
Presented to both Houses of Parliament pursuant to
the Country Roads Act, 1958.

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 23,714 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 6,988 km, freeways 333 km, main roads 14,564 km, tourists' roads 798 km, forest roads 1,031 km.

T H Russell
Chairman

W S Brake
Deputy Chairman

N L Allanson
Member

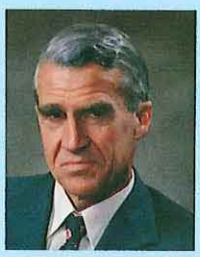
Principal Officers
as at 30th June 1980

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

Deterioration of the road network

Victoria has a highly developed and extensive road system with the highest proportion of sealed roads of any Australian State. This road system is a most significant community asset but one which needs to be protected by an adequate programme of maintenance and reconstruction. However, in recent years a lack of sufficient funds for roads has meant reduced programmes of maintenance and reconstruction, leading to a situation where an undue proportion of the sealed road pavements in Victoria are reaching the end of their economically maintainable lives.

Rural road pavements are designed and built as economically as possible to give approximately 25 to 35 years of life, provided that they are adequately maintained during that period which will primarily involve resealing the pavements as required. At the end of that period, the stage is generally reached where resealing is inadequate to rectify the stresses imposed upon a bituminous surface by traffic and reconstruction is then necessary. Desirably reconstruction should take place before major failures of the road pavement occur. Reconstruction usually involves strengthening a road by the addition of another pavement layer to further extend the life of the road.

To maintain the rural State highways in a satisfactory condition, some 3 to 4% of the total length should be reconstructed each year, but in 1979/80 the Board was only able to allocate funds to enable approximately 1.6% to be reconstructed. In addition, there are more than 2500 timber bridges remaining in the rural areas of Victoria and their replacement is taking place at only half the rate at which they become seriously deficient through normal deterioration.

The graphs opposite show the history of resealing and reconstruction since 1945/46 by showing the proportions of the lengths of sealed declared roads which were treated in each financial year. It is a matter of some concern that the patterns of recent years show some similarities to the early 1950s when it was necessary to double the rate of reconstruction to overcome long lengths of pavement failure occurring during a period of traffic growth and wet seasons.

As illustrated by the graphs, in recent years the rates of resealing and reconstruction have been falling whilst demands on Victoria's road system have been constantly increasing.

Currently, traffic volumes are continuing to increase by about 5% per annum including significant increases in the number and size of heavy commercial vehicles. Certain areas of the State are experiencing increases in the number and type of vehicles due to, amongst other things, the establishment of new industries, grain handling centres and the closure of railway lines.

The Victorian road network provides the primary means of land travel in Victoria and about 28,700,000,000 vehicle kilometres are travelled by intra and interstate motorists annually. Even allowing for a marked increase in petrol prices, it is estimated that vehicle kilometres travelled on the Melbourne metropolitan road network will increase by 40% by the end of the century.

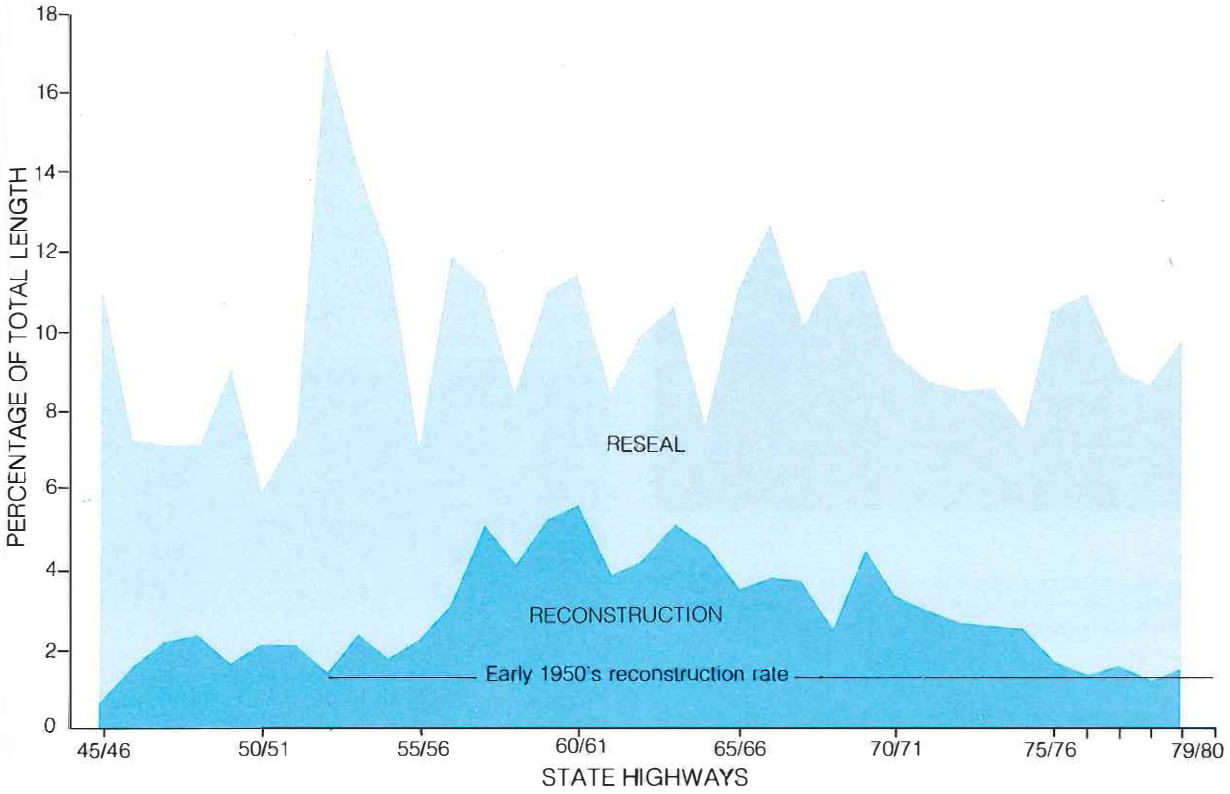
Victoria has the most developed road system in Australia including:

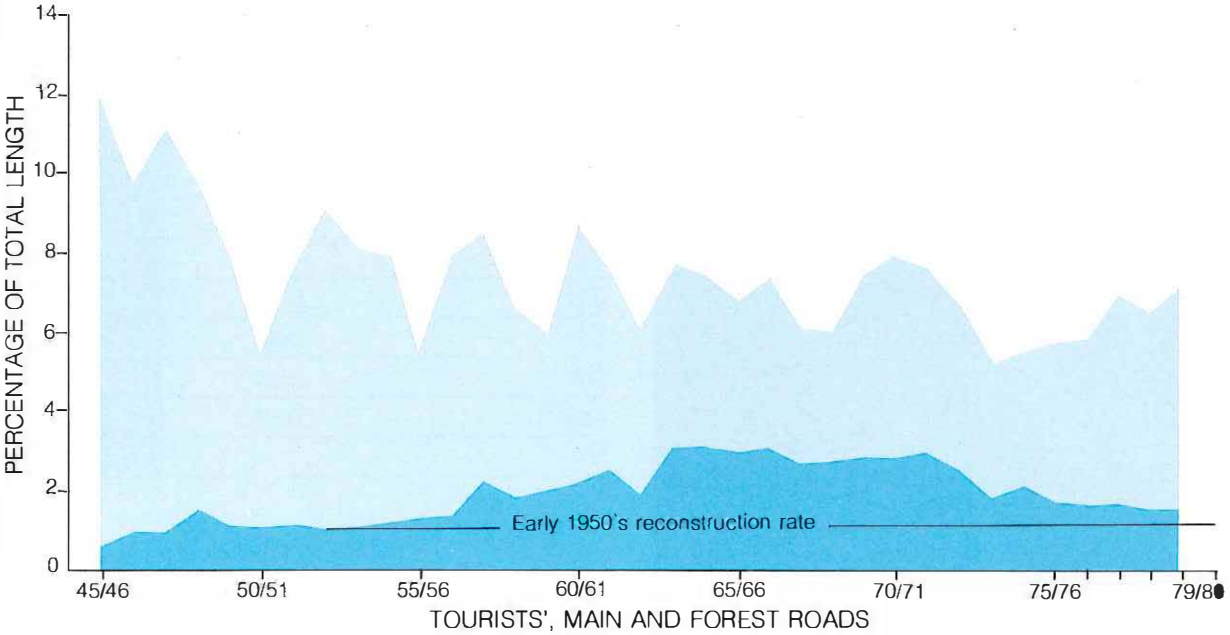
- ☐ the most dense road network with 70 km of road per 100 sq km of area, which is more than double the figure of any other State. Victoria also has 23 persons per kilometre of road, which is a marginally higher figure than that applying in New South Wales, and significantly higher than any of the other States;
- ☐ the highest ratio of registered motor vehicles per kilometre of road — 11.2 motor vehicles per kilometre compared with 10.6 in New South Wales and an average of 8 for all the States;
- ☐ the highest proportion (25%) of urban arterial roads and the highest proportion (35%) of urban travel with peak hour speeds below 25 km/h;
- ☐ the lowest per capita and per vehicle road grant from the Commonwealth in 1979/80. The figures for Victoria are $29 per capita and $59 per vehicle, compared with averages for the six States of $39 per capita and $79 per vehicle.

Between 1970-71 and 1979-80, the Board's annual expenditure on roads has fallen by approximately 20% in real terms based on 1979-80 prices. At the same time there has been an increase of approximately 66% in vehicular travel. Current expectations are that there will be a further 3% decline in expenditure in real terms in 1980/81.

A substantial increase in the real value of total funds available for roads is needed to prevent further deterioration of road conditions.

The only limiting factor on maintenance and improvement of Victoria's road network is finance. There is no shortage of materials, equipment, manpower, environmental approvals or community acceptance which would prevent the implementation of a more adequate programme of works if additional funds were available.





Rate of resealing and reconstruction on State highways, main, tourists' and forest roads

Typical examples of the deterioration in the main road system shown here indicate the need for urgent replacement of a timber bridge and the need for reconstruction of an existing sealed road.

Commonwealth Roads Grants Act 1980

In May 1980, the Honourable R J Hunt MP, Commonwealth Minister for Transport, announced details of the level of Commonwealth roads assistance to the States and the Northern Territory for 1980/81 to be provided under the Commonwealth Roads Grants Act 1980.

Unlike the States Grants (Roads) Act 1977 which provided financial assistance over a three year period, the Roads Grants Act 1980 only provides for the 1980/81 financial year.

The grant to Victoria for 1980/81 is $126,359,000 made up as follows:

National roads — construction and maintenance	$48,469,000
Urban arterial roads — construction	34,040,000
Rural arterial roads — construction	14,182,000
Local roads — construction and maintenance	29,668,000
Total	$126,359,000

Expressed as a percentage of the total Commonwealth road grants (excluding the Northern Territory which was not included in the previous Act), Victoria's grant remains unaltered at 20.8%.

Under the quota requirements of the Act, each State in order to qualify for a Commonwealth grant must expend from its own resources the sum fixed by the Act as its quota.

As a proportion of Commonwealth grants, Victoria's quota is still the highest of any State as indicated below:

State	State dollars for each Commonwealth dollar	
	1979/80	1980/81
NSW	$0.96	$0.95
Vic	1.25	1.24
Qld	0.58	0.59
SA	0.92	0.93
WA	0.66	0.67
Tas	0.57	0.57
NT	—	0.15

The number of road categories provided for in the new Act has been reduced to four, compared with the eight categories in the States Grants (Roads) Act 1977. The categories are now:

- ☐ National roads (which includes national highways and developmental roads)
- ☐ Rural arterial roads
- ☐ Urban arterial roads
- ☐ Local roads

The reduction in the number of categories is welcomed by the Board and will permit the Board to have greater flexibility in the use of funds as well as enabling a reduction in the administrative work associated with the Act.

Under the new Act, Commonwealth funds can be spent on the maintenance of all roads except for the categories of urban arterial and rural arterial roads. Under the previous Commonwealth legislation, Commonwealth funds could only be expended as far as maintenance was concerned on national highways and rural local roads.

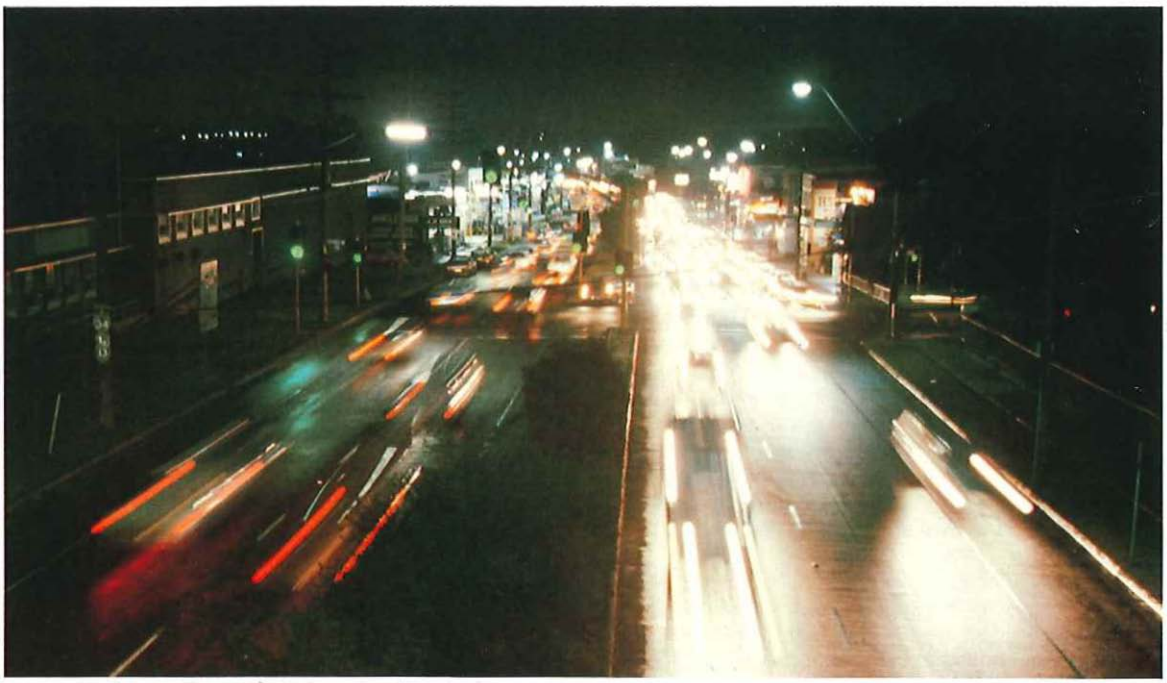
In April 1979, the Commonwealth Bureau of Transport Economics released its interim report "An Assessment of the Australian Road System: 1979 Part 1". One of the conclusions in the interim report was that an increase of some 16% per annum in real terms in roads expenditure in Australia over the estimated expenditure for 1979/80, is warranted on economic grounds.

The grant to Victoria for 1980/81 under the Roads Grants Act 1980 has only been increased by 11.15% over the 1979/80 grant. Taking into consideration the expected increases in both the rate of inflation and the Board's operating costs, the Commonwealth grant for 1980/81 will in real terms result in no increase in expenditure above the 1979/80 Commonwealth funds and therefore will not permit any increased volume of work in the field.

Co-ordinated traffic signal system in Melbourne

During the year the Board continued with the development of the SCRAM traffic signal project (Signal Co-ordination of Regional Areas in Melbourne). The SCRAM project is based on the NSW based traffic signal co-ordination system SCATS (Sydney Co-ordinated Adaptive Traffic System).

The SCRAM project is designed to improve traffic flow along roads by linking traffic signals and connecting them to a regional computer. By monitoring changes in traffic flow the signal phases can be altered through the use of the computer to maintain traffic flow. More economical fuel consumption will result.



Maroondah Highway, Surrey Road Intersection, Blackburn —
SCRAM co-ordinated traffic control signals on Maroondah Highway at Blackburn.

The Board purchased and installed two regional mini-computers at Blackburn and St Kilda as part of the SCRAM traffic signal project, at a cost of $107,000. Work also continued on the progressive connection of the traffic signals at intersections along the Maroondah Highway, the Nepean Highway and the Princes Highway (Dandenong Road) to provide regional linking systems along these urban State highways.

Planning also commenced for the expansion of the SCRAM project to other regions in the metropolitan area. Over the next two financial years it is expected that two additional regional computers will be purchased and installed, in the northwest and southeast areas of Melbourne.

When the four regional computers become operational in 1981/82 the following sections of State highway will have been connected to the system:

- ☐ Maroondah Highway, Mont Albert to Ringwood;
- ☐ Nepean Highway, St Kilda to Moorabbin;
- ☐ Princes Highway East, St Kilda to Oakleigh;
- ☐ Princes Highway West, Footscray to Brooklyn;
- ☐ Western Highway, Footscray to Sunshine.

The Board plans to ultimately extend the regional linking system to include the following further sections of State highway:

- ☐ Burwood Highway, Camberwell to Ferntree Gully;
- ☐ Hume Highway, Coburg to Campbellfield;
- ☐ Nepean Highway, Moorabbin to Mordialloc;
- ☐ Princes Highway East, Oakleigh to Dandenong.

Other major arterial roads will be included in the SCRAM traffic signal project in consultation with local councils.

Declaration of national commerce road

In April, 1980 the Honourable R J Hunt MP, Commonwealth Minister for Transport, declared the Princes Highway East between Dandenong and Traralgon as a national commerce road. The declaration was made pursuant to the Commonwealth States Grants (Roads) Act 1977.

The main effect of the declaration of the Princes Highway East as a national commerce road was to allow the total Commonwealth grant for national commerce roads for 1979/80 to be taken up by the Board.

The possibility of accelerating works on this section of the Princes Highway East over the next three years will largely depend on the level of Commonwealth road grants made available both in total and by road category.

Whilst the grant category of national commerce road is not provided for in the Commonwealth Roads Grants Act 1980, it is expected that the Princes Highway East between Dandenong and Traralgon will be declared by the Commonwealth Minister in the equivalent grant category of developmental road.

Three year programme for municipal allocations

During the year the Board began investigating the introduction of a system of "rolling programmes" for its allocations of funds to municipal councils for works on main roads, forest roads, unclassified roads and Murray River bridges and punts.

The Board's allocations to municipal councils are made generally in accordance with priorities given to road works by councils in their applications for funds. The Board endeavours to maintain a reasonably consistent level of funding to each council but as road needs vary from year to year and from place to place, fluctuations in the level of finance provided do occur.

The level of the Board's allocations to municipal councils represents the greatest amount that can be provided by the Board from all sources of available funds within the context of providing for the overall improvement of the Statewide road network.

To assist councils to plan their future road works programmes the Board has advised councils that a three year rolling programme of allocations based on the estimated level of funds available to the Board from all sources, will be introduced as from the 1981/82 financial year.

Special impact works

During the year the Board allocated $1,959,633 to various municipal councils for special impact works to be carried out during 1979-80.

Funds for special impact works are allocated by the Board based on applications for such funds made by individual councils where the road works come within the following guidelines:

- ☐ improvements to the road network to assist in development projects of major significance to the State or where there has been a marked increase in non local traffic as a result of the impact of government or tourist policies;
- ☐ improvement and/or rehabilitation of the road network necessary to compensate for increased heavy traffic resulting from rail line closures, reduced train services or the development of regional freight centres by the Victorian Railways Board.

Opening ceremonies

The Honourable Robert Maclellan, MLA, Minister of Transport officiated at the opening of five new sections of freeway during the year.

Mulgrave Freeway

The section of the Mulgrave Freeway between Forster Road, Mount Waverley and Huntingdale Road, Oakleigh, was opened to traffic on Wednesday, 12th December, 1979.

This 2.1 km section of the freeway provides three lanes for traffic in each direction plus emergency stopping lanes.

The project included the construction of bridges to overpass the freeway at Stephensons Road, Stanley Avenue and Huntingdale Road and cost approximately $8.7 million. The Mulgrave and South Gippsland Freeways now provide 23 km of continuous freeway conditions between Huntingdale Road, Chadstone, and the South Gippsland Highway, Hampton Park.

Work on the extension of the Mulgrave Freeway to Warrigal Road, Chadstone, progressed satisfactorily during the year and is expected to be completed in mid 1981.

Tullamarine Freeway

The section of the Tullamarine Freeway adjacent to the western boundary ot the Essendon Airport was opened to traffic on Tuesday, 18th December, 1979.

The 1.6 km project involved the upgrading of Lancefield Road at this location to freeway standard.

The last remaining sets of traffic signals on the freeway between Flemington Road, Parkville and Melbourne Airport were removed in conjunction with the opening ot the new section ot treeway.

The project involved the depression of the freeway carriageways and the construction of a two span reinforced concrete bridge carrying English Street over the freeway.

Pedestrian overpasses were constructed at Vaughan Street and Bristol Street and the level of the freeway required the construction of a 700 metre reinforced concrete retaining wall on the west side.

Access to Airport West and the Essendon Airport has been greatly improved by the provision of a tull diamond interchange at English Street, providing on and off ramps tor both northbound and southbound traffic.

The cost of this new section of the Tullamarine Freeway was approximately $7.8 million.

Hume Freeway

A further section of the Hume Freeway between Avenel and Tubbs Hill, near Longwood was opened to traffic on Wednesday, 19th December, 1979.

The new section of 14.5 km involved the construction of a new duplicate carriageway for northbound traffic, with the existing highway carriageway being used by southbound traffic. A single span reinforced concrete bridge was built over Burnt Creek.

The cost of the new section of the Hume Freeway, including the construction of local roads for access restoration, was approximately $6.5 million.

Mornington Peninsula Freeway

The section of the Mornington Peninsula Freeway between Springvale Road, Keysborough and Eel Race Drain, Seaford, was opened to traffic on Tuesday, 18th March, 1980.

The new 6.7 km section of freeway linking Springvale Road and the existing Frankston Freeway provides two lanes plus emergency stopping lanes for traffic in each direction.

Dual nine span reinforced concrete bridges each 192 metres long carry the new freeway over the Patterson River and bridges were also constructed at Chelsea Road and Thompson Road.

The cost of the new section of the Mornington Peninsula Freeway was approximately $14 million.

With the completion of this section of freeway, divided road or freeway conditions are now provided over a total distance of 44 km from Nunawading to a point south of Frankston.

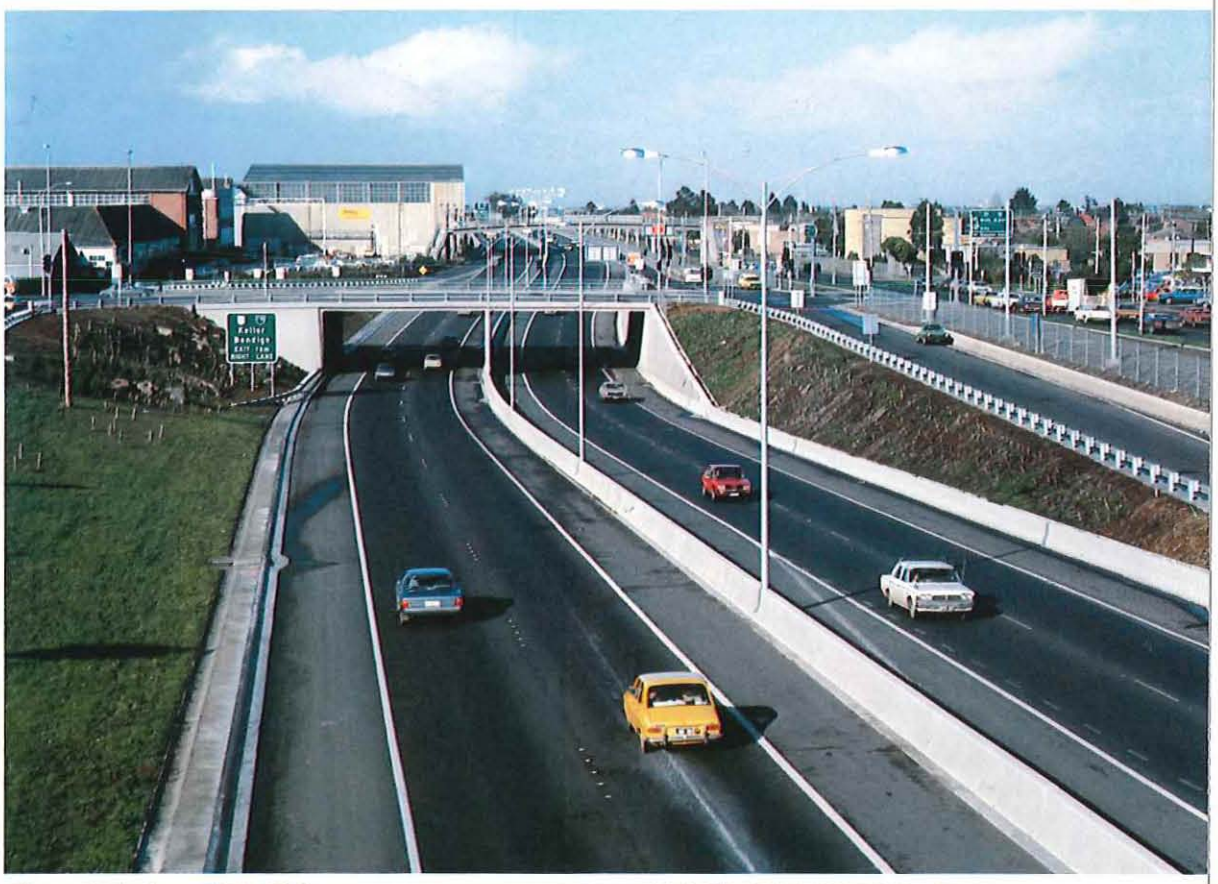
Hume Freeway

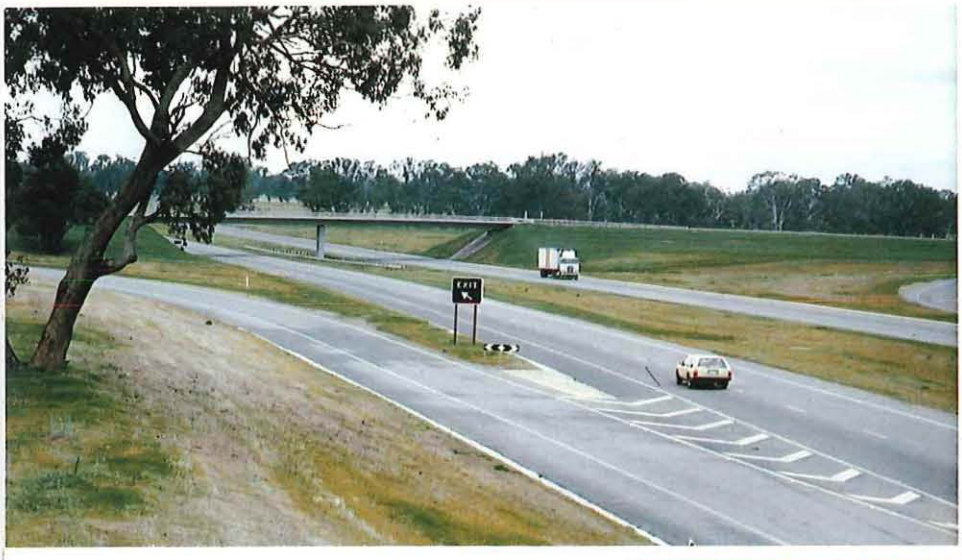
On Friday, 21st March, 1980 a further section of the Hume Freeway, between Wilbrahams Road, south of Violet Town and One Mile Creek, north of Violet Town, was opened to traffic.

The 12 km section of the Hume Freeway bypasses Violet Town and connects with the nine kilometre section of freeway from north of Violet Town to Baddaginnie, which was opened to traffic in October, 1978.

A full diamond interchange including a two span bridge was constructed at Harrys Creek Road and provides access to Violet Town. Three kilometres of minor roads were also constructed to provide access for local traffic.

More than 6000 trees indigenous to the area will have been planted on this section of freeway before the spring of 1980. This new section of the Hume Freeway costs approximately $11 million.


Keller
Bendigo



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Sections of freeway opened during the year:

1. Tullamarine Freeway, Essendon — English Street interchange.
2. Hume Freeway, Avenel to Tubbs Hill — the first vehicle on the new section.
3. Hume Freeway, Violet Town section.
4. Mulgrave Freeway, between Forster Road and Hunlingdale Road, Oakleigh — view towards Forster Road.
5. Mornington Peninsula Freeway, Springvale Road to Eel Race Drain — The Honourable Robert Maclellan, MLA, the Minister of Transport, opened the freeway in a vintage Austin Seven to symbolise the changes in travelling conditions between Melbourne and the Mornington Peninsula.

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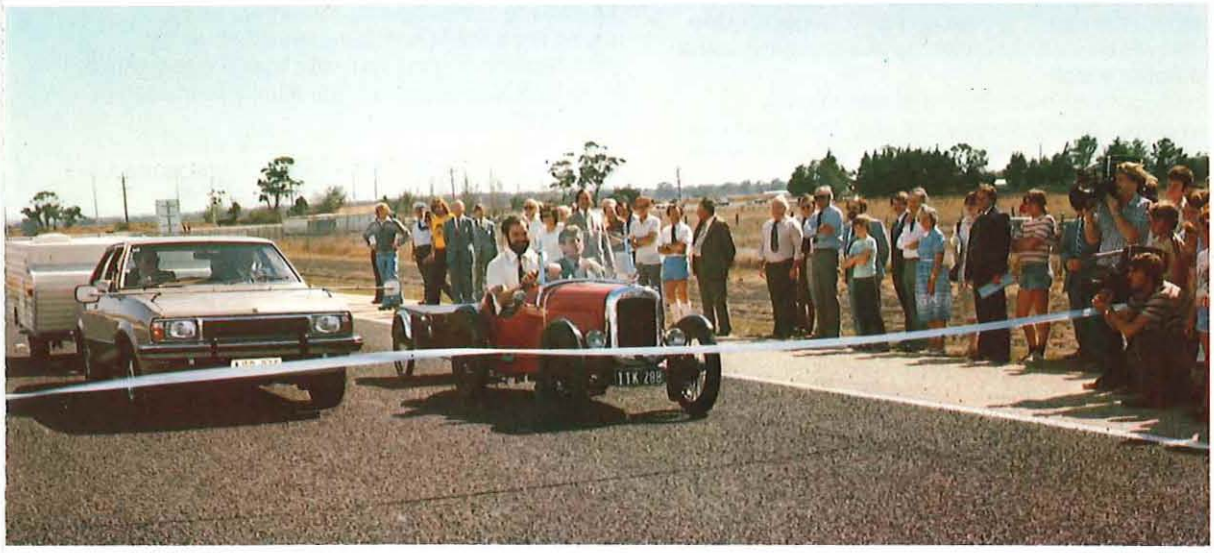


The road system

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 6,988 km, as at 30th June, 1980.

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

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.

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

State highways declared as at 30.6.80

Name	Route	Length (kilometres)
Bass	Lang Lang-Inverloch	60.6
Bellarine	Geelong-Queenscliff	31.6
Bonang	Orbost-NSW border near Delegate	114.2
Borung	Dimboola-Charlton	123.3
Burwood	Burwood-Ferntree Gully	20.4
Calder*	Melbourne-Mildura	554.6
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	181.5
Kiewa Valley	Bandiana-Mt Beauty	78.5
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	493.3
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 30.6.80

Name	Section	Length (kilometres)
Calder	Keilor	2.8
	Elphinstone	2.8
Eastern	Hoddle Street to Bulleen Road	9.0
Frankston	Armstrong Road to Beach Street	5.7
Hume	Craigieburn to Kalkallo	8.3
	Beveridge to Tallarook	52.1
	Avenel-Tubbs Hill	8.3
	Violet Town-Baddaginnie	20.8
	Chiltern	21.3
Midland	Yinnar	9.6
Mornington Peninsula	Springvale Road to Armstrongs Road	8.0
	Dromana to Rosebud	8.4
Princes	Mulgrave	17.9
	Moe and Haunted Hills	17.2
	Orbost	5.3
	Laverton to Lara	47.4
	Dartmoor	3.0
South Eastern	Anderson Street to Tooronga Road	6.8
South Gippsland	Princes Freeway to Pound Road	5.6
	Whitelaw	3.8
Tullamarine	Flemington Bridge to Melbourne Airport	20.9
West Gate	Bertie Street to Graham Street	.3
	Williamstown Road to Princes F'way	5.1
Western	Deer Park to Melton	13.3
	Bacchus Marsh to Gordon	41.9

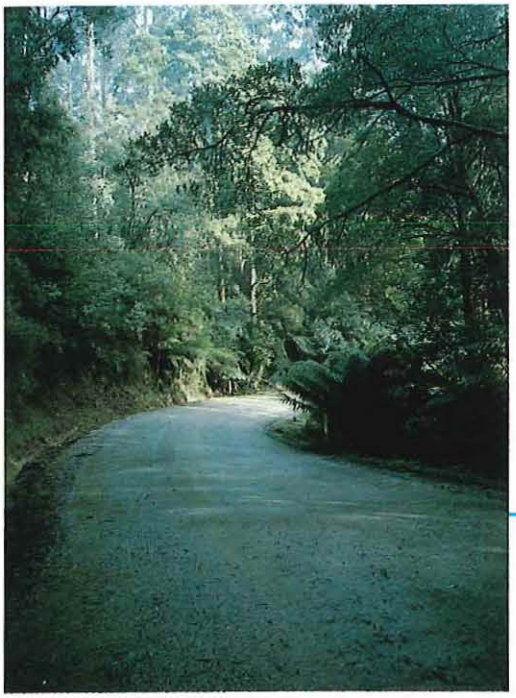
Tourists' roads — declared as at 30.6.80

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	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
Wilsons Promontory	South Gippsland Shire	31.0

Forest roads — declared as at 30.6.80

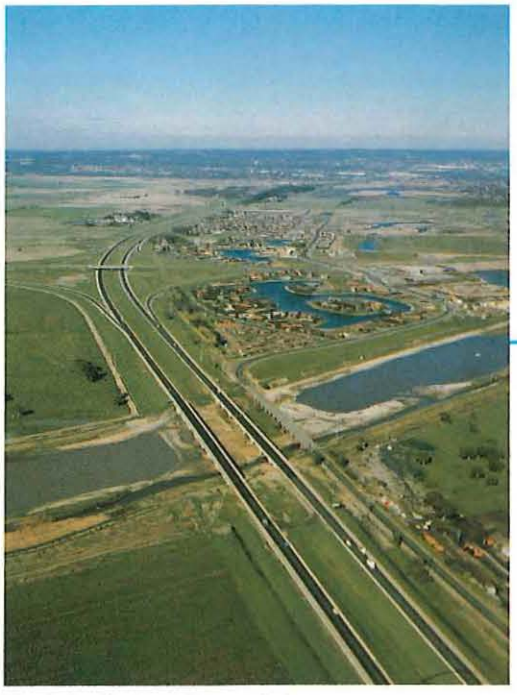
Name	Municipalities	Length (kilometres)
Bairnsdale-Dargo	Avon and Bairnsdale Shires	20.8
Bealiba-Moliagul	Bet Bet Shire	9.0
Beech Forest-Mt. Sabine	Otway Shire	12.6
Benambra-Corryong	Omeo, Tallangatta and Upper Murray Shires	76.5
Benambra-Limestone	Omeo Shire	14.3
Bendoc-Orbost	Orbost Shire	20.9
Brookville	Omeo Shire	15.9
Bruthen-Buchan	Tambo Shire	36.5
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
Timbarra	Tambo Shire	19.5
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

The total length of roads declared or proclaimed in Victoria under the Country Roads Act was 23,714 km as at 30th June, 1980.



Beech Forest — Mt Sabine Road, Otway Shire.

Forest roads 1,031 km



Mornington Peninsula Freeway looking south towards Frankston.

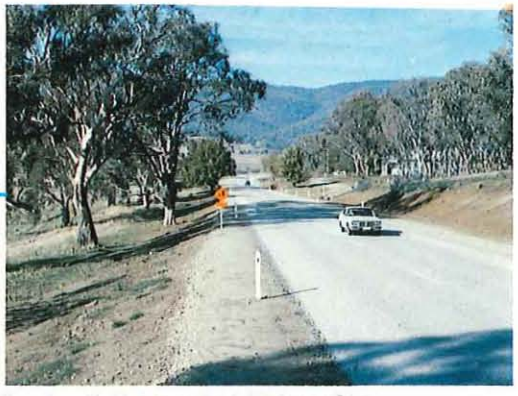
Freeways 333 km

Alpine Road, snow clearing on Mount Hotham, Bright Shire.

Tourists' roads 798 km

Henty Highway near Sunday Creek, Portland Shire.

State highways 6,988 km



Beechworth-Wodonga Road, Wodonga City.

Main roads 14,564 km

Total length of declared road system 23,714 km

Road construction and maintenance

Major projects

During the year the Board carried out work on many major projects throughout the State including work on the construction of divided roads which as a result of work completed increased the total length of dual carriageways on freeways, State highways, and main roads throughout the State to 796 km.
In addition work continued on many projects including 10 major projects each having an estimated cost of at least $4 million.
The more important major projects in progress or completed during the year included:

URBAN

Arterial Road Extension of the Eastern Freeway

Work continued during the year on the 2.7 km arterial road extension of the Eastern Freeway from Bulleen Road to Doncaster Road.
Work in progress along the alignment of the arterial road extension included drainage, temporary diversions of the existing Koonung Creek, the forming of sound attenuation mounding and the preparation of the subgrade for the roadway formation.
At the end of the year, work associated with the road widening and channelisation at the Doncaster Road terminal was well advanced and works east of the Koonung Creek and in High Street were nearing completion
The total estimated cost of the arterial road extension including the Doncaster Road intersection work and the undergrounding of Koonung Creek is $18.7 million at 1980 prices.
Subject to the availability of funds, roadworks are expected to be completed during 1982 and the undergrounding of the creek in 1983.

West Gate Freeway

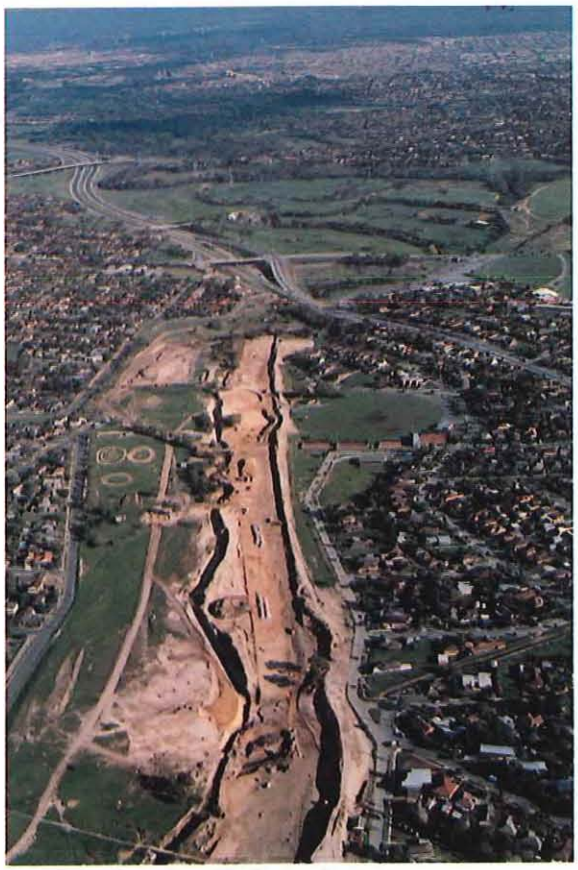
Work continued on the 3.6 km West Gate Freeway between Graham Street, Port Melbourne and Grant Street, South Melbourne, including the construction of 264 foundation piles for part of the 1.85 km elevated section of the freeway.
The project is estimated to cost $96 million at 1980 prices and on the basis of present estimates of funds likely to be available for this project it is estimated that the northern carriageway for eastbound traffic will be completed in the 1983/84 financial year and the whole of the freeway project will be completed during the 1984/85 financial year.

Latrobe Terrace

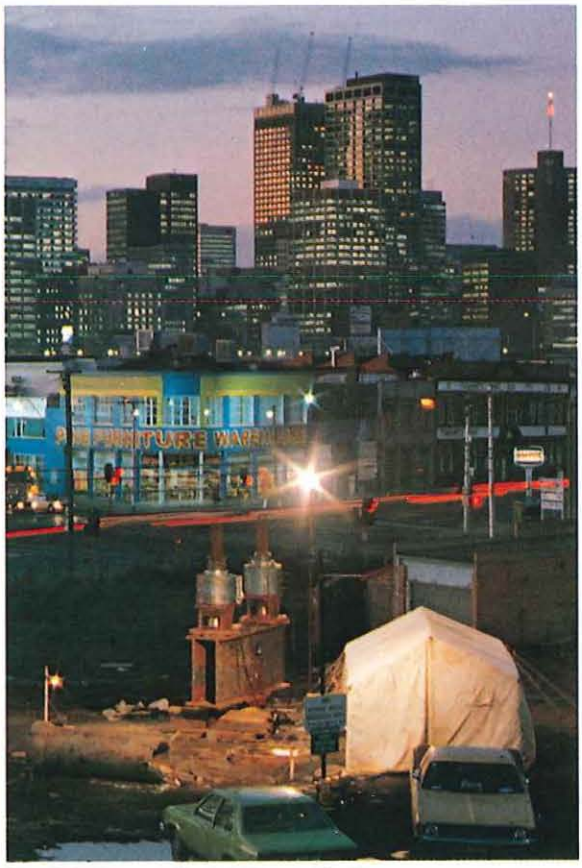
Work continued on the reconstruction of Latrobe Terrace in Geelong to provide a high capacity arterial road from the Princes Highway West, near York Street, to Fyans Street, Geelong South, a distance of 2.4 km.
The 0.6 km section between Hope Street and Skene Street was completed early in 1980 and a further 0.6 km section between Skene Street and Kilgour Street is expected to be completed by December, 1980.
As part of the first stage of the Latrobe Terrace project, work proceeded on the construction of a 269 metre long road over rail overpass from the Princes Highway West, near York Street, to Hope Street.
Construction of a reinforced earth retaining wall as part of the approaches to the overpass was completed during the year.
A 4 span reinforced concrete pedestrian overpass, 118 m long and 2.1 m wide, was completed during the year to restore pedestrian access over the railway line.
The Latrobe Terrace project from the Princes Highway West to Fyans Street, Geelong South, is estimated to cost $10.25 million at 1980 prices and is expected to be completed in 1982.
In April 1980 the Board announced details of its favoured proposal for a new crossing over the Barwon River and the Princes Highway at Geelong, to connect Latrobe Terrace and Settlement Road. Details of this proposal are contained on Page 32 of this report.

Nepean Highway

The widening of the Nepean Highway between Cochrane Street, Elsternwick and South Road, Moorabbin continued during the year.
The project involves the construction of new duplicate carriageways along the west side of the existing highway over a distance of 6 km. The existing highway carriageway will be converted into a service road.
A 1.2 km section of the project between Spink Street, Gardenvale and Bay Street, North Brighton, was opened to traffic in June, 1980.
A new central pier of the Gardenvale Railway bridge was completed early in 1980 and the bridge is expected to be completed in early 1981.
The estimated cost of the project is $38 million at 1980 prices and upon completion of the widening in 1984, divided highway facilities will be continuous from St Kilda Junction to Mordialloc.

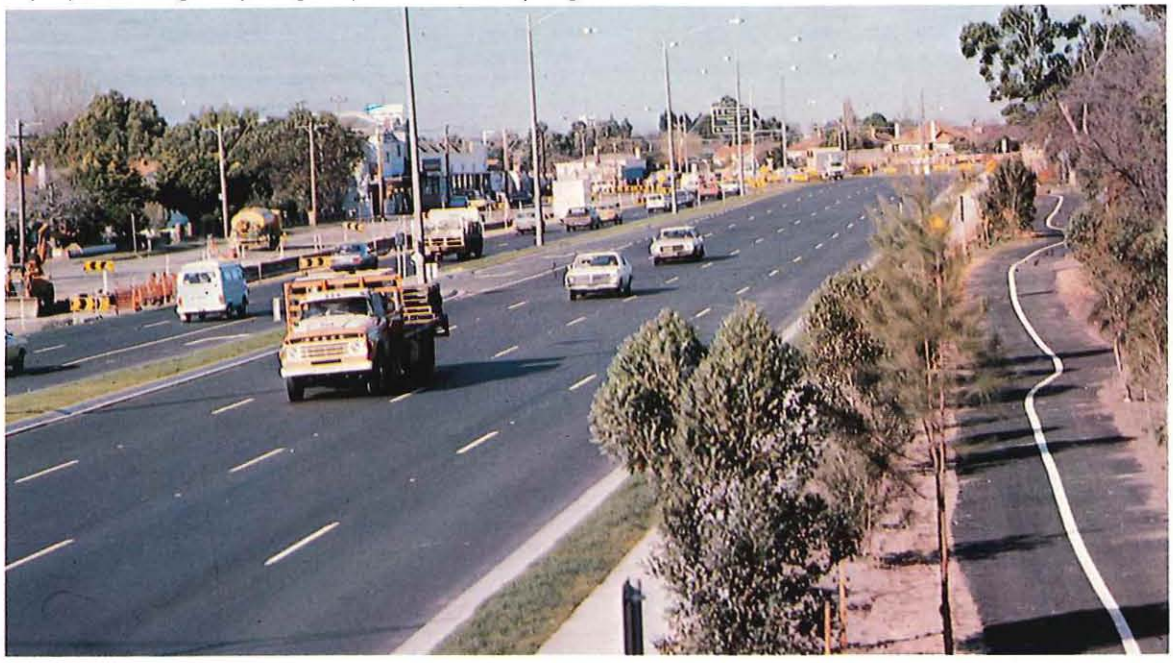


Arterial Road Extension of the Eastern Freeway — looking west towards the Eastern Freeway.



West Gate Freeway, South Melbourne Section — load testing freeway foundations.

Nepean Highway, East Brighton — newly opened section of divided highway including a bicycle path threading its way through the plantation reserve adjoining the new road.



Calder Freeway
Work continued during the year on the Calder Freeway, Keilor Section, from Erebus Street, Keilor East, to the Keilor-Melton Road, a distance of 5 km.
During the year earthworks were substantially completed between Cemetery Road and the Maribyrnong River, and work was commenced on the construction of the twin freeway bridges over the Maribyrnong River.
The first section of the freeway between Erebus Street and Arundel Road is expected to be opened by late 1981.
The estimated cost of the project is $22.2 million at 1980 prices and completion is expected in 1984.

Mulgrave Freeway
Work continued on the construction of the 1.6 km extension of the Mulgrave Freeway from Huntingdale Road to Warrigal Road, Chadstone.
During the year work progressed on the construction of the freeway carriageways, a bridge at Atkinson Street, and a 60 metre long culvert for Scotchmans Creek at the Warrigal Road exit ramp. A pedestrian overpass spanning the freeway at Jacana Street was completed in April 1980.
This section of the freeway is estimated to cost $7.1 million at 1980 prices and is expected to be completed early in 1981.

RURAL

Western Freeway
Wallace-Bungaree Section
Work continued on the construction of the freeway section bypassing the townships of Wallace and Bungaree, a length of 11.9 kilometres.
The Ormond Road overpass was completed early in 1980 and a 1.2 km section of the Ballarat bound carriageway between the Moorabool West interchange and Spargo Creek Road was opened to traffic in June, 1980.
The project is estimated to cost $20 million at 1980 prices and is expected to be completed in 1983.

Princes Freeway
Drouin Section
Work continued during the year on the 7 km bypass of Drouin, between Robin Hood and the interchange with the Princes Highway, east of Drouin.
The project is estimated to cost $11 million at 1980 prices and is expected to be completed early in 1981.

Bypass of Berwick
Preliminary work began on the Princes Freeway bypass of Berwick in early 1980.
An access track was constructed along the freeway alignment at the rear of Casey Airfield to permit the construction of major culverts on Berwick Town Drain and Casey Airfield Drain.
Work commenced on the construction of a major service culvert to take a 1400 mm State Rivers and Water Supply Commission pipeline under the freeway.
The project is estimated to cost $14 million at 1980 prices and is scheduled for completion in 1983.

Hume Freeway
Avenel and Seymour Sections
Work continued on the construction of the Hume Freeway bypasses of Seymour and Avenel, the total length of these new freeway sections being 27 kilometres.
Earthworks and drainage work on the 20 km bypass of Avenel were substantially completed and the pavement construction of dual freeway carriageways between the Goulburn River and north of Avenel was well advanced.
Construction of twin freeway bridges, spanning the north east railway and existing Hume Highway, was completed during the year.
Major earthworks and drainage work began on the bypass of Seymour during the year.
This project is estimated to cost $43 million at 1980 prices and the Avenel and Seymour Sections are expected to be completed in 1981 and 1983 respectively.
As mentioned in more detail on page 9 the following five new sections of freeway were opened during the year by the Honourable Robert Maclellan, MLA, Minister of Transport.

Hume Freeway
- ☐ A 14.5 km section between Avenel and Tubbs Hill, near Longwood.
- ☐ A 12 km section between Wilbrahams Road, south of Violet Town, and One Mile Creek, north of Violet Town.

Mornington Peninsula Freeway
- ☐ A 6.7 km section between Eel Race Drain, Seaford and Springvale Road, Keysborough.

Mulgrave Freeway
- ☐ A 2.1 km section between Forster Road, Mount Waverley, and Huntingdale Road, Oakleigh.

Tullamarine Freeway
- ☐ A 1.6 km section adjacent to Essendon Airport.

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 in financial year 1978-79 are shown in the following table:

	1978-79		1979-80	
Type of contract	No. of contracts	Value $	No. of contracts	Value $
Road construction —				
1. Over $1M	1	1,437,524	2	4,231,893
2. $100,000 to $1M	4	1,084,935	4	2,081,438
3. Under $100,000	4	268,005	4	176,858
Supply of roadmaking materials	121	6,089,928	176	13,821,787
Bituminous treatment and supply of materials	78	15,675,050	79	15,965,001
Bridge construction —				
1. Over $1M	1	3,212,598	2	6,838,763
2. $100,000 to $1M	4	963,780	7	2,095,355
3. Under $100,000	5	270,166	5	181,472
Components and fabricated steel	17	1,254,088	22	1,479,365
Building construction	2	145,302	2	89,700
Construction equipment	27	1,645,696	40	4,270,379
Divisional facilities	1	52,682	1	278,150
Miscellaneous stores	1	37,030	7	8,070,487
Miscellaneous services	44	1,258,899	51	2,857,354
Total	315	33,400,683	402	62,438,002

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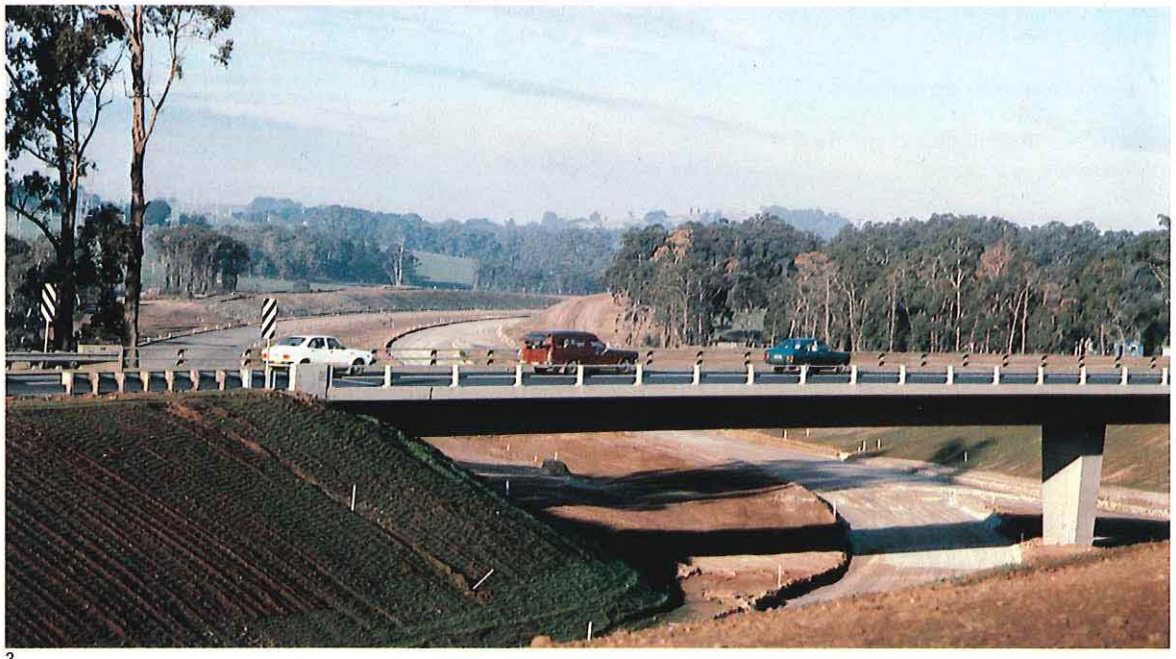

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1. Mulgrave Freeway, Chadstone — construction of the Scotchmans Creek culvert.
2. Princes Freeway, Drouin Section — new bridge carrying the existing Princes Highway over the freeway near Robin Hood.
3. Hume Freeway, near Seymour — major earthworks on the bypass of Seymour.

4. Great Ocean Road, Otway Shire — construction of a new bridge at Skenes Creek.

5. Calder Freeway, Keilor — construction of piers for the freeway bridges over the Maribyrnong River.

6. Goulburn Valley Highway — reconstruction south of Seymour.

7. Princes Highway East — resealing near the Wingan River.

4

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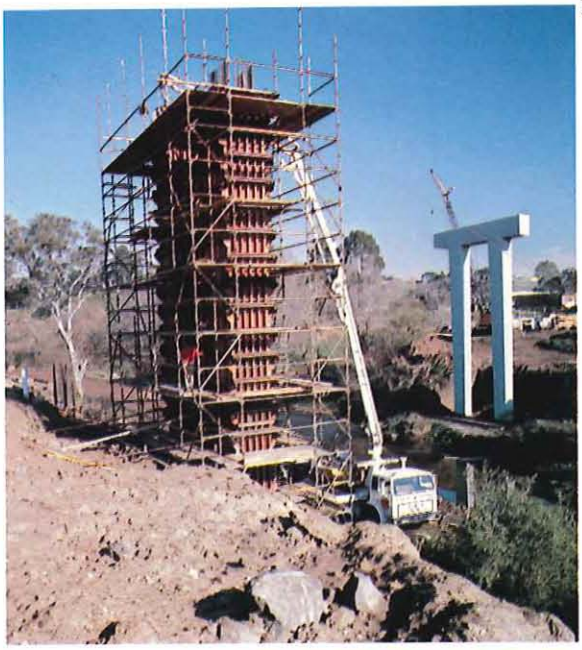

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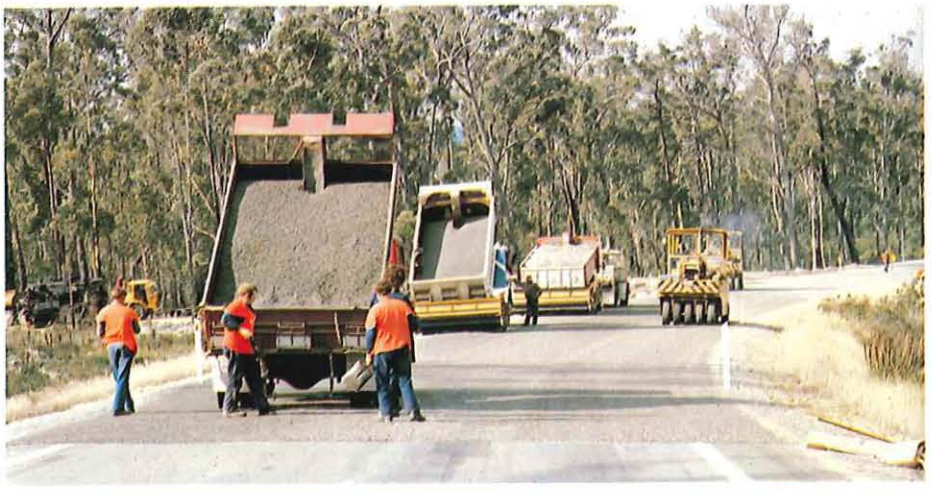


7

State highways and freeways

Significant works completed or substantially completed during the financial year 1979-80.

Burwood Highway

Nunawading City
Widening 3 km at Vermont South.

Calder Highway

Gisborne Shire
Construction of a climbing lane north of Gisborne.
Widening 3 km south of Woodend.
Construction of climbing lanes at three locations south of Kyneton.

Korong Shire
Reconstruction of 2.3 km north of Inglewood.

Maldon and Marong Shires
Reconstruction of 2 km south of Ravenswood.

Marong Shire
Widening 1.2 km between Station Street and Alder Street, Kangaroo Flat.

Metcalfe Shire
Widening 3.1 km south of Faraday.

Wycheproof Shire
Widening and resurfacing of 3.1 km north of Wycheproof.

Goulburn Valley Highway

Seymour Shire
Reconstruction of 2.6 km south of Seymour.

Shepparton Shire
Reconstruction of the Katandra Road intersection north of Shepparton.

Hamilton Highway

Bannockburn Shire
Reconstruction of 2.1 km near Inverleigh.

Warrnambool Shire
Widening and resheeting 1 km at Caramut.

Henty Highway

Hamilton City
Duplication of 2.3 km between Mt Baimbridge Road and Rowes Corner in Hamilton City.

Portland Shire
Reconstruction and realignment of 1.3 km at Sunday Creek.
Reconstruction and realignment of 7.4 km at Branxholme.

Hume Highway

Kilmore Shire
Resurfacing 3 km near Beveridge.

Kiewa Valley Highway

Yackandandah Shire
Reconstruction of 2.6 km at Running Creek.

Mcivor Highway

Bendigo City
Installation of traffic roundabout at Chapel Street/Myers Street intersection.

Midland Highway

Benalla Shire
Reconstruction and widening of 3.1 km north of Swanpool.

Huntly Shire
Reconstruction of 2 km between Bagshot and Goornong.

Metcalfe Shire
Reconstruction of 2.3 km between Castlemaine and Harcourt.

Shepparton City
Reconstruction between Welsford and Wyndham Streets.

Murray Valley Highway

Cohuna Shire
Reconstruction of 0.7 km including intersection improvement at the junction of Cohuna-Koondrook Road.
Widening and strengthening Barr Creek bridge.

Kerang Shire
Widening and resurfacing 2.3 km north of Wandella Creek.

Rutherglen Town
Reconstruction of 1 km in Rutherglen.

Nepean Highway

Flinders Shire
Duplication of 2 km at Dromana.

Northern Highway

Pyalong Shire
Reconstruction of 3 km including the construction of a climbing lane north of Pyalong.

Waranga Shire
Intersection improvements at the junction with the Midland Highway.

Omeo Highway
Baimsdale Shire
Reconstruction of 3.6 km near Sandhill.

Ouyen Highway
Walpeup Shire
Widening 9.2 km east of Walpeup.
Widening 9.1 km east of Boinka.
Widening 2.5 km at Cowangie.

Ovens Highway
Wangaratta Shire
Widening 1.7 km between Tarrawingee and Everton.

Princes Freeway East
Moe City
Construction of 3.6 km between Watsons Road and Gunns Gully.

Princes Freeway West
Corio Shire
Resurfacing 13.6 km at Lara.

Princes Highway East
Baimsdale Shire
Reconstruction of 0.9 km east of Baimsdale.
Moe City
Intersection improvements at George Street, Moe.
Morwell City
Intersection improvements at Alexanders Road, Morwell.
Narracan Shire
Resurfacing 3.7 km at Trafalgar.
Orbost Shire
Construction of 4 km between Rankins and Wingan River.
Reconstruction of 1.1 km east of McKenzie River.
Reconstruction of 0.7 km west of Bluenose Creek.
Widening 2.4 km west of Jones Creek Track.

Princes Highway West
Corio Shire
Resurfacing 2.3 km between Plantation Road and Cox Road.
Heytesbury Shire
Reconstruction and realignment of 3.4 km east of Terang.
Portland Shire
Widening and resheeting 4.2 km west of Lyons.
Warrnambool Shire
Reconstruction and realignment of 4.1 km east of Cudgee.
Werribee Shire
Resurfacing 1 km near Hoppers Crossing.

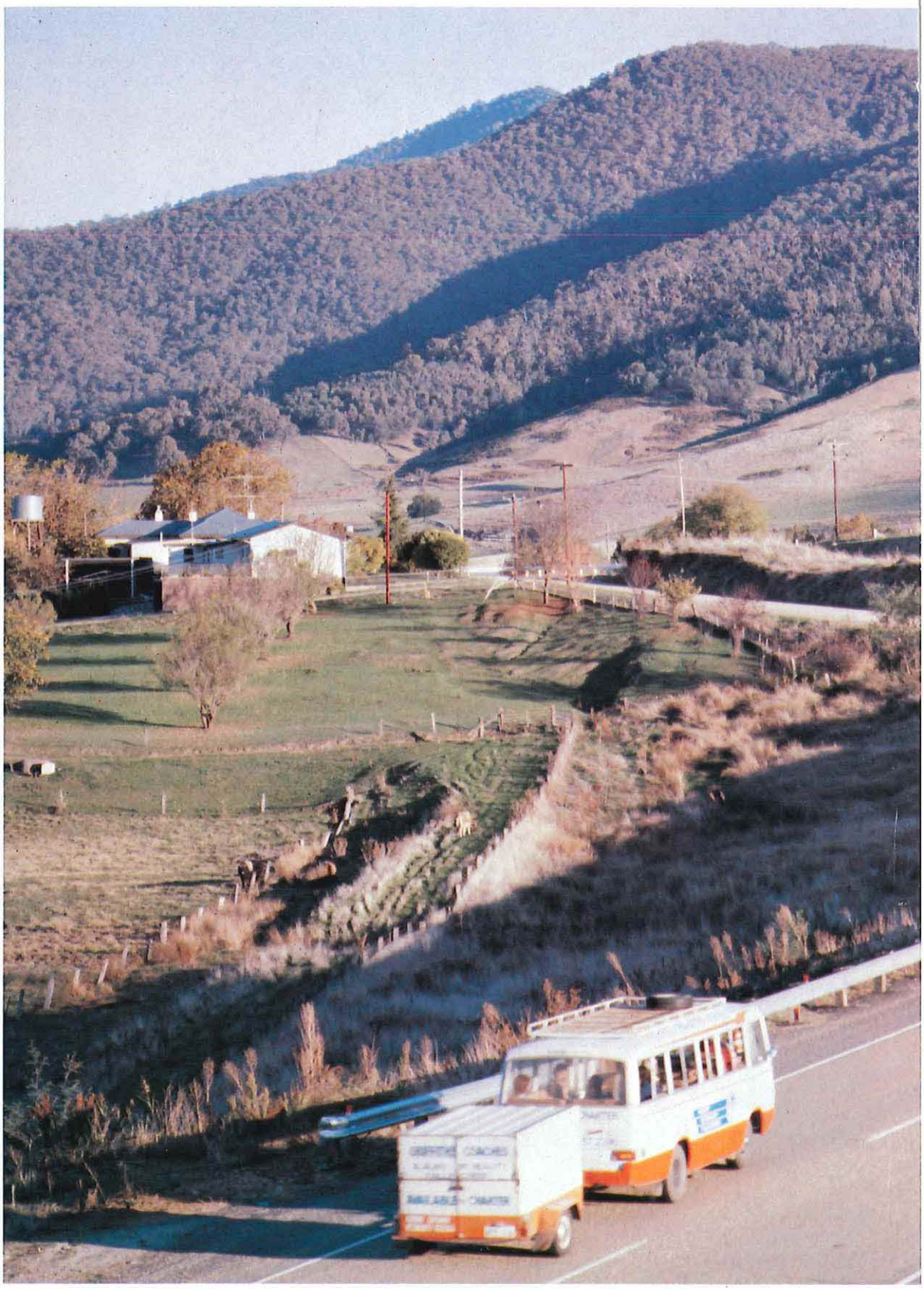
Pyrenees Highway
Avoca Shire
Widening 2.3 km west of Avoca.
Tullaroop Shire
Reconstruction of 2.9 km east of Carisbrook.

South Gippsland Highway
Cranbourne Shire
Widening of 2 km south of Sladen Street.
Korumburra Shire
Construction of a climbing lane east of Loch.
Widening 1 km west of Bena township.
Sale City
Reconstruction including part duplication in York Street South, Sale.

Sunraysia Highway
Ballarat Shire
Widening 5.6 km south of Learmonth and 5.2 km north of Learmonth.
Construction and realignment of 4 km between Bet Bet Creek and Lamplough.
Kara Kara Shire
Reconstruction of 7 km between St Arnaud and Cope Cope.

Tullamarine Freeway
Brunswick and Essendon Cities
Construction of an emergency shoulder on the north bound carriageway between Brunswick Road and Moreland Road.

Western Highway
Ballaarat City
Resurfacing 3.7 km between Grenville and Gillies Streets.
Dimboola/Wimmera Shires
Reconstruction of 8.45 km between Wail and Dimboola.
Stawell Shire
Reconstruction of 5.8 km between Ararat and Armstrong.



Kiewa Valley Highway at Running Creek — reconstructed section of highway.

Tourists' roads

Significant works completed or substantially completed during the financial year 1979-80.

Alpine Road

Bright Shire

Reconstruction of 3.2 km south of the "Meg"

Bogong High Plains Road

Bright Shire

Widening 2.5 km near Turnback Creek.

Great Ocean Road

Otway Shire

Realignment and reconstruction of 5 km between Lighthouse Road and Calder River.

Construction of 3 span bridge over Skenes Creek.

Mallacoota Road

Shire of Orbost

Construction of 1.4 km near Halls Creek.

Marysville-Woods Point Road

Healesville Shire

Reconstruction and realignment of 2.4 km.

Forest roads

Significant works completed or substantially completed during the financial year 1979-80.

Healesville and Upper Yarra Shires

Warburton-Woods Point Road

Resurfacing 32 km between Fehrings Clearing and Matlock.

Narracan Shire

Sunny Creek Road

Reinstatement of flood damaged roadway 4.9 km south of Princes Highway.

Walhalla Road

Construction of a single span bridge over Stringers Creek.

Reinstatement of 2 km of roadway and stream banks through Walhalla township.

Repair of major slips on 2.9 km of road between Thompson River and Walhalla township.

Otway Shire

Forest-Apollo Bay Road

Repairs to a roadway slip at Barramunga.

Tambo Shire

Bruthen-Buchan Road

Reconstruction of 2.5 km near Ti Tree Creek.

Bituminous surfacing

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

An amount of $39.2 million was spent in surfacing 5,027 km of road during the financial year.

The price of bituminous materials increased markedly during the year. The cost to the Board in purchasing bitumen increased from $142 per tonne at 1st July 1979 to $220 per tonne at 30th June, 1980. The increases in bitumen are estimated to have added $2.5 million to the cost of roadworks.

Approximately 95.7% of the total length of bituminous surfacing done was of the sprayed seal type. 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. In spite of increases in the cost of bituminous materials it remains an economical surfacing process which provides a safe, skid resistant surface.

The Board's 18 mobile bituminous surfacing units together with plant owned by municipal councils and contractors, completed 4,823 km of sprayed work at a cost of $26.5 million.

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

Contractors operating from fixed asphalt plants completed 204 km of plant mix work at a cost of approximately $12.7 million using 364,000 tonnes of asphalt.

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

243 km of sealing widened pavements;

33 km of initial sealing on dual carriageways;

618 km of restoration of seal coats on reconstructed sections;

450 km of final sealing on initial treatments;

2,860 km of maintenance retreatments;

506 km of extensions to the bituminous sealed road system including 75 km of roads declared or proclaimed under the Country Roads Act;

317 km sealed on behalf of other State and municipal authorities.

The following quantities of material were used by the Board and by contractors during the year on bituminous surfacing work:

Material	Quantity	
Bitumen for sprayed work	37,700	tonnes
Bitumen for asphalt	19,000	tonnes
Aggregate for sprayed work	309,000	cubic metres
Aggregate for asphalt	248,000	cubic metres
Other bituminous materials for sprayed work and maintenance	9,000	tonnes

Land purchase

During the year the Board paid compensation and associated costs totalling $17,454,000 for land required for the construction of new roads and the widening or deviation of existing roads.
The expenditure incurred included $2,484,000 for land required for the widening of 6 km of the Nepean Highway between Cochrane Street, Elsternwick and South Road, Moorabbin and $3,840,000 for the purchase at the owners' request, and on hardship grounds of 60 properties affected by the proposed South Eastern Freeway, Malvern Section.
The following table shows expenditure on land purchase in relation to the Board's road classifications and the Commonwealth road categories on which the expenditure was incurred.

	Commonwealth road category						
CRB road classification	National highways	Urban arterial roads	Urban local roads	Rural arterial roads	Rural local roads	National commerce roads	Total
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
Freeways	935	9,534		155		869	11,493
State highways	78	2,935		270		15	3,298
Tourists' roads				1	2		3
Forest roads				2	2		4
Main roads		1,219		213	109		1,541
Unclassified roads		694	223	7	179	12	1,115
Totals	1,013	14,382	223	648	292	896	17,454

The table below shows the number of land purchase transactions completed and the amount of compensation and associated costs paid by the Board for the period 1975/76 to 1979/80.

	1975/76	1976/77	1977/78	1978/79	1979/80
Number of land purchase cases settled	661	671	786	629	558
Compensation and associated costs paid by the Board	$16.02m	$20.97m	$22.53m	$22.95m	$17.45m
Land purchase expenditure on unclassified roads under council supervision	$0.73m	$0.74m	$1.26m	$1.70m	$0.84m

Of the $17.45 million expended on compensation and associated costs during the year, $9.05 million was spent in purchasing properties at the request of owners who demonstrated that they were incurring hardship due to the Board's future road proposals.

The Board received $2,165,982 from 887 rented residential or commercial properties and 129 separate areas of vacant land. During the year 38 separate areas of surplus land were sold for $470,026. Twelve residential properties surplus to requirements were sold for $507,200 and 18 houses were sold for removal for $33,510.

Bridges

Construction of new bridges

One hundred and nineteen new bridges estimated to cost $30.1 million were commenced during 1979/80. The following table gives a comparison between the number and estimated cost of bridge projects commenced in 1979/80 and those for the preceding financial year.

Description	1978/79		1979/80	
	No.	Est. cost $'000	No.	Est. cost $'000
New bridges commenced under the supervision of the Board's staff	46	14,708	47	25,276
New bridges commenced under municipal supervision with financial assistance from the Board	67	3,476	72	4,716
Miscellaneous — Sign structures, poles, footings, stone beaching and block facing		113		167
Total bridges commenced	113	18,317	119	30,159

Major bridges completed in rural areas

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

Hume Freeway, Seymour
Goulburn Valley Highway interchange
A two span box girder bridge, 77.5m long and 12.4 to 17.9m between kerbs;
A three span beam and slab bridge, 36m long and 11.6m between kerbs;
A two span box girder bridge, 81m long and 9.8m between kerbs.

Chiltern-Howlong Road bridge over part of the Murray River floodway, Rulherglen Shire.

Bruthen-Buchan Road bridge over the Buchan River, Tambo Shire.

Latrobe Terrace bridge, Geelong

North East Rail overpass
Two 2 span prestressed and reinforced concrete bridges, each 70m long and 11.6m between kerbs.

Western Freeway, Wallace-Bungaree
Ormond Road
A two span prestressed and reinforced concrete bridge, 67m long and 9.8m between kerbs.

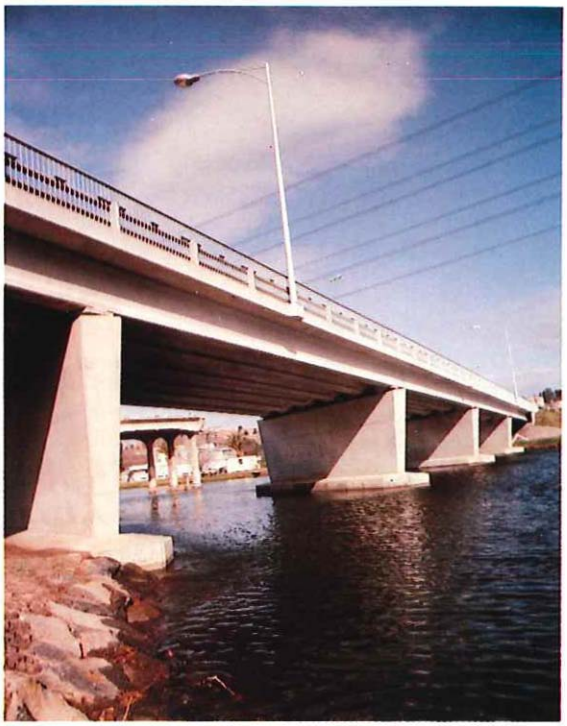
Rutherglen Shire
Chiltern-Howlong Road
Murray River Floodways — two reinforced concrete U-slab bridges, one of 4 spans, 42.5m long and 8.6m between kerbs, and the other of 2 spans, 21.2m long and 8.6m between kerbs.

Tambo Shire
Bruthen-Buchan Road
Buchan River — a five span prestressed concrete beam and reinforced concrete bridge, 100m long and 8.8m between kerbs plus a 1.8m wide footway.

Larger bridges completed during the year under municipal supervision, with financial assistance from the Board, included:

Broadmeadows City
Broadmeadows Road deviation
Moonee Ponds Creek — a three span reinforced concrete beam and slab bridge, 32.4m long and 9.8m between kerbs.

Dundas Shire
Natimuk-Hamilton Road
Dundas River — a three span reinforced concrete U-slab bridge, 28m long and 9.8m between kerbs.



Fisher Parade bridge over the Maribyrnong River, Essendon and Footscray Cities, with the old bridge being demolished in the background.

Jacana Street pedestrian overpass spanning an unopened section of the Mulgrave Freeway, Chadstone.

Glenelg Shire
Moree Road
Pigeon Ponds Creek — a four span reinforced concrete U-slab bridge, 43m long and 7.5m between kerbs.

Otway Shire
Colac-Beech Forest Road
Gellibrand River — a three span reinforced concrete beam and slab bridge, 38m long and 9.8m between kerbs.

Bridges and overpasses in the metropolitan area

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

Mornington Peninsula Freeway, Carrum
Chelsea Road overpass
Two 2 span prestressed concrete beam and reinforced concrete bridges, each 47m long and 11.6m between kerbs.
Patterson River bridges
Two 9 span prestressed concrete beam and reinforced concrete bridges, each 192m long and 11.6m between kerbs.
Overpass on Thompsons Road
A two span prestressed concrete beam and reinforced concrete bridge, 73m long and 8.6m between kerbs plus two 1.8m wide footways.

Mulgrave Freeway, Waverley
Overpass on Huntingdale Road
A two span prestressed concrete box girder and reinforced concrete bridge, 64m long and 19.7m between kerbs plus two footways 1.8m wide and 2m wide.

Essendon and Footscray Cities
Fisher Parade
Maribyrnong River — a five span prestressed concrete beam and reinforced concrete bridge, 108m long and 9.2m between kerbs plus a 1.8m wide footway.

Grade separated pedestrian crossings

Two grade separated pedestrian crossings were completed by the Board during the year, restoring pedestrian access interrupted by major projects:

Jacana Street at the Mulgrave Freeway
A three span prestressed concrete beam and reinforced concrete overpass, 99m long and 1.8m wide.

Latrobe Terrace rail overpass, Geelong
A four span reinforced concrete overpass, 118m long and 2.1m wide over the railway tracks.

Elimination of railway level crossings

In 1954 the Slate 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 1 July 1974, the total cost of this work has been charged to the Transport Fund. Since the inception of the scheme, 67 road overpasses or underpasses have been constructed to eliminate railway level crossings.
A three span road over rail overpass, 45m long and 9.8m between kerbs was completed during the year on the Princes Highway West, near Cudgee.
Work continued during the year on twin 15 span road over rail overpasses, each 269m long and 8.6m between kerbs at Latrobe Terrace, Geelong.

Road planning

The road planning function of the Board is an essential and highly sophisticated operation, involving many diverse skills. 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. In addition specially trained officers in the Board's service using specialised equipment provide technical information 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.

Princes Highway East, Caulfield to Malvern
Over the past five years the Board has been investigating possible improvements to the Princes Highway East (Dandenong Road) between Hawthorn Road and Waverley Road, in Caulfield and Malvern. Extreme traffic congestion is often experienced on this section of the highway, particularly during peak periods. As a result, significant delays are caused to both through traffic and local traffic with a resultant adverse effect to the amenity of the adjacent areas including the Caulfield shopping centre.
During the year the Board issued a summary report of its investigations which was forwarded to the affected municipal councils for comment. For the purpose of obtaining comment from the public the report was placed on exhibition at the Caulfield and Malvern Town Halls during February and March, 1980.
The summary report listed four main alternatives, as follows:

1. The construction of a new road over rail overpass immediately east of Malvern station with the widening of the highway and re-arrangement of the provision for trams and road traffic through the Caulfield shopping centre.
2. The construction of a new road under rail overpass on an improved alignment adjacent to the existing underpass with the widening of the highway and a re-arrangement of the provision for trams and road traffic through Caulfield.
3. The development of the route along the south side of the railway line with the widening of Normanby Road and the construction of a new road overpass of the railway east of Caulfield Station.
4. A system of one-way streets in which the highway would be used only by east-bound traffic with Normanby Road being used only for the west-bound movement and with new road overpasses being constructed east of Malvern Station and west of Caulfield Station.

In June 1980, a conference of interested parties was held in the Board's theatrette attended by Board Members, officers of the Board and representatives of the Caulfield and Malvern City Councils, government authorities and resident groups. As a result of the conference the Board is carrying out further investigations into proposals 1 and 4.
These investigations will include:

- ☐ the possibility of developing proposal 1 using an underpass instead of an overpass.
- ☐ further general investigations into a modified proposal 4 involving the use of a system of one way streets.

Healesville Freeway
Over a period of years, the Board has carried out planning investigations concerning the desirable road facilities to service anticipated future urban development in the corridor from Box Hill to Coldstream in order to relieve the increasing traffic demands on the existing arterial road system in this corridor.
Investigations for the future route of the Healesville Freeway commenced in the early 1960s, in consultation with the affected municipal councils. By 1964, the Board's proposals had received general acceptance and since then, action has been taken to protect sections of the route by the progressive inclusion of parts of it in the relevant planning schemes and by purchasing land as necessary.
The route was included in the 1969 Transportation Plan recommended by the Metropolitan Transportation Committee. More recently it was included in the draft Transport Plan 1978 released for community discussion in December 1978 in the category of "proposals beyond the five year plan" to receive further examination.
The Board has now reviewed and developed the earlier proposals taking into account up-to-date traffic predictions, changing community attitudes, current land use and environment protection policies. In September, 1979 the Board issued a summary report of the planning investigations to that date. Copies were sent to the relevant municipal councils and authorities for comment, as part of the process of developing the proposals to a stage where a planning scheme amendment can be sought to protect the necessary land.
The construction of any facility in the Healesville Freeway reservation is considered to be of a long term nature.

Calder Freeway

In May 1980 the Board completed planning investigations for the Calder Freeway between the Keilor-Melton Road and Diggers Rest, a distance of 9.8 km.

The Board's planning investigations for this section of the Calder Freeway were conducted as part of the development of the Calder Highway as the major link between Melbourne and Bendigo and in the light of:

- the increasing traffic between Melbourne and Bendigo;
- the need to provide access to the increasing urban development adjacent to the highway between Keilor and Diggers Rest and access to the proposed Sunbury growth centre; and
- the desirability of providing for the significant tourist and recreational traffic using this section of the highway.

A summary report was prepared in April 1980 outlining the investigations and copies were forwarded to the relevant municipal councils and interested authorities for information and comment. The comments received will be carefully considered prior to the development of a final scheme following which an amendment to the Melbourne Metropolitan Planning Scheme will be sought to reserve the land required for road purposes.

The first stage in the upgrading of this section of the Calder Highway will be the construction within the next ten years of a duplicate carriageway and the reconstruction of the present carriageway, with the retention of at-grade intersections.

The second stage will involve the upgrading of the duplicated highway to freeway standard with possible grade separated interchanges at Highland Road, Kings Road and near the Organ Pipes National Park. Traffic volumes and available finance will determine the timing of the conversion to freeway standard. This is most unlikely before the mid 1990s.

New Barwon River crossing, Geelong

In April 1980 the Board announced details of its favoured proposal for a new crossing of the Barwon River, Geelong, to connect Latrobe Terrace with Settlement Road.

The 1.78 km proposed new road and crossing, estimated to cost $14.7 million at 1980 prices, includes a bridge spanning both the Barwon River and Moorabool Street.

At a meeting in the City of Geelong municipal offices on 10th April, 1980, Board officers explained the proposals to Members of Parliament, representatives of the municipal councils concerned and other authorities affected by the proposed project.

The existing Barwon River bridges are reaching peak capacity and a new crossing is necessary to cater for the expected growth in traffic over the next 20 to 30 years.

The Board's favoured proposal was selected having regard to factors such as environmental effect, possible flooding and the general effect on private and public land.

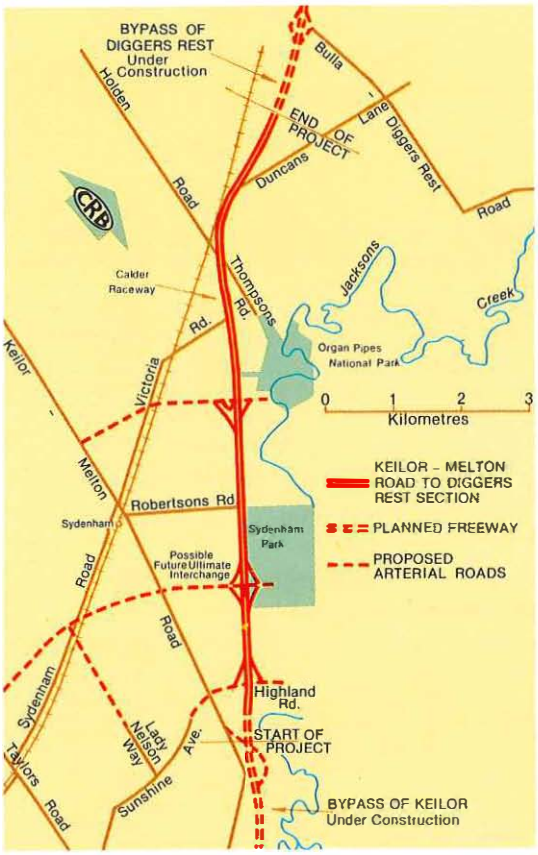
The proposed bridge structure crossing the Barwon River and Moorabool Street would have two 3.7 m traffic lanes in each direction together with outer shoulders which could be used by cyclists. The bridge would be constructed above the highest recorded flood level for the Barwon River.

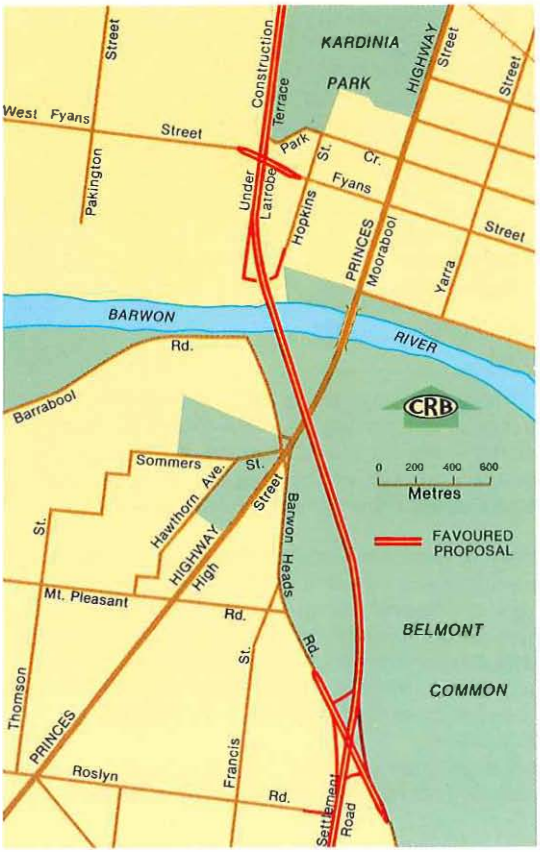
The Board released details of the proposal so that comments from interested parties could be evaluated before a firm proposal is adopted and a planning scheme amendment is sought to reserve the land required.

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 Melbourne Metropolitan Planning Scheme between Toorak Road and Burke Road, 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.

During the year the Board completed plans defining land requirements for the freeway. This work was carried out in consultation with municipal councils and other authorities previously involved in the Gardiners Creek Valley Study.





Between February and May 1980 the Melbourne and Metropolitan Board of Works placed on public exhibition a proposed amendment to the Melbourne Metropolitan Planning Scheme incorporating the land required for the freeway.

During the year the Board also continued work on the assessment of possible traffic management improvements in the Malvern area which will be required in the short-term after the completion of the extension of the Mulgrave Freeway from Huntingdale Road to Warrigal Road. The assessment of possible short-term traffic improvement measures is being made in conjunction with officers of the municipal councils concerned, and other authorities.

Northern arterial road route

In October 1979 a report prepared by the Board of its investigations for the proposed future arterial road from Reynolds Road, Donvale to the Maroondah Highway, Croydon, known as the Proposed Northern Route, was forwarded to local municipal councils for comment.

The proposal for the Northern Route was originally included in the recommendations of the Eastern Corridor Study approved by the Government in 1976. The Board's investigations were carried out in consultation with officers from the municipal councils affected by the proposal, the Upper Yarra Valley and Dandenong Ranges Authority and other local authorities.

The report recommended that provision should be made for a reservation for the extension of Reynolds Road easterly to the Maroondah Highway at Croydon North.

Although the Northern Route is a long term proposal, comments have been sought by the Board so that the finally approved route can be incorporated in the Melbourne Metropolitan Planning Scheme. This will allow development to take place with the knowledge of the location of the proposed road.

General

In addition to the road planning studies described, the Board continued with a number of other planning investigations, including investigations in relation to:

- the Western Freeway, Ballarat Section — to provide a northern bypass of Ballarat;
- the Hume Freeway, between the Lincoln Causeway, Wodonga and Albury — to provide a new freeway connection between Wodonga and Albury;
- the Princes Highway East, between Warragul and the Moe River — initial duplication with provision for long term conversion to freeway standard.

Linemarking

During the 1979/80 financial year the Board spent $2.53 million 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 — 19,134 km or 42,673 km of equivalent standard stripe.

☐ Other CRB declared or proclaimed roads — 11,686 km or 19,136 km of equivalent standard stripe.

☐ Unclassified roads — 3,474 km or 6,374 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:

☐ $32.80/km of standard stripe.

☐ $6.5/km of 75 mm wide solid stripe.

The cost of extending and maintaining the system of raised pavement markers on declared roads was $140,757 and 57,115 reflective markers were laid.

Tullamarine Freeway new emergency shoulder

In March 1980 work began on the construction of a 3 m wide emergency shoulder adjacent to the northbound carriageway of the Tullamarine Freeway between Brunswick Road and Moreland Road.

The original emergency stopping lane on this section of the freeway was converted in March 1978 to an auxiliary traffic lane to provide additional capacity for peak traffic volumes. Four emergency parking bays were subsequently installed to improve operating and safety conditions on the section.

The emergency shoulder is being constructed to provide better facilities for broken down vehicles and improved access conditions for emergency vehicles. The emergency shoulder will not be available for use as a traffic lane and will be discontinuous at each of the three freeway bridges crossing Moonee Ponds Creek and at the Wilson Street Overpass.

Three controlled access points from the adjoining local street system will however be provided to allow emergency vehicles to reach any section of the freeway at any time.

The estimated cost of the emergency shoulder is $500,000 and it is scheduled for completion in July 1980.

West Gate Freeway/South Eastern Freeway Traffic Management Study

In 1977 the Board and the Melbourne City Council agreed that the City Road-Alexandra Avenue route should be developed to provide for the movement of traffic between the South Eastern Freeway and the West Gate Freeway extension to Kings Way (when completed) and to function as the main east-west traffic artery in this corridor.

During the year a committee comprising officers of the Board and representatives from the Melbourne City and South Melbourne City Councils, was convened to undertake a study for the purpose of identifying traffic management measures which would develop this route and to determine appropriate traffic management measures for other roads in the corridor, consistent with environmental factors and expected traffic demand.

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, 1958, 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 1978/79.

	1978/79	1979/80
Single trip permits	21,293	20,183
Annual permits	3,139	3,058
NAASRA permits*	26,079	6,300
Total number of permits issued	50,511	29,541

*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.

During the year, the State Electricity Commission continued the movement of heavy generating equipment from Melbourne to the Commission's project at Jeeralang in the Latrobe Valley. During the five month period from July to December, 1979, four heavy transformers ranging in weight from 140 to 227 tonnes gross were transported from Melbourne to Jeeralang.

Other significantly heavy loads comprising generating equipment and ranging in weight from

215 tonnes gross to 540 tonnes gross were also transported during the year by the Commission from Melbourne to its installations at Newport, Hazelwood and Warragul.

Weighbridges

To supplement the fifteen weighbridges already installed by the Board and which form an integral part of the Board's control of vehicle weight activity, the installation of three new weighbridges was commenced during the year at Horsham, Benalla and Kerang. The weighing platforms on the Western Highway, Horsham and on the Hume Highway, Benalla, which will utilise the recently developed electronic mass units for weighing, are expected to be in service in August, 1980 while the conventional mechanical weighbridge at Kerang is expected to be operational by December 1980.

Another electronic weighbridge operated by the Board is located in Lorimer Street, South Melbourne, and has been in use since January 1979 for the specific purpose of weighing heavy permit load vehicles.

Prosecutions

The number of offences reported during the year by the Board's twenty two traffic officers and the six police officers seconded to the Board was 5,444. These offences resulted in over $983,015 in fines and costs which were paid into the Consolidated Fund.

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 (Third Edition)
- ☐ Snow Driving, It's An Art
- ☐ A Driver's Guide to the Mulgrave and South Gippsland Freeways
- ☐ A Guide to Melbourne's Freeways.

Snow clearing

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

The 1979 snow season had average falls of snow by comparison with previous years, except for some unusually heavy falls occurring in August. Snow clearing started in June and finished in October.

All night snow clearing was carried out at Mt Hotham on Friday and Saturday nights during the season, the work being funded by a special Treasury Grant.

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

Five, 4 wheel drive Aveling Austin grader snowploughs, three Rolba R1500 snowblowers, two Rolba R400 snowblowers and one Schmidt Unimog multi purpose snow clearing unit were used to carry out snow clearing for the season.

Details of snow falls recorded during the 1979 winter by the Board's snow clearing gangs together with the costs of snow clearing are shown in the following table:

Road	Resort	Earliest snowfall	No. of snow days	Cost 1979 season
Alpine Tourists' Road	Mt Hotham	11/6/1979	47	$241,000
Mt Buffalo Tourists' Road	Mt Buffalo	29/6/1979	30	$ 48,100
Mt Buller Tourists' Road	Mt Buller	11/6/1979	35	$ 48,600
Bogong High Plains Tourists' Road	Falls Creek	11/6/1979	37	$ 60,900

(a) Costs do not include clearing of car parks for committees of management.
(b) Night clearing of Mt Hotham is funded by a Treasury Grant of $35,300 and is included in the cost of $241,000.
(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 included in the cost of $60,900.

Above:
A motorist using an emergency telephone on a freeway to request assistance from the Board's emergency service.

Above left:
Board's traffic officers checking the weight of a vehicle on a weighbridge near Seymour.

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
During the year the emergency telephone service on the Mulgrave Freeway was extended to include the new freeway section from Forster Road to Huntingdale Road. In addition, the emergency telephone services on the Tullamarine and Calder Freeways were extended to include the section of the Tullamarine Freeway from Bulla Road to the Airport, and the sections of the Calder Freeway from Tullamarine Freeway to north of Keilor township.
The emergency service operates for 24 hours per day and provides assistance for minor mechanical problems, the sale of sufficient petrol to enable the vehicle to be restarted and driven clear of the freeway and 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 4800 calls in the first year of operation in 1975 to 20,872 calls during financial year 1979/80.
The Emergency Service Centre permits continuous radio communication with the Board's road maintenance personnel and traffic officers outside normal working hours. The Centre also enables up to date information on road conditions to be provided outside normal working hours, especially during the occurrence of floods or bush fires. The following table shows the distribution and types of calls for emergency services received during financial year 1979/80.

Emergency Services — call analysis (1979/80)

Fault	Total	% of all calls
Roadside Emergency Telephone		
Petrol	3361	16.2
Tyres	860	4.2
Radiator	1248	5.9
Mechanical	4855	23.2
Hoax	472	2.3
Hazard	435	2.0
Accident	280	1.3
Sub Total	11,511	55.1
Ordinary Telephone		
Other	8128	38.9
Hazard	250	1.2
Traffic Lights	983	4.8
Total	20,872	100

Emergency Services — road analysis

Road	No. of calls	%
Tullamarine Freeway	2880	24.2
Eastern Freeway	3271	27.5
South Eastern Freeway	1581	13.2
West Gate Freeway	738	6.2
Kings Bridge/Queens Way	155	1.3
Mulgrave Freeway	3294	27.6
Total	11,919	100

Environmental studies

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.

During the year the Environmental Studies Section was involved in the following studies.

Banksia Street to Bell Street Connection, Heidelberg

During the year the Board continued with studies of ways to relieve traffic congestion in the Banksia Street-Bell Street area of Heidelberg. Some years ago an investigation carried out by the Board

The Mulgrave Freeway, Doveton — (above) the freeway during construction and (below) the freeway showing well-established roadside landscaping.

concluded that a direct connection was warranted between Banksia Street, south of the Austin Hospital and Bell Street.
Following discussions with the Heidelberg City Council and because of public concern expressed, the Director of Conservation, in June 1977, requested the Board to prepare an Environment Effects Statement in relation to the Board's proposal.
Preparation of the statement included an assessment of cost, noise, landscaping, construction aspects and the effects on traffic, pedestrian movement, the shopping centre and properties and after taking into account these factors, the alternatives for the connection were reduced to the following:
(a) a one way pair system utilising Banksia Street, Waterdale Road, Bell Street, Burgundy Street and Jika Street; and
(b) the Board's modified proposal, a direct divided road connection between Bell Street and Banksia Street.
The statement concluded that the better alternative would be the Board's modified proposal.
The Environment Effects Statement was subsequently forwarded to the Ministry of Conservation for public exhibition and assessment.
In February, 1980 the Honourable Robert Maclellan, MLA, Minister of Transport, released details of the Ministry of Conservation's assessment report and of the action then to be taken which included:
☐ The Board, in conjunction with the Heidelberg City Council, to investigate and implement traffic management measures to maximise the capacity of the existing routes in the corridor.
☐ The Board, in conjunction with the Heidelberg City Council, to investigate the desirability of developing a shortened one way pair system as part of the traffic management measures on the existing routes.
☐ The Board to discuss with the Heidelberg City Council possible action to preserve the longer term option of providing a direct connection between Banksia Street and Bell Street by seeking an amendment to the Melbourne Metropolitan Planning Scheme to reserve any land.
In June 1980 the Council advised the Board that it agreed with the implementation of short term traffic management measures and the inclusion of a reservation in the Melbourne Metropolitan Planning Scheme for the route of a direct connection between Banksia Street and Bell Street.

Route E6

During the year the Board began the preparation of an Environment Effects Statement for Route E6 between the Eastern Freeway and Harp Road, Kew.
As part of the development of the Eastern Freeway, Route E6 was proposed as a feeder road in the form of a grade separated four lane divided road between the Eastern Freeway and Harp Road. Although a planning scheme reservation has existed since 1954 some minor amendments to the reservation would be required to cater for a feeder road in that form.
As a result of public concern expressed and submissions made to the Ministers of Transport and Conservation, the Board, in September, 1979, began the preparation of an Environment Effects Statement to examine traffic problems and the possible solutions.
To keep the public informed on the progress of the Statement, information bulletins were distributed throughout the area in October 1979 and February and June 1980. In addition a public display was held in February, 1980, to outline the various alternatives under consideration.
The Environment Effects Statement is expected to be completed in late 1980 at which time it will be forwarded to the Ministry of Conservation for public exhibition and evaluation prior to a final decision being announced.

Landscaping

Landscaping of road reserves is an integral part of the Board's roadmaking and maintenance practice. The careful planting of trees and shrubs enhances the aesthetic appearance of the road and provides a pleasant and safer travelling environment.

Number and cost of trees and shrubs planted during the 1979/80 financial year.

Divisions	No. of Trees and shrubs	Purchase cost $
Bairnsdale	—	—
Ballarat	—	—
Benalla	1,000	3,800
Bendigo	7,950	4,350
Dandenong	16,000	8,000
Geelong	3,630	3,200
Horsham	1,500	1,200
Metropolitan	32,500	20,540
Traralgon	4,000	3,000
Warrnambool	3,300	2,000
Projects		
Mulgrave Freeway	16,000	6,300
West Gate Freeway	700	1,200
Total	**86,580**	**53,590**

Municipal allocations

In April 1980 the Board allocated $90,072,000 to Victoria's 212 municipal councils for road works on main and unclassified roads for 1980/81.
This represented $6,912,000 more than the original allocations made in April, 1979 for 1979/80.
The table below shows the applications and allocations of funds to municipal councils for 1979/80 and 1980/81.
The table below shows the applications and allocations of funds to municipal councils for 1979/80 and 1980/81. The table also shows the final allocations for 1978/79 and 1979/80, the percentage increase in final allocations over these two years and the percentage increase in original allocations from 1979/80 to 1980/81.

	1978/79	1979/80				1980/81		
	Final allocations $'000s	Applications $'000s	Original allocations $'000s	Final allocations $'000s	% increase in final allocations over 1978/79	Applications $'000s	Original allocations $'000s	% increase in original allocations over 1979/80
Main roads	39,195	76,014	39,782	45,826	16.92	84,478	43,605	9.60
Unclassified roads	42,348	110,119	43,378	46,059	8.76	118,995	46,467	7.12
Total	81,543	186,133	83,160	91,885	12.68	203,473	90,072	8.31

As at April 1980 when the Board announced the 1980/81 allocations to municipal councils, the Commonwealth Government had not advised the States of the level of Commonwealth funds to be made available for roads in 1980/81 or passed the necessary roads legislation to replace the States Grants (Roads) Act 1977 which expired on 30 June 1980.
Accordingly, municipal councils were advised that the Board would only be in a position to guarantee the reimbursement in 1980/81 of expenditure by municipal councils up to 55% of the allocations, this being the level of State funds for roads. Councils were also advised that this restriction in expenditure reimbursement would be reviewed by the Board when the Commonwealth Government indicated the level of Commonwealth funds available for roads in 1980/81.
In May 1980, following the announcement of the 1980/81 Commonwealth road grants, the Board was able to advise municipal councils that the restrictions on expenditure no longer applied.

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 1979/80, increasing the authorised contributions to $1,430,000.
The Board's Divisional Engineers combine with the appropriate Forests Commission Officers to determine the priority 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 $654,000 and the Board allocated $143,825 during the year after allowing for allocations previously made in excess of the total funds available.

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 Members 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

1. Ballan-Meredith Road — construction of a 5 span bridge over the Moorabool River, Ballan Shire (Main road).
2. Mansfield-Whitfield Road — reconstruction of 2 km, Mansfield Shire (Main road).
3. Dederang Road — reconstruction of 1.6 km, Yackandandah Shire (Main road).
4. Wellington Road/Stud Road intersection — improvements to the interesection, Knox City (Main roads).

Huon Creek Road — a 4 cell box culvert over House Creek, Wodonga City (Unclassified road).

therefore 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 Doncaster and Templestowe, Hamilton, Heidelberg, Mordialloc, Northcote, Oakleigh, Sandringham and South Melbourne; the Borough of Sebastopol; and the Shires of Bacchus Marsh, Bet Bet, Buln Buln, Bungaree, Buninyong, Charlton, Cobram, Diamond Valley, Dundas, Dunmunkle, Glenelg, Kyneton, Maldon, McIvor, Ripon, Rochester, Sherbrooke, Tambo, Tungamah, Wannon, Werribee and Yea. 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 municipal 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 Footscray, Moe and the Rural City of Wodonga and the Shires of Gordon, Stawell, Wimmera and Wycheproof.

Fisken Street — a new 3 span bridge over the Werribee River, Bacchus Marsh Shire (Unclassified road).

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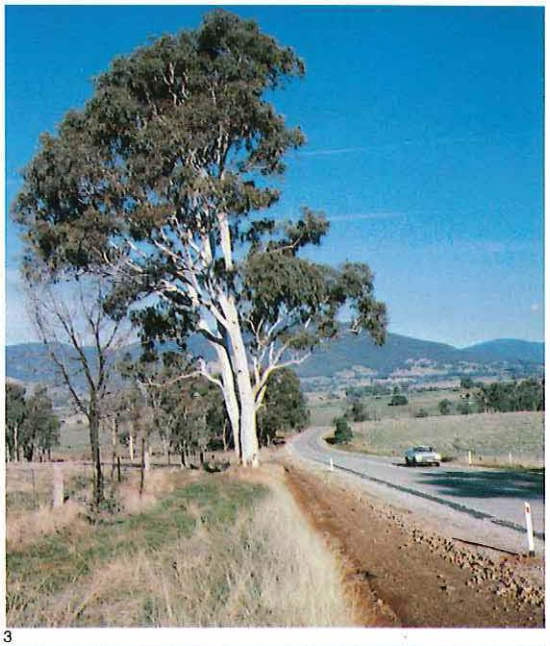

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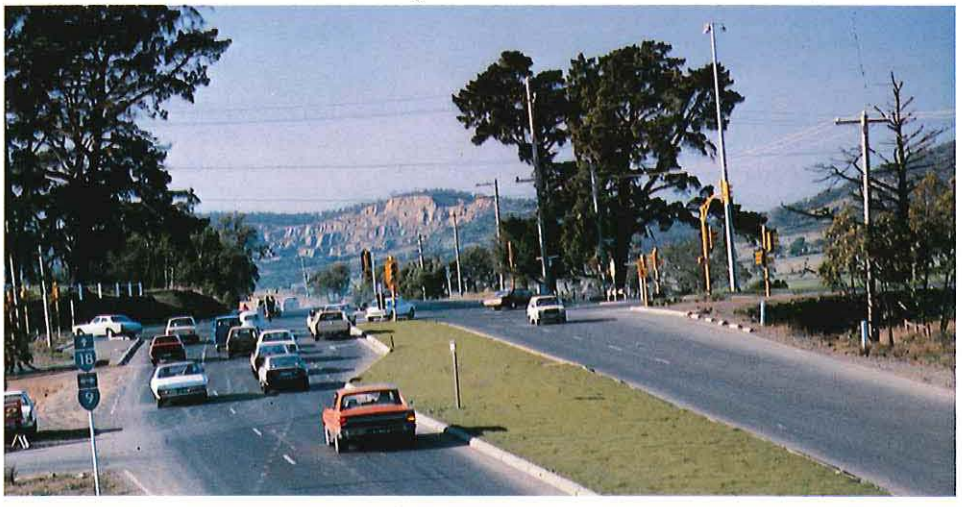

4

The Board also received a joint deputation from a group of councils in the South Gippsland area, comprising representatives from the Shires of Korumburra, Phillip Island, South Gippsland and Woorayl. In addition, deputations were received from five special interest groups, comprising representatives from the Australian Road Federation, the Association of Professional Engineers, Australia, the Australian Earthmovers and Road Contractors Federation, the Upper Yarra Valley and Dandenong Ranges Authority and the Echuca South Primary School Council.
The main topics raised by the councils and special interest groups 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 and matters associated with road and bridge planning, design and construction and intersection treatments.

36th Conference of Municipal Engineers

The 36th 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 3rd and 4th March, 1980, concluding with a technical tour of freeways and major road projects in the metropolitan area on 7th March.
The Conference was offficially opened by the Board's Chairman, Mr T H Russell, on behalf of the Honourable Robert Maclellan, MLA, Minister of Transport.
The theme of the Conference, "The Challenge of the 1980s", was the subject of a keynote address presented by Sir Louis Mathieson, KBE, CMG, MBE. Sir Louis' comments on energy alternatives, protection of the environment, planning for leisure and the possible reorganisation of local government provided an excellent introduction to a highly informative and successful conference. Other papers presented were on the general themes of management, planning, research, bridge design and construction, roadmaking materials, traffic management and community leisure needs together with separate papers on various innovations and developments associated with road and bridge engineering. Panel discussions were held on road funding, refuse handling, the interim report of the Board of Review of the role, structure and administration of local government, and alternative fuels for motor vehicles. For the first time an address was presented at the Conference luncheon when Dr A W Willee, Chairman, Department of Human Movement Studies, University of Melbourne, spoke on "Activity and Healthy Living". Approximately 200 Local Government and CRB engineers attended the Conference 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 Sir Louis Mathieson, and to all engineers participating, particularly those who presented papers, for contributing to the success of the Conference.

Access roads to schools

In January 1979 the Board invited municipal councils to submit applications for funds to construct urgently needed access roads to new schools. This action was taken pursuant to Government policy that the Board should make annual allocations over the three year period 1978/79 to 1980/81 for the purpose of providing safe access roads to schools.
A total amount of $59,060 was allocated by the Board in the 1978/79 financial year for this work. During the 1979/80 financial year, a total allocation of $120,710 was made by the Board to municipal councils to assist the councils with the construction of urgently needed access roads to schools at the following locations:

Municipality	Location
Bacchus Marsh Shire	Nelson Street, Darley
Ballarat Shire	Connector Road
Echuca City	Butcher Street
Horsham City	Lutheran School Road
Kilmore Shire	Bentinck Street
Knox City	Wantirna-Sassafras Road
Upper Yarra Shire	Carter Street, Launching Place
Werribee Shire	Sayers Road

Flood and storm damage restoration works

During the 1979/80 financial year, grants totalling $731,894 were made by the State Government under a Commonwealth/State agreement for road restoration works following natural disasters. The allocation was expended on works associated with the restoration of damage to roads and bridges including damage caused by the extensive flooding in eastern Victoria in June, 1978, and the southern and northern areas of the State in August, November and December, 1978. 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, where the State Government has expended more than $7 million on restoration works, Commonwealth financial assistance is provided on a $3:$1 basis with regard to any single natural disaster for which expenditure by the State Government on restoration works exceeds $700,000. 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.

Significant works on main and unclassified roads

Main roads

Significant works completed or substantially completed during financial year 1979/80.

Alberton Shire
Yarram-Traralgon Road
Reconstruction of 2.9 km between Devon North Road and Boodyarn Road.

Arapiles Shire
Natimuk-Hamilton Road
Reconstruction of 3.2 km near Noradjuha.

Ballan Shire
Ballan-Meredith Road
Construction of a 5 span bridge over the Moorabool River at Morrison.

Belfast Shire
Hamilton-Port Fairy Road
Realignment and reconstruction of 2.3 km south of Orford.

Buln Buln Shire
Longwarry-Drouin Road
Reconstruction of 1.5 km near Red Hill.
Main Neerim Road
Reconstruction of 0.4 km north of Rokeby.

Bunlnyong Shire
Colac-Ballarat Road
Reconstruction of 1.6 km south of Enfield.

Cobram Shire
Benalla-Tocumwal Road
Reconstruction of 1.3 km south of the Murray Valley Highway.

Cranbourne Shire and Dandenong City
Dandenong-Frankston Road
Duplication of 1.6 km between Kirkham Road and Greens Road.

Cranbourne Shire and Springvale City
Dandenong-Frankston Road
Construction of 1.9 km between Thompsons Road and Boundary Road.

Doncaster & Templestowe City
Doncaster Road
Reconstruction of 1.6 km between Elgar Road and Koonung Creek.
Heidelberg-Doncaster Road
Reconstruction of 1.2 km between Derrick Avenue and Lillian Street.

Eltham Shire
Whittlesea-Kinglake Road
Reconstruction of 3.1 km at Gangelhoff Deviation.

Heytesbury Shire
Camperdown-Cobden Road
Resurfacing 2.5 km north of Stoneyford Road.
Timboon-Scotts Creek Road
Realignment of 0.7 km.

Knox City
Ferntree Gully Road
Intersection improvements at Scoresby Road.
Stud Road
Duplication of 2.4 km from High Street Road to Ferntree Gully Road.
Wellington Road
Intersection improvements at Stud Road.

Main Roads (cont.)

Lilydale Shire
Canterbury Road
Intersection improvements at Liverpool Road.
Yarra Glen Road
Reconstruction of 4.5 km.

Lillydale and Sherbrooke Shires
Olinda-Monbulk Road
Reconstruction of 1.3 km between Red Hill Road and Invermay Road.

Mansfield Shire
Mansfield-Whitfield Road
Reconstruction and realignment of 2 km south of Tolmie.

Mordialloc City
Beach Road
Resurfacing 5.1 km.

Mordialloc and Springvale Cities
Doncaster-Mordialloc Road
Intersection improvements at Lower Dandenong Road.

Myrtleford Shire
Myrtleford-Yackandandah Road
Reconstruction and realignment of 2.5 km north of Myrtleford.

Newham and Woodend Shire
Mt Macedon Road
Reconstruction of 2.5 km east of Woodend.

Otway Shire
Colac-Beech Forest Road
Construction of a 3 span bridge over the Gellibrand River at Gellibrand.

Oxley Shire
Bright Road
Reconstruction of 1.7 km east of Ovens Road.

Portland Shire
Portland-Casterton Road
Realignment and reconstruction of 2.5 km at Digby.

Preston City
Bell Street
Duplication of 0.6 km between Hotham Street and the railway line.

Ringwood City
Canterbury Road
Duplication of 0.9 km between Maidstone Street and Heatherdale Road.

Rutherglen Shire
Chiltern-Howlong Road
Construction of a two span bridge and a four span bridge on the Murray Valley Flood Plain.

Sebastopol Borough
Colac-Ballarat Road
Construction of 2 roundabouts and duplication of 0.3 km between Rubicon and Hertfield Streets.

South Barwon City
Barwon Heads Road
Reconstruction of a timber bridge at Barwon Heads.
Reconstruction between Breakwater Road and Waurn Ponds Creek.

Stawell Shire
Navarre Road
Construction of a 5 span bridge over the Wimmera River.
Stawell-Pomonal Road
Reconstruction of 1.3 km near Bellallen.

Talbot and Clunes Shire
Clunes-Creswick Road
Redecking the bridge over Creswick Creek in Clunes township.

Tambo Shire
Bruthen-Buchan Road
Construction of a 5 span bridge over the Buchan River at Buchan township.

Wangaratta Shire
Wangaratta-Yarrawonga Road
Reconstruction and widening of 3.1 km south of Peechelba.

Wannon Shire
Coleraine-Edenhope Road
Reconstruction of 7.6 km.

Waverley City
High Street
Reconstruction of 1.4 km between Lee Avenue and Rose Avenue.
Wellington Road
Reconstruction of 2.1 km west of the Mulgrave Freeway.

Wodonga City
Beechworth-Wodonga Road
Reconstruction of 1.7 km between Wodonga and Leneva.

Wycheproof Shire
Sea Lake-Robinvale Road
Resurfacing 14.7 km from the Calder Highway to near Tyrell Downs.

Yackandandah Shire
Dederang Road
Reconstruction of 1.6 km south of Yackandandah.

Yea Shire
Yarra Glen-Yea Road
Construction of a passing lane between Glenburn and Yea.

Unclassified roads

Significant works completed or substantially completed during financial year 1979-80.

Alexandra Shire
Glendale Lane
Construction of a 3 span bridge over the Acheron River.

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

Ballaarat City
Gillies Street
Reconstruction of 0.4 km.

Beechworth Shire
Wooragee-Chiltern Road
Construction of 2 km and a single span bridge over Rising Sun Creek.

Bellarine Shire
Murradoc Road
Reconstruction of 1 km west of Soho Road.

Broadmeadows City
Mickleham Road
Duplication of 1.8 km between Foreman Street and Lackenheath Drive.

Corio Shire
Cox Road
Duplication of 0.8 km between Princess Street and Anakie Road.
Steiglitz Road
Reconstruction of 2.9 km near Hopes Bridge.

Cranbourne Shire
Warneet Road
Construction of 2 km.

Diamond Valley Shire
Yando Street/Church Avenue
Construction of 0.75 km of new road.

Doncaster and Templestowe City
Blackburn Road
Reconstruction of 3 km from Andersons Creek Road.
Williamsons Road
Reconstruction of 0.5 km at Serpells Road intersection.

Dundas Shire
Ripponhurst Road
Resurfacing 1.8 km.

Eltham Shire
Hurstbridge-Arthurs Creek Road
Construction of a bridge and approaches.

Essendon and Footscray Cities
Fisher Parade
Construction of 0.5 km approaches to the new Maribyrnong River bridge.

Flinders Shire
Browns Road
Construction of 3.9 km between Truemans Road and Rye Ocean Beach Road.
Sandy Road
Construction of 1.8 km west from Mornington-Flinders Road.

Footscray City
Francis Street
Reconstruction of 0.4 km.
Williamstown Road-Francis Street intersection
Intersection improvements.

Geelong West City
Douglass Street
Reconstruction of 0.5 km between Minerva Road and Wirksworth Street.

Heytesbury Shire
Timboon-Terang Road
Reconstruction of 3 km.

Horsham City
O'Callaghans Road
Reconstruction of 0.7 km.

Unclassified roads (cont.)

Kara Kara Shire
Moyreisk-Natte Yallock Road
Construction of a 2 span bridge over Cherry Tree Creek.

Keilor City
Buckley Street
Construction of a 0.7 km connecting link across Steele Creek.
Keilor-St Albans Road
Construction of 1 km at Taylors Creek.
Taylors Road
Duplication of 0.9 km

Keilor and Broadmeadows Cities
Melrose Drive
Duplication of 0.8 km and intersection improvements at Mascoma Street and Sharps Road.

Kew City
High Street
Reconstruction of 1.7 km near Charles Street.

Lillydale Shire
MacIntyre Lane
Construction of 2.6 km east of Yarra Glen Road.

Mansfield Shire
Hearns Lane
Reconstruction of 2 km between the Delatite River and Mt Buller Road.

Melton City
Centenary Avenue
Reconstruction of 0.5 km.

Mildura Shire
Channel Road
Reconstruction of 4 km.

Nunawading City
Terrara Road
Reconstruction of 0.5 km between Hanover Road and George Road.

Omeo Shire
Little River Road
Construction of a 3 span steel and concrete bridge over the Little River north of Ensay.

Orbost Shire
Combienbar Road
Replacement of a timber bridge over Possum Creek north of Club Terrace.
Construction of a 3 span steel and concrete bridge over the Combienbar River at Combienbar.

Richmond City
Church Street
Reconstruction of 0.8 km.

Shepparton City
The Boulevard
Reconstruction between Waters Reserve and Kittles Road.

South Barwon City
Marshalltown Road
Widening between Bailey Street and Station Road.

Stawell Shire
Illawarra-Mt Dryen Road
Reconstruction of a 3 span bridge over Mt William Creek.

Tallangatta Shire
Jarvis Creek Road
Reconstruction and realignment of 1.1 km.

Tambo Shire
Bonang-Gelantipy Road
Reconstruction of 1.1 km near the Gelantipy Bush Nursing Centre.
Bonang-Gelantipy Road
Reconstruction of 1.8 km north of Gelantipy.

Upper Murray Shire
Bunroy Road
Reconstruction of 4.2 km west of Upper Murray Road.

Werribee Shire
Fitzgerald Road
Construction of a roundabout and intersection improvements at Doherty's Road.
Nerowie Road
Construction of 1.5 km west of Telephone Road.

Wodonga City
Huon Creek Road
Construction of a 4 cell box culvert over House Creek.
Pearce Street
Construction between House Creek and Melrose Drive in Wodonga City.

Yea Shire
Limestone Road
Reconstruction of 2 km between Limestone and Yea.

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:

Baw Baw National Park	Narracan Shire
Brisbane Ranges National Park	Bannockburn & Corio Shires
Bulga National Park	Alberton Shire
Cape Schank National Park	Flinders Shire
Cathedral Range National Park	Alexandra Shire
Churchill National Park	Knox City
Croajingolong National Park	Orbost Shire
Discovery Bay National Park	Portland 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	Elthamand 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
Pink Lakes National Park	Walpeup 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
Werribee Gorge National Park	Bacchus Marsh Shire
Wilsons Promontory National Park	South Gippsland 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 $1,697,000 available for these purposes since 1st July 1963.

Personnel

The Board's personnel strength as at 30th June, 1980 was as follows:

Technological staff (professional)	625
Technical staff	619
Administrative staff	806
Supervisory staff — field	177
depot	77
Clerks of Works	71
Construction and maintenance personnel	2243
Workshop and depot personnel	653
Total	5271

During the year the Board continued to examine carefully all requests for staff recruitment and staff replacements 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.
As a result of staff resignations and retirements the Board recruited 23 newly qualified civil engineers, 15 draftsmen and 19 apprentices.
Thirty six young people were engaged 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 and 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 seventeen weeks, mostly in field positions.

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1. Media helicopters arriving at the opening of the Mornington Peninsula Freeway.
2. Apprentices being instructed at the Board's Mechanical Sub-Branch, Glen Waverley.
3. 63rd Intermediate NAASRA Meeting (Melbourne), 6th May, 1980.

3

The Board was also able to provide 200 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 anyone school term. The State Education Department reimbursed to the Board the allowance paid to the students.

Apprenticeships

Nineteen new apprentices were employed during the year in the trades of motor mechanics (14), carpentry and joinery (2), electrical mechanics (1), fitting and turning (1) and structural steel fabrication (1).
The total number of apprentices in training at 30th June, 1980, was:

Motor mechanics	68
Structural steel fabrication	5
Carpentry and joinery	7
Painting and decorating	3
Electrical mechanics	3
Cooking	1
Automotive electrics	1
Landscape gardening	3
Gardening	1
Lithographic printing	2
Instrument making and repairing	1
Fitting and turning	3
Plumbing and gas fitting	1
Total	99

One of the Board's final year motor mechanic apprentices, Mr D Townsend, was awarded the 1979 Victorian Motor Mechanic Apprentice of the Year Award. Mr Townsend was also awarded the General Motors-Holden's Travel Award for 1979.

Training and development

As in previous years, the Board provided a comprehensive in service training programme for its staff at all levels based on an assessment of training needs. Courses covered technical subjects such as traffic engineering, quality control, bituminous surfacing techniques, electronic data processing and also management principles and skills.

During the year officers attended the following external training courses:

- ☐ Australian Administrative Staff College (Advanced Session and Management Development Senior)
- ☐ University of Melbourne (Summer School of Business Administration)
- ☐ University of New South Wales (Construction Management Course, Traffic Planning and Control Course, Government Administrative Staff Course).

A study leave scheme and a job rotation programme for professional, technical and administrative staff were conducted to assist staff development.
During the year the Board also provided training attachments for twenty five engineers from Africa and Asia. These training attachments are part of Australia's aid programme and were organised by the Board following requests received from the Australian Development Assistance Bureau.

Industrial relations

The Board's relationships with trade unions continued to be generally satisfactory.
A major feature of industrial relations during the year was the various wage increases granted by the Australian Conciliation and Arbitration Commission on the basis of changes in work value. Work value cases were conducted and completed during the year in the following Awards covering Board's personnel:
Australian Workers' Union Construction & Maintenance Award.
Transport Workers' (General) Award.
Metal Trades Award.
Engine Drivers and Firemen's Award.
Carpenters and Joiners Award.
CRB Salaried Staff Award.
Municipal Officers (CRB) Senior Officers Award.
Professional Engineers (CRB) Agreement.
Professional Engineers (CRB) Senior Engineers Award.
In addition, significant increases in fares and travelling allowances were granted by the Full Bench of the Commission in the National Building Trades Construction Award and the Building Construction Employees and Builders Labourers Award. Several minor stoppages took place on Board's construction sites over the issue before it was resolved.
Other significant matters involving proceedings before the Conciliation & Arbitration Commission included applications by the Municipal Offficers'

Association to obtain award coverage of two classes of employees — chainmen and gangers. In the case of chainmen, an agreement between the Board and the MOA was negotiated in which chainmen were transferred to the salaried staff. The case involving gangers was unresolved at the end of the year.
The Board also had extensive negotiations with the Municipal Officers Association over claims by that Association for revision of the travelling allowances received by field supervisory personnel.
Details of Federal Awards to which the Board is a respondent party and the number of its employees covered by these awards as at 30th June 1980 are as follows:

Award	No.of Personnel
Australian Workers' Union Construction and Maintenance Award	1898
Building Construction Employees and Builders Labourers' Award	113
Carpenters and Joiners Award	11
Engine Drivers and Firemen's Award	3
National Building Trades Construction Award	72
Metal Trades Award	354
Transport Workers' (General) Award	290
Country Roads Board Salaried Staff Award	1804
Municipal Officers (Country Roads Board) Senior Officers Award	18
Professional Engineers (Country Roads Board, Victoria) Agreement	513
Professional Engineers (Country Roads Board, Victoria) Senior Engineers Award	20
Total	5096

The remaining employees are covered by several Victorian Wages Board determinations.

Retirement benefits for employees
On 23rd January, 1980, the State Employees Retirement Benefits Act 1979 came into operation. This Act enables retirement benefits in the form of a lump sum together with a life time pension to be offered to 2700 Board employees who were previously ineligible for superannuation benefits, although eligible to participate in the Board's retiring gratuity scheme.
Participation is optional for eligible employees who were employed by the Board as at 22nd January, 1980. Employees who have exercised their option not to participate in the retirement benefits scheme are able to continue their participation in the Board's retiring gratuity scheme. Participation in the new scheme will be compulsory after twelve months' service for employees engaged on or after 23rd January, 1980. The Act provides for benefits to be paid retrospectively in respect of eligible employees who retired or died on or after 1st January, 1979. Contributions by employees who join the scheme commence on 1st July, 1980.
Mr N L Allanson, Member of the Country Roads Board, was appointed a member of the State Employees Retirement Benefits Board.

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

Name	Position	Location	Length of Service (years)
Penrose, D M (Miss)	Senior Typist	Central Stores	47
Baggs, R C	Superintendent of Works	Horsham Division	44
Smith, A G	Engineering Assistant	Mechanical Sub-Branch	42
Jones, R C	Roadmaster	Horsham Division	40
Finnegan, S E (Miss)	Administrative Officer	Chief Accountant's Branch	37
*McLeod, R W	Fitter	Mechanical Sub-Branch	37
Barton, J W	Administrative Officer	Chief Accountant's Branch	33
Jardine, R C	Supervising Draftsman	Bridge Sub-Branch	33
Pearce, F B X	Printer	Title Survey Division	32
*West, L W N	Plant Operator	Geelong Division	30
Julien, J R	Patrol Assistant	Geelong Division	29
Milligan, J A	Patrolman	Dandenong Division	29
Pryor, A J	Works (Administration) Engineer	Works Sub-Branch	29
Watson, B A	Bridge Construction Engineer	Bridge Sub-Branch	29
Duffield, I C	Welder	Geelong Division	27
Fuller, E F	Clerk of Works	Bridge Sub-Branch	27
Haggar, I	Truck Driver	Bairnsdale Division	27
Ruffles, W P	Fitter	Mechanical Sub-Branch	27
Callow, J A	Plant Serviceman	Benalla Division	25
Mordaunt, M S (Mrs)	Senior Typist	Asphalt Division	25
Powlesland, R L (Miss)	Senior Machine Operator	Chief Accountant's Branch	25
*Sellings, G	Patrolman	Bairnsdale Division	25
Taskis, H D	Scientific Officer	Materials Research Division	25
Irwin, M F	Draftsman	Warrnambool Division	23
Robinson, E J	Senior Draftsman	Plans & Surveys Division	23
*Swain, B	Truck Driver	Bendigo Division	23
Whyley, G C	Administrative Officer	Secretary's Branch	23
Hall, N B (Miss)	Senior Clerical Assistant	Title Survey Division	22
Lengyel, L (Mrs)	Senior Drafting Assistant	Road Planning Division	21
Shaw, C J	Rail Tank Car Attendant	Warrnambool Division	21
Watts, F E	Superintendent of Works	Bridge Sub-Branch	21
Hooper, T R	Administrative Officer	Geelong Division	20
Smithwick, N J	Data Processing Officer	Computer Section	20

*Deceased.

National Association of Australian State Road Authorities

The National Association of Australian State Road Authorities (NAASRA) is an organisation of the Road Authorities of the six States, the Commonwealth Department of Housing and Construction and the Northern Territory Department of Transport and Works. 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 organisation 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 rationalise road and bridge design standards, construction and maintenance practices and road research projects, and also to gather and publish 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 finance for roads and 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.

☐ 62nd Annual Meeting (Canberra), 30th October to 1st November 1979, attended by Mr T H Russell, Chairman.

☐ 63rd Intermediate Meeting (Melbourne), 6th May 1980 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:

☐ International organisations and conferences (the XVIIth World Road Congress of the Permanent International Association of Road Congresses is to be held in Sydney in 1983).
☐ Commonwealth road funds legislation.
☐ State roads legislation.
☐ Standards for design, construction and maintenance of National highways.
☐ Road vehicle limits.
☐ NAASRA data bank system.
☐ Road surveys and price indices.
☐ Road classifications.
☐ NAASRA study of road maintenance standards, costing and management.
☐ Traffic management.
☐ Line marking.
☐ Route marking.
☐ Australian Development Assistance Bureau courses.
☐ Co-ordination of road research.
☐ National transport strategy.

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 T H Russell, Chairman, attended the 39th Directors' meeting of ARRB at the Department of Transport, Canberra, on 29th October, 1979, and the 40th meeting held at the Australian Road Research Centre, Vermont on 7th and 8th May 1980. At the 40th meeting Mr Russell was appointed Deputy Chairman of ARRB for the ensuing year. Technical conferences for the wider dissemination of the results of research and the exchange of knowledge are held bi-ennially — the last conference, the 9th ARRB Conference, being held in Brisbane in August 1978.

A number of the Board's officers are members of ARRB technical or specialist committees and Board officers are also 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 1979 annual camp was held in three parts totalling six weeks over the period from September to November 1979 at two locations, Puckapunyal and the Defence Department Engineer Design Establishment at Monegeeta.

As part of the training programme at Puckapunyal, the units were employed on the improvement of fire access tracks into the adjoining State Forest.

At Monegeeta, the Headquarters 22 Construction Regiment constructed 3.6 km of road 5.3 m wide in November with the section being sealed in February.

Lieutenant Colonel P M Hosking ED, the Board's Assistant Principal Traffic Officer, commands the Headquarters 22 Construction Regiment and the 107 Plant Squadron is commanded by Major E G Renton, an engineer in the Works Sub-Branch.

At 30th June, 1980, fourteen members of the Board's staff were officers of the Regiment.

Roads of tourist interest

The State Government provided loan funds totalling $200,000 in 1979/80 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 Department of State Development, Decentralisation and Tourism. The total amount made available by the Government since 1960 is $4,094,000.

Applications 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 $1,571,418 was paid during the year.

The Tourist Fund is administered by the Department of State Development, Decentralisation and Tourism.

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 August 1979 the National Publications Competition awards of the Society of Industrial Editors were announced, and the Board received a First Award in the Newspaper category for the February, 1979 edition of the staff magazine, Interchange. In addition the Board received a First Award in the Photograph (colour) category.
During the year the Board issued the following publications and pamphlets:

- ☐ CRB News Nos 42, 43
- ☐ Driver's Guide to Victoria — Third Edition
- ☐ Colouring Book (Reprint)
- ☐ Snow Driving . . . It's An Art (reprint)
- ☐ The Early Days of the CRB
- ☐ Urban Freeways (reprint)
- ☐ Driver's Guide to the Mulgrave and South Gippsland Freeways
- ☐ A Guide to Melbourne's Freeways
- ☐ Financial Facts

Information bulletins were produced for the following projects:

- ☐ Nepean Highway Widening, Elsternwick to Moorabbin
- ☐ Route E6
- ☐ Arterial Road Extension of the Eastern Freeway
- ☐ Princes Highway East, Caulfield to Malvern.

These information bulletins were issued to residents, councils, Members of Parliament and the media, and outlined current progress on the projects concerned.

Audio visual productions

During the year three short video productions were produced for use at rural agricultural shows in the Benalla, Bendigo and Traralgon areas.
As part of the Board's exhibit at the 1979 Royal Melbourne Show an audio-visual slide show was prepared involving the use of six slide projectors and sound equipment. The Royal Show exhibit was also used at the Local Government Engineers Association of Victoria CivEnEx field display held at Albert Park in March, 1980.

The Board's Mobile Information Centre was used to house displays at rural shows at the following locations:

Benalla	Lardner
Bendigo	Leongatha
Castlemaine	Mansfield
Echuca	Seymour
Glengarry	Warragul
	Yea

The displays centred on work undertaken by the Board's regional divisions appropriate to the location of the show.

Legislation affecting the Board

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

Transport (Road Funds) Act 1980

This Act was passed in the Autumn Session of State Parliament and came into operation on 20th May, 1980 with the exception of sections 6, 7, 8 and 9 which came into operation on 1st July, 1980.
The Act validates payments made from the Roads (Special Projects) Fund to enable the Crown to purchase or carry out noise amelioration measures on residential properties abutting Alexandra Parade between Gold Street and Brunswick Street in the cities of Collingwood and Fitzroy.
The validating legislation was made necessary following some queries which had arisen as to whether such payments were a proper use of the Roads (Special Projects) Fund. The purchase of properties and the carrying out of noise amelioration works took place at the request of residents in Alexandra Parade pursuant to an undertaking to this effect by the Government given in December, 1977 and designed to assist residents in Alexandra Parade between Gold Street and Brunswick Street who considered that they were disadvantaged by reason of increased traffic volumes in Alexandra Parade following the opening of the Eastern Freeway to traffic in October, 1977.
Sections 6, 7, 8 and 9 of the Act provide in effect for the abolition of the Roads (Special Projects) Fund and the closure of the Road Maintenance Account within the Country Roads Board Fund. As from 1st July, 1980, motor vehicle registration fees previously directed to the Roads (Special Projects) Fund which was established by Section 7A of the Motor Car Act 1958, are to be directed to the Consolidated Fund to be appropriated from that Fund to the Roads and Special Projects Fund, established by the Business Franchise (Petroleum Projects) Act 1979.

Section 6 (b) of the Transport (Road Funds) Act provides for not less than 75% of the amount credited to the Roads and Special Projects Fund under the Business Franchise (Petroleum Products) Act 1979 or any other Act, to be paid each financial year to the Country Roads Board Fund.
Section 7 provides for all moneys received by way of road maintenance charges under the Commercial Goods Vehicles Act 1958 to be paid into the Country Roads Board Fund instead of to the Road Maintenance Account within the Country Roads Board Fund.
Sections 8 and 9 make consequential amendments to the Motor Car Act 1958 and the Country Roads Act 1958.

Motor Registration Act 1980
This Act was passed during the Autumn Session of State Parliament but as at the end of the 1979/80 financial year, a date for the Act to come into operation had still to be fixed by proclamation.
The Act provides for the transfer of the staff and administration of the Motor Registration Branch to the Transport Regulation Board, an expanded membership of the Transport Regulation Board and for consequential amendments to the Commercial Goods Vehicles Act 1958, the Country Roads Act 1958, the Motor Car Act 1958, the Recreation Vehicles Act 1973, the Stamps Act and the Transport Regulation Act 1958.
Membership of the Transport Regulation Board is expanded from three members to five by the addition of two part-time members being the Chief Commissioner of Police and the Chairman of the Country Roads Board or their nominees. Mr W S Brake, Deputy Chairman of the Country Roads Board, has been appointed as part-time member of the Transport Regulation Board.

Business Franchise (Petroleum Products) (Licence Fees) Act 1979
This Act came into operation on 1st September 1979 and amends certain provisions of the Business Franchise (Petroleum Products) Act 1979, details of which were set out in the Board's 66th Annual Report.
The Business Franchise (Petroleum Products) Act 1979 requires petroleum wholesalers to hold a licence, the monthly licence fee for which is $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.
The Business Franchise (Petroleum Products) (Licence Fees) Act 1979 now exempts from the above calculation diesel fuel sold for uses other than propelling diesel engined vehicles on public roads as well as making a number of other minor amendments to the Business Franchise (Petroleum Products) Act 1979.

Grain Handling Improvement Authorities Act 1979
This Act, which was passed in the 1979 Spring Session of Parliament and came into operation on 20th December 1979, establishes the following authorities:
- ☐ the Geelong Grain Handling Improvement Authority
- ☐ the Portland Grain Handling Improvement Authority
- ☐ the Country Grain Handling Improvement Authority

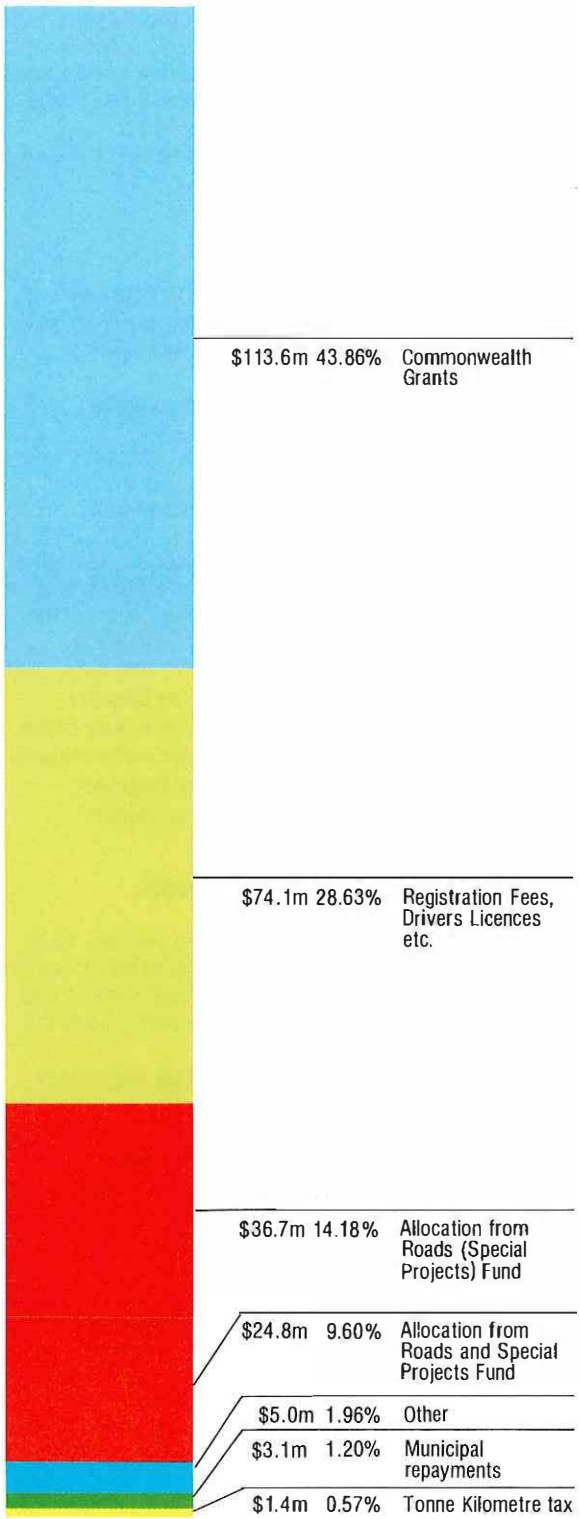
The Act provides for the Portland Grain Handling Improvement Authority to have five members, one being nominated by the Country Roads Board. The Board is also able under the Act to nominate a deputy member.
Mr W S Brake, Deputy Chairman of the Country Roads Board, has been appointed a member of the Portland Grain Handling Improvement Authority and Mr F G Lodge, the Board's Divisional Engineer, Warrnambool, has been appointed as deputy member.

State Employees Retirement Benefits Act 1979
This Act came into operation on 23rd January 1980 and enables superannuation benefits to be offered to approximately 2700 wages employees of the Board who were previously not eligible to contribute to the State Superannuation Scheme.
Further details of the Act are set out on page 50 of this Report.

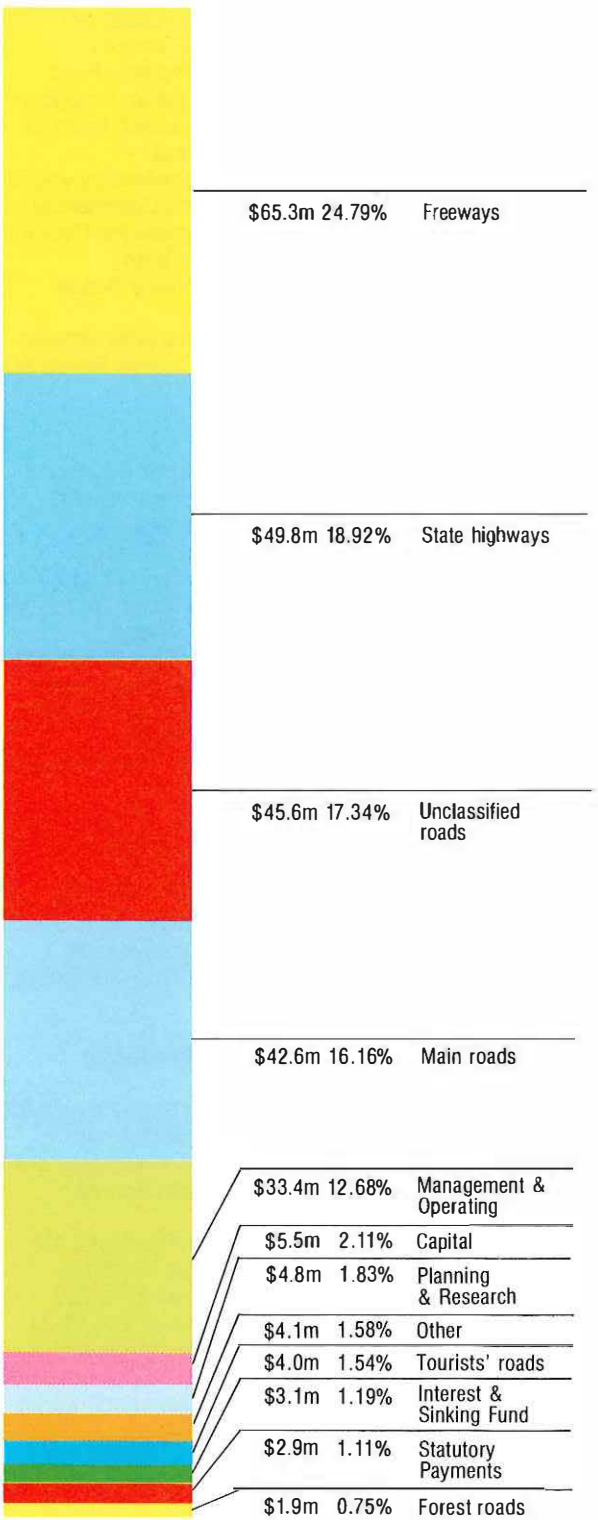
Commonwealth Roads Grants Act 1980
This Act, which came into operation on 1st July, 1980, provides for Commonwealth roads assistance to the States and to the Northern Territory for the 1980/81 financial year.
The Act replaces the States Grants (Roads) Act 1977 which provided for Commonwealth roads assistance for the three year period which ended on 30th June 1980.
Further details of the Act are set out on page 6 of this Report.

Finance

Receipts 1979-80



Payments 1979-80



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 $263,861,807-59. The funds were derived from:

State sources	145,388,833-78
Commonwealth sources	113,630,663-22
Balance brought forward from year 1978/79	4,842,310-59
Total	$263,861,807-59

The Board's receipts for 1979/80 were obtained from the following main sources:

State sources

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

2. Registration number plate fees.
Fees payable for the provision and/or replacement of number plates less the cost of providing the plates and collecting the fees.

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

4. Authorised log book fees.
Fees payable for the purchase of log books less the cost of providing the books and collecting the fees.

5. 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).

6. 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.

7. 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).

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

9. Motor driving instructors' licence fees.
One-quarter of the fees payable for the issue of motor driving instructors' licences less one-quarter of the cost 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).

10. 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 cost of collection of the fee.

11. 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 cost of collection of the fee.

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

13. A proportion of the revenue raised from licence fees issued under the Business Franchise (Petroleum Products) Act, 1979, paid into the Roads and Special Projects Fund.

14. All moneys received under Part II of the Commercial Goods Vehicles Act (tonne-kilometre tax). The tonne-kilometre tax ceased to operate from 1st July, 1979, however some moneys were received during the year for the period prior to 1st July, 1979.

15. Municipal payments on account of main road works.

16. Any special moneys appropriated by Parliament.

17. Loan money.

18. Allocation from the 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 1979/80 compared with 1978/79.

Item	1978/79	1979/80
Receipts from State sources	$	$
Fees under the Motor Car Act less cost of collection	78,570,895	74,147,911
Commercial Goods Vehicle Act	9,577,183	1,487,266
Municipalities contributions	2,955,935	3,111,588
State loan funds	325,000	300,000
Loan funds — Sec 31A CR Act 6229	1,000,000	1,200,000
Redeemed Investments		1,000,000
Special grant from State treasury	463,000	114,000
General receipts	2,194,451	2,478,111
Allocation from Roads (Special Projects) Fund	36,319,546	36,749,958
Transfer from Roads and Special Projects Fund		24,800,000
Balance brought forward at 1st July	1,587,490	4,097,352
	132,993,500	149,486,186
Receipts under Commonwealth grants for roads		
National highway	31,015,000	33,335,000
National commerce roads	3,341,000	5,977,000
Urban arterial roads	30,852,000	31,548,000
Urban local roads	4,628,000	4,200,000
Rural arterial roads	11,871,000	12,759,000
Rural local roads	20,321,000	21,841,000
Minor traffic engineering and road safety improvements	2,457,000	2,793,000
Balance brought forward at 1st July	215,677	744,959
	104,700,677	113,197,959
Traffic engineering and road safety	48,609	23,025
Receipts under Transport Planning & Research (Financial Assistance) Act 1977	1,118,500	1,154,638
Total funds available for expenditure by the Country Roads Board	238,861,286	263,861,808

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 1979/80 was $142,075,000.

Expenditure

Expenditure in the form of cash payments during the financial year amounted to $263,599,223 leaving a balance of $262,585 to be carried forward into financial year 1980/81.
The following table shows expenditure incurred by the Board including that from the Roads (Special Projects) Fund, in the years 1978/79 and 1979/80.

Item	1978/79	1979/80
	$	$
Construction and maintenance of roads and bridges	189,709,980	213,726,248
Capital expenditure (plant, workshops, offices, etc.)	3,756,467	5,553,677
Planning and research	3,722,626	4,839,450
Salaries operating accounts and other administrative expenditure	30,902,815	33,412,462
Statutory payments to Traffic Authority Fund, Transport Regulation Fund and Tourist Fund etc.	2,868,424	2,931,758
Interest and Sinking Fund payments	3,058,663	3,135,628
Total	234,018,975	263,599,223

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 1979 expenditure on the normal program of main roads works in financial year 1978/79 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	19,721,937
Expenditure from Commonwealth funds	9,607,178
Expenditure from proceeds of tonne/kilometre tax (Commercial Goods Vehicles Act)	7,014,986
	36,344,101
Amount of Country Roads Board Fund expenditure apportioned to councils	$2,982,673

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 1979/80 compared with 1978/79 was as follows:

	1978/79		1979/80	
	CRB	Council Contribution	CRB	Council Contribution
	$	$	$	$
Patrol maintenance	2,618,805	1,170,682	2,811,458	1,226,808
Construction, reconstruction and other maintenance	36,999,851	8,594,563	41,494,242	10,399,146
Total	39,618,656	9,765,245	44,305,700	11,625,954

Muncipal councils were not required to contribute towards the cost of works involving an expenditure during the year of $121,254,052 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 Description
7	Western Freeway — Construction of a four lane divided freeway west of Myrniong to east of Ballan.
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 new bridge at Trawool over the Goulburn River.
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 a multi-lane highway, between Hope Street and Settlement Road, Geelong.
57	Mornington Peninsula Freeway — Construction of a multi-lane freeway between Eel Race Drain, Seaford and Springvale Road, Keysborough.
58	Nepean Highway — Construction of a 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 a multi-lane highway between Hawthorn Road and Waverley Road, Malvern.
61	Western Highway — Construction of a 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 the Kiewa River.
70	Midland Highway — Improvements between Reef Hills and Barjarg south of Benalla.
71	Murray Valley Highway — Improvements between Wood Wood an Piangil.
72	Phillip Island Tourists' Road — Improvements between Anderson and Nobbies Road.
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.

Appendix 1 cont.

Project No.	Name and Description
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	West Gate 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.
85	Rathdowne Street, Carlton — Minor widening and construction of a median between Park Street and Victoria Street.
90	Princes Highway East — Construction of a four lane highway between east of Pakenham and east of Bunyip River including construction of various bridges.
91	Alexanders Road, Tramway Road, Old Melbourne Road — Improvement of roads on alternate route for quarry trucks to Loy Yang project between Quarry Road, Yallourn North and Firmans Lane.
92	Quarry Road — Reconstruction of various sections within the Shires of Morwell and Narracan to provide access to Yallourn North Quarry.
93	Princes Highway West — Undergrounding of State Rivers and Water Supply Commission channels adjacent to highway in Shire of Werribee.

Appendix 2

Motor registrations

Registrations under the Motor Car Act during 1979/80 totalled 2,355,987 an increase of 2.0% over the total for the previous year.

Vehicle	Financial year 1978/79		Financial year 1979/80		Increase
Private					
New	126,585		118,678		
Secondhand:					
Re-registered	57,702		57,896		
Renewed	1,515,604		1,556,504		
		1,699,891		1,733,078	33,187
Commercial and hire					
New	15,794		14,949		
Secondhand:					
Re-registered	5,907		5,704		
Renewed	134,698	156,399	137,153	157,806	1,407
Primary producers' trucks and tractors					
New	5,153		5,166		
Secondhand:					
Re-registered	3,167		3,394		
Renewed	78,912	87,232†	80,170	88,730*	1,498
Trailers		316,113		319,649	3,536
Motor Cycles		48,205		55,873	7,668
Licences under the Motor Omnibus Act		861		851	−10
Totals		*2,308,701*		*2,355,987*	*47,286*

† Includes 43,303 no-fee tractors * Includes 44,702 no-fee tractors

Appendix 3

Statement of receipts and payments

for year ended 30 June 1980 (Adjusted to nearest dollar)

		Country Roads Board Fund							
		Act 6229	Act 6222 Road Maint. A/C	State Loan Funds	Roads (Special Projects) Fund	States Grants (Roads) Act 1977	Transport Plan. & Res. (Fin. Asstance.) Act 1977	C'wealth Traffic & Road Safety Improvement Trust Account	Total $
Receipts									
Balance as at 1 July 1979		4,097,352				744,959			4,842,311
Motor Car Act 1958 (No. 6325)									
Motor Car Registration Fees	81,399,430								
Drivers Licence Fees	2,660,996								
Drivers Licence Testing Fees	485,255								
Trailer Registration Fees	2,385,619								
Learner Drivers Permit Fees	570,607								
Examiners Licence Fees	9,150								
Sale of Log Books	20,793								
Motor Driving Instructors Licence — Appointment and Testing Fees	1,530								
Motor Driving Instructors Licence Fees	12,390								
	87,545,770								
Less: Cost of Collection	13,397,859	74,147,911							74,147,911
Municipalities Contributions									
Permanent Works — Main Roads	129,340								
Maintenance Works — Main Roads	2,982,248	3,111,588							3,111,588
Fees — Commercial Goods Vehicles Act No. 6222 — Road Maintenance A/c			1,487,266						1,487,266
Transfer From Roads and Special Projects Fund		12,708,545	12,091,455						24,800,000
Transport Works and Services Act No. 9306		114,000							114,000
Fines — Country Roads Act No. 6229		10,362							10,362
General Receipts		2,467,749							2,467,749
State Loan Funds — Act No.9306				300,000					300,000
Loans — Act No. 6229 Sec 31A		1,200,000							1,200,000
Redeemed Investments		1,000,000							1,000,000
Allocation — Roads (Special Projects) Fund					36,749,958				36,749,958
Commonwealth Grants									145,388,834
States Grants (Roads) Act 1977						112,453,000			112,453,000
Transport Plan. & Res. (Fin. Asstce) Act 1977							1,154,638		1,154,638
Traffic & Road Safety Improvement								23,025	23,025
									113,630,663
		$98,857,507	13,578,721	300,000	36,749,958	113,197,959	1,154,638	23,025	263,861,808

Payments

Road Expenditure									
Main Roads	— Construction and Reconstruction	14,381,320		138,344	10,686,298	5,437	25,211,399		
	Maintenance	8,648,649	8,741,224				17,389,873	42,601,272	
State Highways	— Construction and Reconstruction	5,717,250	300,000	11,803,311	12,705,905	14,410	30,540,876		
	Maintenance	12,448,874	4,837,497		2,038,344		19,324,715	49,865,591	
Freeways	— Construction and Reconstruction	8,633,076		14,622,069	38,305,653		61,560,798		
	Maintenance	2,546,858			1,241,918		3,788,776	65,349,574	
Tourists' Roads	Construction and			464,134			1,		
							2	4,060,590	
Forest Roads	— Construction and Reconstruction	769,702					769,702		
	Maintenance	1,208,595					1,208,595	1,978,297	
Unclassified Roads	— Construction and Reconstruction	10,568,570		1,388,030	24,358,038	3,178	36,317,817		
	Maintenance	1,797,266			7,081,825		8,879,091		
Contribution to Melbourne & Metropolitan Tramways Board Tram Tracks Reconstruction		500,000					500,000	45,696,908	
Rail/Road Bridges Protection		438,584						438,584	
Metropolitan Bridges		12,708						12,708	
State Intersection Control (STATCON) Programme				946,495				946,495	
Murray River Bridges & Punts		636,180						636,180	
Traffic Line Marking		2,140,049						2,140,049	
								213,726,248	
Statutory Payments									
Interest and Sinking Fund — State Loans	3,020,648								
Interest and Loan Repayments — Board's Loans	109,980								
Sinking Fund Contribution — Act 6229 Sec. 31C	5,000								
Traffic Authority Fund	785,709								
Tourist Fund	1,571,418								
Transport Regulation Fund	574,631	6,067,386						6,067,386	
Planning & Research		3,684,812				1,154,638		4,839,450	
Capital Expenditure									
Plant Replacement and Additions	3,997,936								
Buildings, Workshops, etc.	1,555,741	5,553,677						5,553,677	
Management & Operating Expenditure		9,275,391		7,387,575	16,749,496			33,412,462	
		$98,594,921	13,578,721	300,000	36,749,958	113,197,959	1,154,638	23,025	263,599,223
Balance available to the Board as at 30 June 1980		$262,585							262,585

Auditor General's Certificate

The accounts of the Country Roads Board for the year ended 30th June 1980 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, 2nd October 1980

R. G. Cooper, Chief Accountant, 1st October 1980

Appendix 4

Loan Liability to the Government of Victoria

as at 30th June 1980

	Main Roads etc.	Developmental Roads	Total
	$	$	$
Permanent Works			
Main Roads	16,730,322.16		16,730,322.16
State Highways	19,904,304.20		19,904,304.20
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	756,792.88	585,820.95	1,342,613.83
Total Amount Borrowed	40,620,903.57	13,437,336.04	54,058,239.61
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	3,758,433.58		3,758,433.58
National Debt Sinking Fund	10,596,531.13	9,581,899.02	20,178,430.15
Consolidated Fund	80,179.27		80,179.27
	15,176,958.85	10,984,837.77	26,161,796.62
Loan Liability at 30 June 1980	25,443,944.72	2,452,498.27	27,896,442.99

Appendix 5

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	Date Raised	Maturity Date	Amount $
1.	State Insurance Office	Inscribed Stock	9.5%	30 March 1979	30 March 1989	500,000
3.	State Insurance Office	Inscribed Stock	10.8%	31 Jan. 1980	31 Jan. 1990	500,000
5.	The National Bank Savings Bank Limited	Inscribed Stock	9.3%	15 June 1979	15 June 1994	500,000
6.	The National Bank Savings Bank Limited	Inscribed Stock	12.6%	13 June 1980	13 June 1990	700,000

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

Invested with	Type of Investment	Interest Rate	Date Invested	Maturity Date	Amount $
State Electricity Commission of Victoria	Inscribed Stock	10.5%	1 Dec. 1979	1 Dec. 1989	5,000
State Electricity Commission of Victoria	Inscribed Stock	10.9%	1 March 1980	1 March 1990	2,500

Appendix 6

Works executed on behalf of Commonwealth and State Government Authorities

for the year ended 30th June 1980 (Adjusted to nearest dollar)

Departments	Description of Works	Expenditure	
Commonwealth			
Department of Housing and Construction	Access roads to various Commonwealth establishments		3,530
Victoria			
Melbourne and Metropolitan Board of Works	Roadworks in connection with Cardinia Reservoir	CR 25,010	
Melbourne and Metropolitan Tramways Board	Roadworks associated with the East Burwood Tramway Extension	269,544	
Ministry of Tourism	Additional snow clearing on the Alpine Road to Mt Hotham	30,441	
Ministry of Transport	Grade separated level crossing projects, etc., charged to the Transport Fund	5,458,648	
Ministry of Transport	Grade separated pedestrian crossings charged to State Treasury, Municipalities and Transport Fund	18,705	
Port of Melbourne Authority	Repairs to upgrade the structure of Centenary Bridge, Port Melbourne	377,701	
Premier's Department	Roadworks in connection with Wonderland and Sundial Roads, Stawell Shire	300	
Rural Finance and Settlement Commission	Construction of access road to Palpara Estate	30,860	
State Electricity Commission	Roadworks to enable the movement of heavy loads to Loy Yang power station	602,181	
State Rivers and Water Supply Commission	Construction of service culvert, Berwick By-Pass Project	100,000	6,863,370
State Treasury	Improvements to various roads adjacent to State Forests to facilitate the extraction of timber and charged to Municipalities Forest Roads Improvement Fund	87,477	
State Treasury	Restoration works on roads and bridges damaged by floods	731,893	
State Treasury	Works and Services — Construction of Pedestrian Overpass at Nepean Highway/Spink Street Elsternwick	28,895	848,265
			$7,715,165

Engineer in Chief's Report

Country Roads Board
Melbourne

The Chairman

I submit herewith my Report for 1979/80. 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

The Road Inventory System — progress with 'Crisp'

Road structure and intersection data collected by the Board on arterial roads since 1972 has been formed into a computer-based information bank, with data being continually revised through the Board's Continual Road Inventory Survey Program (CRISP). This program provides for updating of information both from office records as changes occur in the road network and from a rolling program of surveys (using an instrumented road inventory vehicle) to check the validity of the data currently stored, particularly with respect to intersections where there have been many changes effected by the installation of traffic signals and other traffic management measures in recent years. It is envisaged that the inventory vehicle will in future be used to systematically collect travel time and pavement and surface condition information in addition to geometric information.

All data are now stored in the format of the NAASRA Data Bank System for use with the NAASRA Road Planning Model (NIMPAC) to examine the consequences of various roading strategies. In addition, other computer systems currently nearing completion will enable a much faster response to queries concerning the past and present state of the arterial road network.

Route E6 Environment Effects Statement

The 1954 Metropolitan Planning Scheme for Melbourne included a main road reservation along land in Kew and Camberwell between Princess Street and Canterbury Road which previously was occupied by the Outer Circle Railway. In 1969, the Metropolitan Transportation Plan provided for a freeway generally along this reservation, however in March 1973 the Premier announced that construction of this freeway "would not now proceed."

In investigations for the Eastern Freeway, alternative forms of road facility providing an approach road to the freeway along part of this reservation were examined in consultation with the Kew City Council. The proposal then adopted provided for a grade separated four-lane divided road between the Eastern Freeway and Harp Road, Kew.

By May 1979, because of growing doubts about the proposal, a number of submissions were made to the Minister of Transport and the Minister for Conservation requesting a review in the form of an Environment Effects Statement. As a result, in September 1979 the Board was directed to prepare an Environment Effects Statement in accordance with Ministry for Conservation guidelines.

Preparation of this statement has been the responsibility of the Board's Environmental Studies Section. The study team prepared plans of a series of alternatives. Information was collected concerning a wide range of relevant factors, including traffic noise, open space, and landscape quality, as well as sociological data.

In order to collect this information and to keep the community informed a variety of methods were adopted to ensure community participation in the study processes. In October 1979, the first of a series of Study Bulletins was distributed to householders throughout the study area, to local Members of Parliament, councils, relevant authorities, and interested community groups. This bulletin described the purpose of the study and informed people how they might participate. Some people telephoned members of the study team with their comments, others wrote letters or visited the study office to talk with members of the study team.

In February 1980, a second bulletin was issued announcing the venue for the public display of the alternative road proposals. This display was held in a local church hall, and was attended by approximately six hundred people over a period of two weeks. Members of the study team were present at all times to answer queries.

The public display presented information about the detailed process of investigation and assessment undertaken up to that time. The various maps and charts included, for example, information about the community facilities in the area, the present traffic conditions and problems, traffic origins and destinations, six alternative proposals, future traffic volumes, and an explanation of traffic noise terms. Sheets were also provided for public comment.

Group discussions were also used to obtain community participation, and these provided opportunities for residents to discuss planning issues with members of the study team. Usually no more than about ten residents gathered in a neighbour's home and were joined by two members of the study team, one a sociologist and the other an engineer. Group discussion also provided opportunities for members of the study team to find out the important issues related to the quality of life of the residents. Altogether, fourteen group discussions were held between November 1979 and March 1980.

By March 1980, analysis of all the information gathered began, as well as the assessment of all public comment. In June 1980, the third study bulletin was distributed with information about a new alternative, the study objectives and the public display and comment.

The Environment Effects Statement is expected to be submitted to the Ministry for Conservation by late 1980. The Ministry will then arrange for the statement to be exhibited publicly and comment to be sought. The Ministry for Conservation will then prepare an assessment of the environmental effects of the alternative proposals for consideration by the State Government.

Nepean Highway widening — A study of the social effects of displacement

The widening of 6 km of the Nepean Highway between Cochrane Street, Elsternwick and South Road, Moorabbin has required the acquisition of over three hundred homes. Many homes have been purchased on the grounds of hardship before being required for roadwork. In other cases, homes were obtained by compulsory acquisition. The Board has carried out studies to ascertain the social effects associated with the displacement of people from their homes by this project.

Between April 1977 and May 1978, interviews were conducted with group of 33 families. One or two years after relocation, 25 of these families were interviewed again. The time lapse between the two interviews was planned with the assumption that the individuals would be sufficiently settled in their new environment for comparisons to be made with the previous environment. The sample of people involved in the study included elderly people, older people whose children have left home, young to middle-age families with children at home, and young married couples. All the families had been in their previous residences long enough to be strongly attached to their homes, and to have established social ties in the area.

The elderly people ranged in ages from 60 to 80 years and relocation brought distress and problems that appeared insurmountable to some, particularly when the experience of moving from a familiar environment and resettling into a new environment was compounded by ill-health, widowhood, or retirement. On the other hand, relocation presented several elderly families with a challenge and an opportunity for new experiences such as accommodation in smaller modern units or retirement to new homes in seaside townships.

To some of the late middle aged and older, long-term families who had their grown-up children about them, relocation appeared to have had negligible effects. They adjusted to their new environment, partly because of their children's support, and partly because they were physically and socially active. Relocation involved having to arrange the new home to suit their life style. Several families missed the contact with their former neighbours and shopkeepers.

Six of the families had children at home, and most had relocated in the general vicinity of their previous residences so that their children's schooling would not be disrupted. Some of these families preferred their new neighbourhood.

The three young couples in the sample were not altogether disadvantaged by forced relocation. Like many young couples, they considered their house as a "stepping stone" to other things.

The interviews confirmed the expectation that a change in home to a location further away from the place of work would not be regarded as a major problem. Most families did not consider the cost of everyday living expenses to have increased because of relocation.

Some families had to wait for purchase of their homes to be settled before looking for a new home because they did not possess the finance. According to these families, this period of waiting resulted in emotional strain. Several families from the older age group believed that they did not have sufficient time to carefully consider a suitable replacement property and would have appreciated assistance in this procedure.

The study confirmed that, while the effects of relocation were detrimental to some people, the majority welcomed or were not critical of the change.

South Eastern Freeway: Malvern Section Landscape concept

Following government approval of the recommendations of Gardiners Creek Valley Study that a freeway be provided between Mulgrave Freeway and the South Eastern Freeway, Board personnel prepared functional plans as a basis for amendment of the Melbourne Metropolitan Planning Scheme. As part of this work, a conceptual plan was prepared for landscaping the valley in conjunction with the freeway.

Previous studies on possible open space improvements were taken into consideration, and the Malvern, Camberwell and Hawthorn City Councils were consulted to determine their views on open space development in and near the valley.

As Malvern golf course was affected by the route, golf-course consultants were appointed to prepare conceptual plans for an altered course in the same general location.

The landscape concept demonstrated that the opportunity exists to retain and improve the visual appeal and to enhance the recreation facilities of the Gardiners Creek Valley alongside the freeway.

The landscape concept also includes visual and aural screening of homes close to the freeway, while more open views from the new freeway to the parklike areas of the valley are retained.

Improvements in road construction practice

During the year, an appraisal was made of design features, specification requirements, construction practices and quality control standards, as a result of which many practices have been modified.
The major change in road design practice has been the provision of subsoil drainage systems in pavements on all major facilities. Design traffic loading has been carefully assessed with proper allowance for actual growth factors and the composition and characteristics of traffic.
Specifications for pavement materials and for pavement construction have been proven by the construction and testing of trial sections to ensure satisfactory performance before major construction has been undertaken.
Provisional standards have been adopted for the minimum frequency of testing of road construction works. These standards are for normal use, but the frequency of testing is increased when critical phases of work are being undertaken or where special problems develop. The provisional standards are as follows:

Standard A
To be used for all large sized roadworks with full time testing staff, estimated to incur expenditure in excess of $1 million per annum and projects of critical importance.

Material or Component	Lot Size	Frequency of Testing	
		Density Tests	Classification Tests*
Fill	2000-10000m³	Six per lot	At start of use of each significant material type and then as necessary
Selected Fill			
or Subgrade	4000-12000m²	Six per lot	One test unless variable
Sub-base	3000-15000m²	Six per lot	Six per lot
Base	1500-8000m²	Six per lot	Six per lot
Loose Pavement Material			Six per lot of 1000t**

* "Museum samples" should be held on site for each material type.
** Six sieving tests per day plus Sand Equivalent or Linear Shrinkage tests depending on material and on full classification test.

Standard B
To be used for medium sized works estimated to cost between $250,000 and $1 million.

Frequency of testing
Earthworks — at least one day per week with an experienced Experimental Officer.
Pavement Construction — at least one day per week with an experienced Experimental Officer.

Amount of testing
It is expected that in one day on site, an experienced Experimental Officer would complete six density tests and take up to six samples for grading and Atterberg Limit testing.
The day on which testing is carried out should be selected at random so far as conditions permit. Lot testing would be preferred as this permits a measure of the variability of the work to be obtained. If there is any doubt as to the homogeneity of the lot because of variations in weather, or placing methods etc., then each result should be viewed independently.

Standard C
To be used for small sized works estimated to cost between $50,000 and $250,000.

Frequency of testing

Earthworks	— As requested.
Pavement Construction	— At least one day per fortnight with an experienced Experimental Officer when pavement materials are of uniform quality.

Standard D
To be used for minor works estimated to cost up to $50,000.

Frequency of Testing

No procedure is specified but it would be expected that pavement material quality will be assessed by testing prior to the work commencing and that testing will be undertaken as needed, to check density and quality of the pavement construction in place.

Provisional standards have also been issued for the acceptance of construction by statistical interpretation of density test results. These standards ensure that not only is acceptable density achieved, but that the compaction standard achieved is reasonably uniform. The standards recognise however that a proportion of a given area of pavement may have a compacted density less than the nominated density. It has been found in practice to date that a limit of 20 per cent of test results below the nominated density aim provides a satisfactory basis for statistical control and ensures satisfactory performance of pavements.

In this procedure, density tests are carried out on an area on pavement termed a *lot*, considered by the engineer to be homogeneous in terms of material quality and compaction processing. The number of tests taken in a lot is usually six for conventional density testing and ten for testing with a nuclear gauge. The mean ($\bar{X}$) and standard deviation (S) of the test results for the lot are calculated. The specification requirement is expressed in the form —

$$L_T = \bar{X} - k_{\phi}S \geq L \text{ where}$$

L_T is the 'characteristic value of relative compaction' for the lot, and L is the specification limit.

As indicated above, this requirement means that the uniformity of compaction is as important as the average level of compaction if the acceptance criterion is to be met.

The multiplier k_{ϕ} in this equation is dependent on the number of test results taken in the lot and the percentage ϕ is the nominated percentage (approximately 20 per cent adopted in these Board procedures) of the entire population of test values that could be obtained from the test area which would fall below the specification limit L.

If testing capacity does not permit testing of each day's work, then intermittent testing of one day's work as a lot is preferred to one or two individual tests on each of several successive days. The standards of acceptance which have been adopted are summarized in Table 1.

Although testing of materials and construction quality is seen as an essential aid in making judgements about the quality of works, it is not enough to depend only on the results of testing. Supervisory personnel have been instructed to ensure—

- that all works are regularly and carefully inspected to identify any incorrect practices or unsound sections,
- that work is test rolled in accordance with the provisions of standard specifications,
- that specimen samples of materials which have been approved for use should be held available on all works as an aid to visual checking of the quality of materials supplied.

Table 1
A. Earthworks

Situation	Standard Proposed		Action proposed based on lot test results	
	Depth	Acceptance criteria based on laboratory "standard" compaction test	Standard	Action
1 Minor Works	Top 150 mm of subgrade in cutting and filling within 0.5 m of finished subgrade levels	Mean 100% minimum	≥ 100.0% 98.0-99.9% < 98.0%	A B D
	Balance of earthworks, including top 150 mm of areas under fills	Mean 95% minimum	≥ 95.0% 93.0-94.9% < 93.0%	A B D
2 Medium Works e.g. Important undivided arterial and subarterial construction	Top 150 mm of subgrade in cutting and filling within 0.5 m of sub-grade level	$\bar{X} - k_{\varnothing}S \geq 98\%$	≥ 98.0% 96.5-97.9% < 96.5%	A B D
	Lower 1 m of deep fills on poor ground	$\bar{X} - k_{\varnothing}S \geq 93.\%$	≥ 93.0% < 93.0%	A D
	Balance of earth-works, including top 150 mm of areas under fills	$\bar{X} - k_{\varnothing}S \geq 95\%$	≥ 95.0% 93.5-94.9% < 93.5%	A B D
3 Major Works e.g. Freeway or divided carriageway construction	Top 150 mm of subgrade in cutting and filling within 0.5 m of sub-grade level	$\bar{X} - k_{\varnothing}S \geq 99\%$	≥ 99.0% 98.0-98.9% < 98.0%	A B D
	Lower 1 m of deep fills on poor ground	$\bar{X} - k_{\varnothing}S \geq 95\%$	≥ 95.0% < 95.0%	A D
	Balance of earthworks, including top 150 mm of areas under fills	$\bar{X} - k_{\varnothing}S \geq 98\%$	≥ 98.0% 97.0-97.9% < 97.0%	A B D

$\bar{X}$ = Mean relative compaction
S = Standard deviation of relative compaction
$k_{\varnothing}$ = Multiplier k for various maximum allowable percentages ø outside the specified limit. k varies with the number of tests in the lot.

A = Accept
B = Re-roll; no re-test
C = Re-roll, re-test
D = Rip, re-work and re-test

B. Crushed rock and gravel base/subbase and select fill subbase

Situation	Standard Proposed		Action proposed based on lot test results	
	Depth	Acceptance criteria based on laboratory "modified" or "vibratory" compaction test	Standard	Action
1 Minor Works	Base or top 150 mm of granular pavement	Mean 100% minimum	⩾ 100.0% 98.0-99.9% < 98.0%	A B D
	Remainder	Mean 98% minimum	⩾ 98.0% 96.0-97.9% < 96.0%	A B D
2 Medium Works e.g. Important undivided arterial and sub-arterial construction	Base	$\bar{X} - k_{\phi}S \geqslant 98\%$	⩾ 98.0% 97.0-97.9% 96.0-96.9% < 96.0%	A B C D
	Subbase	$\bar{X} - k_{\phi}S \geqslant 97\%$	⩾ 97.0% 96.0-96.9% 95.0-95.9% < 95.0%	A B C D
3 Major Works e.g. Freeway or divided carriageway construction	Base : (a) Top 100 mm opening with surface seal	$\bar{X} - k_{\phi}S \geqslant 100\%$	⩾ 100.0% 99.0-99.9% 98.0-98.9% < 98.0%	A B C D
	(b) Balance	$\bar{X} - k_{\phi}S \geqslant 99\%$	⩾ 99.0% 98.0-98.9% 97.0-97.9% < 97.0%	A B C D
	Subbase	$\bar{X} - k_{\phi}S \geqslant 98\%$	⩾ 98.0% 97.0-97.9% 96.0-96.9% < 96.0%	A B C D

$\bar{X}$ = Mean relative compaction
S = Standard deviation of relative compaction
k_{ϕ} = Multiplier k for various maximum allowable percentages ø outside the specified limit. k varies with number of tests in the lot

A = Accept
B = Re-roll, no re-test
C = Re-roll, re-test
D = Rip, re-work and re-test

C. Asphalt

Situation	Standard Proposed		Action proposed based on lot test results
	Depth	Acceptance criteria based on "Marshall" test	
1 Minor Works e.g. Very minor Board works (say, less than 100 tonnes per day) and municipal subdivisional work	⩽ 50 mm > 50 mm	Mean 94% minimum Mean 96% minimum	Pay at 100% schedule rate if the lot value equals or exceeds the specified value reducing at a uniform rate to 70% payment at 90% of relative compaction
2 Balance e.g. Covering all medium to heavy traffic situations and the majority of the Board's asphalt work	< 30 mm 30-50 mm > 50 mm	Mean 94% minimum $\bar{X} - k_{\phi}S \geqslant 93\%$ $\bar{X} - k_{\phi}S \geqslant 95\%$	Pay at 100% schedule rate if the lot value equals or exceeds the specified value reducing al a uniform rate to 70% payment at 90% of relative compaction

Notes :

1. In the case of asphalt the Engineer may elect not to do density tests for work of a minor nature, for hand placed areas, for regulation areas and on tapered sections where the depth falls below twice the nominal mix size, provided all reasonable care has been taken with compaction.
2. Number of tests per lot shall be generally in accordance with the following:

	Cores	Nuclear Gauge
Minor Works	3	5
Medium and Major Works	6	10

3. The following values of the multiplier k_p shall be used:
   6 tests per lot = 0.92
   10 tests per lot = 0.88
4. The Engineer shall insert in the specification which method of acceptance of compaction is to apply to the particular contract.

Revised flexible pavement design procedure

The Board's pavement design procedures for flexible pavements were published in 1969 in Technical Bulletin 26. The document provided one set of design curves for granular pavements with a surface seal and a second set of design curves for pavements to be surfaced with asphalt. In both cases the design process involved assigning a strength to the subgrade in terms of California Bearing Ratio (CBR) and estimating the daily commercial traffic at the end of the design period.

Revised procedures for pavement design have been approved for publication and include the following features:

- ☐ design curves for surface sealed pavements, asphalt surfaced pavements and for deep strength and full depth asphalt pavements
- ☐ subgrade strength evaluation in terms of CBR
- ☐ adoption of any design period and estimation of the number of Equivalent Standard Axles (ESA) to load the pavement in the design period
- ☐ a design check to apply when the application of an asphalt wearing course is delayed for a period
- ☐ a procedure for a design of pavement resheeting

Limitations of Technical Bulletin 26

The design procedures of Technical Bulletin 26 have been judged to give adequate pavement thicknesses when an adequate evaluation of subgrade strength and design traffic loading is carried out. The new design procedures use the existing relationship between CBR, traffic and pavement depth.

Some of the limitations of Technical Bulletin 26 were identified as follows:

- ☐ The design curves were for a notional 20-year design period and it would be better to select a design period appropriate to the particular facility, e.g. freeway 40 years, farm access road 15 years.
- ☐ While the CBR design procedure relates to the deformation and distress that occurs under cumulative repetitions of traffic loading the use of traffic groupings obscured this fact.
- ☐ The procedures did not differentiate between the types of commercial vehicles on different classes of roads, e.g. one commercial vehicle (cv) on the Hume Highway = 1.6 ESA while 1 cv on a residential street = 0.2 ESA.
- ☐ There was no design procedure for deep strength and full depth asphalt.

The revised pavement design procedures

The principal features of the new procedures are as follows —

Subgrade Strength

As with the previous procedures the revised method requires that a design strength be assigned to the subgrade. This is an estimate of the insitu CBR under the pavement in the weakest soils along each segment of the road in the wettest seasonal conditions. The procedures describe the various methods of estimating or measuring CBR and the selection of the design CBR.

As design thickness is very sensitive to changes in CBR, this remains the most important step in the procedures.

Design Period

The new procedures introduce the concept of design period which is the number of years of service sought from the pavement before rehabilitation would be required to correct pavement distress or loss of shape.

Routine maintenance including surface resealing is essential during the design period which does not equate with a "maintenance free" state.

Design Traffic Loading (DTL)

The DTL used in the procedures is an estimate of the number of ESAs that will pass over the pavement in *one direction* during the design period. The estimation of DTL requires consideration of the following factors:

- ☐ present commercial traffic volume
- ☐ present commercial traffic vehicle types and masses
- ☐ commercial traffic growth
- ☐ road capacity

Design thickness is not highly sensitive to errors in traffic prediction and for a given design CBR a doubling in traffic load results only in a 10 percent increase in pavement thickness. Conversely, a 10 per cent reduction in thickness due to error in design would result in a reduction in design loading and hence the design period to half that intended.

Minimum Base and Subbase Thicknesses

The concept of providing minimum thicknesses of base and subbase quality materials for asphalt surfaced pavements and minimum thicknesses of base quality for surface sealed roads is maintained. It is accepted that in regions where the stipulated base quality materials are not available lesser quality materials will continue to be used but a reduced level of performance could be expected in those situations.

Asphalt or Surface Seal

If asphalt surfacing is planned in the early pavement life, the appropriate design charts for an asphalt surfaced pavement must be used. These specify the thickness of asphalt, base and subbase which must be used to provide a pavement of sufficient stiffness to prevent such surface deflection under load as could lead to fatigue failure of the asphalt. Conversely, if the pavement is designed in accordance with the charts provided for surface sealed pavements, no assurance is given that the stiffness of the pavement will be adequate to avoid fatigue failure early in the life of asphalt surfacing of moderate thickness. If this second approach to design is used, it becomes mandatory to carry out a surface deflection survey before designing an asphalt overlay.

Asphalt Surfacing Thickness

The procedures provide that for any particular subgrade CBR and traffic loading only *one* asphalt surfacing thickness is given. The selection of any other thickness falls outside of the scope of the procedures.

Delayed Asphalt Wearing Surface

A procedure is provided to check on the length of time that the asphalt wearing surface may be delayed before undesirable effects on pavement performance become a matter for consideration.

Deep Strength and Full Depth Asphalt Pavements

Design charts are provided for deep strength and full depth asphalt pavements based on the presently used equivalencies. These provide that an asphalt surfaced pavement design can be converted to an equivalent asphalt pavement by the following procedure:

☐ *Asphalt Surfacing*

Convert 1 unit of thickness of asphalt surfacing to 1 unit thickness of asphalt base

☐ *Granular Base*

Convert 2 units of granular base to 1 unit of asphalt.

☐ *Granular Subbase*

Convert 3 units of granular subbase to 1 unit of asphalt.

Pavement Resheeting

Procedures which can be followed for the design of pavement resheeting include some guidelines to the diagnosis of the cause of existing pavement distress. Diagnosis is required so that an appropriate rehabilitation treatment can be selected.
The procedures provide that in some situations a granular resheet thickness may be selected on the basis of a surface deflection survey of the existing pavement.

The revised pavement design procedures provide pavement thickness designs that are essentially the same as the previous Technical Bulletin 26 if the same assumptions on design period and traffic loading are made. The new procedures, however, require that consideration be given to the design period for which the facility is required to serve before rehabilitation and also to the repetitions of traffic loading in that design period.
In addition to obliging the designer to better consider and evaluate these design parameters, the procedures also aim to ensure that adequate consideration is given to the factors influencing the choice between asphalt and surface sealed pavements.
The general principles of the revised procedures have been incorporated into new pavement designs and reviews of designs carried out in recent years.

Drainage and pavement design for a difficult site

The Wallace to Bungaree Section of the Western Freeway is located in poorly drained country comprising red volcanic soils overlying water-bearing lava flows. The waterbearing lava varies from dense to tuffaceous vesicular basalts to jointed basalts. The red volcanic soils are shallow and investigations and early site works showed free ground water two to three metres below natural surfaces with the soils above the water-table dampened by capillary action.

Open trenches failed to dewater the damp zone indicating that longitudinal subsoil drains would have to be deep and closely spaced to lower the water-table. Where practicable, the gradeline of the freeway was raised to minimize the risk of long term pavement problems due to ground water conditions, but some cuttings were inevitable and presented difficulties.

For these conditions, it was decided that the pavement should be designed with a base of low permeability to prevent the ingress of surface water, a subbase of medium permeability, and a free draining blanket drain to shed groundwater and condensation resulting from water-tables with a high capillary rise.

Because capillary rise of moisture would in time moisten and weaken the subgrade and subbase, a pavement thickness of 760 mm was required over subgrades with soaked CBR values of 2 to 3.

In cuttings, a blanket drain has been provided to protect the pavement. This comprised a 60 mm layer of coarse sand and then 200 mm of size 20 open graded crushed basalt filter. The open graded rock was partly compacted and then confined with the first layer of subbase. Crushed rock subbase of 20 mm maximum size and grading close to n= 0.45 maximum density curve was used as subbase. Transverse sand filter drains 300 x 150 mm were constructed at 20 m spacings to intercept seepage down the freeway grade. The blanket drain was connected to a longitudinal pavement subsoil drain (see Figure 1).

The base layer comprised 200 mm of 20 mm crushed basalt with 5% crusher dust added. After compaction, the grading approached the upper limit of a n = 0.45 maximum density envelope.

Permeability of the base was low with a coefficient of permeability of the order of 5×10^{-5} cm/sec, while that of the subbase was 5×10^{-4} cm/sec.

A section of carriageway 2 km long was built to this specification and opened to two-way highway traffic in the autumn of 1980. Before opening, the base was sealed with a size 10 primer seal which will be followed by a size 13 reseal after nine months of traffic. Piezometers were installed to measure movements in groundwater levels, and a close check is being kept on blanket drain and subsoil drainage during the trial period, and especially in the winter and spring of 1980.

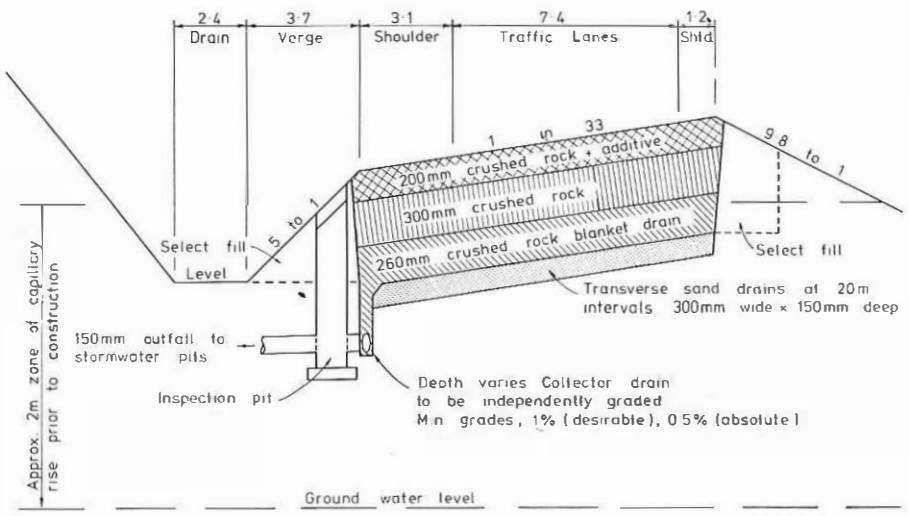


Figure 1: Typical cross section in culling of the Western Freeway (Wallace to Bungaree).

Modification of design and survey practices to facilitate the use of the Autograde

To facilitate the use of the Autograde in the construction of the rural freeway pavements, survey and design practices have been modified, or are being modified to simplify construction setting out and control.

The Autograde trims, or spreads, to the designed line and level by operating from a string line, usually established on the median side of the carriageway, and by using a crossfall control device. Where the crossfall is variable (e.g. in superelevation transition areas) string lines are established on both sides of the carriageway and the crossfall device is disengaged.

The following survey procedures have been adopted to enable string lines to be set and checked quickly and accurately (see Figure 2)—

☐ Control points are set up outside the limit of stripping for complete job control at approximately 200 m intervals.

☐ A particular offset for the proposed string line from the edge of carriageway is selected — usually 1.5 m.

☐ Control points are set on the proposed string line by radiations from the job control points or other established points.

☐ Points on the string line are then located at 10 m intervals by radiation from the string line control points. A check on the position of these points is available by measuring the chord distance between these points which is constant for circular arc or tangent sections. 'Eyeing' the line is a check for gross errors.

☐ Pegs (usually steel rods) are then set to projected crossfall level on this string line by normal levelling procedures.

☐ The peg levels are then independently checked before setting up the string line at a predetermined height above the pegs.

The advantage of using the string line control point for setting out rather than the job control point is that the terrain is relatively unobstructed in the median and on the verges of the freeway formation and measurements up or down batters or around stockpiles are avoided. Also, small errors of measurement longitudinally have little effect on the transverse position of the string line, whereas an error in the substantially transverse measurements from the job control points could result in a noticeable deviation of the string line.

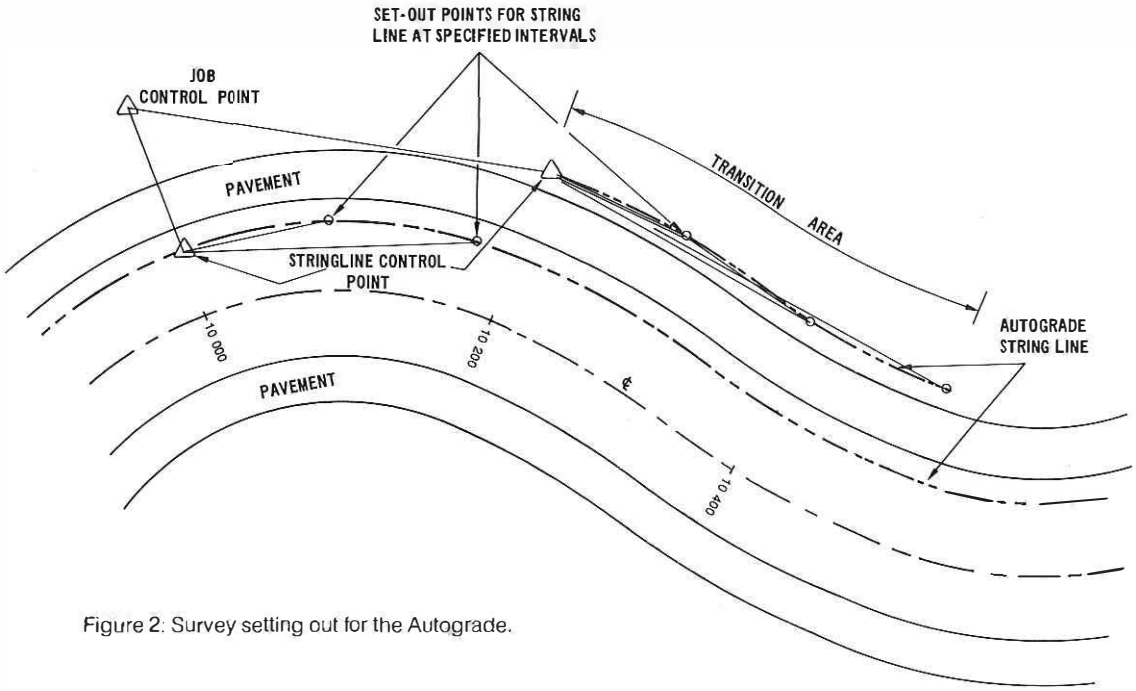


Figure 2. Survey setting out for the Autograde.

A computer program "Autograde Set Out" has been developed to facilitate the calculation of radiation angles, chord lengths and levels needed under the above procedures.
The program is designed to be compatible with the 'RIDGE' system and operate on HALO and DRM files generated in the normal course of design.

Reinforced earth

The Board is constructing bridges over the railway at the northern end of La Trobe Terrace in the Cities of Geelong and Geelong West, in conjunction with upgrading La Trobe Terrace southerly to Fyans Street.
The northern and southern approaches to the bridges have been built using reinforced earth construction (see Figure 3). This is the first application of the reinforced earth concept in Victoria, although it has been used quite extensively overseas and in other States. The concept was developed in France, and is subject to patents registered in Australia.
Preliminary investigation of alternative structural systems for the retaining walls at La Trobe Terrace indicated that approximate savings of $0.25 million and $0.65 million could be achieved by adoption of reinforced earth construction as compared with embankments retained by conventional reinforced concrete walls or crib walls respectively; the actual cost of the total area of walls constructed (2180 sq. metres) was approximately $0.76 million compared with the initial estimate of $0.85 million.
The reinforced earth construction comprises an earthen embankment reinforced with galvanized steel strips placed horizontally in layers at intervals of height of around 750 mm; the outer faces of the embankment are retained and protected by vertical interlocking concrete panels bolted to the galvanised steel strips. The interlocking concrete panels and the galvanized steel strips are placed progressively as the construction of the embankment proceeds.
Under the action of vertical loading, the reinforcing strips resist the horizontal expansion or dilation of the soil mass. The restraint to horizontal expansion relies upon the friction between the soil and the reinforcing strips and the tensile strength of the strips.
The model of reinforced earth behaviour currently used for design is called the 'coherent gravity structure' model (see Figure 4), which assumes that the mass of reinforced earth behaves as a composite block. The tensile stresses in the reinforcing strips vary along their length and are at a maximum value some distance behind the wall. The locus of the

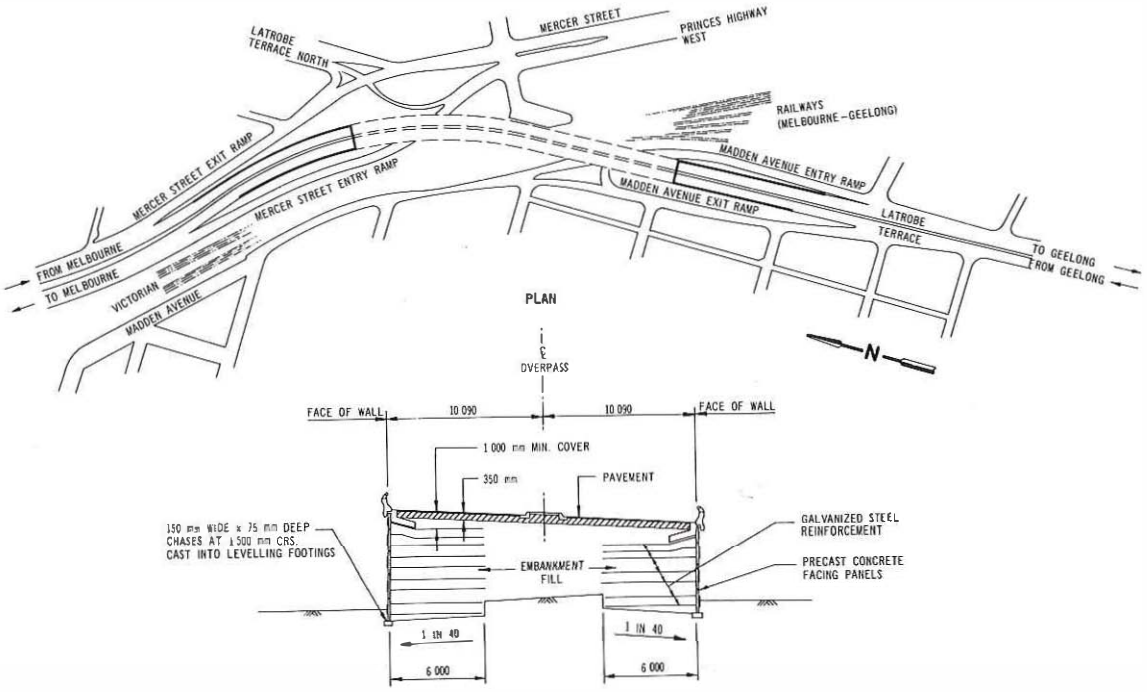


Figure 3

points of maximum strip tension defines two zones within the structure — viz. the active zone close to the face with shearing forces directed outwards, and the resisting zone where the shearing forces are directed inwards (see Figure 5).

The earth fill for reinforced earth construction must comply with specific criteria aimed at ensuring stability of the reinforced earth block and limiting corrosion of the reinforcing strips. Coarse grained soils which derive strength from interparticle friction are preferred for construction of reinforced earth embankments. The free-draining characteristics of coarse grained soils also ensure that pore pressure does not develop during construction, with the possibility of reduced friction on the strips and instability. Fine grained materials are not suitable because of possible short term instability and creep effects which could result in post-construction movements and settlements.

Fill material for reinforced earth construction must comply with the following criteria:

- less than 15% (by weight) passing 80 micron sieve (plain strip), or less than 15% (by weight) passing 15 micron sieve (ribbed strip)
- not more than 25% (by weight) larger than 150 mm
- no particles larger than 350 mm
- pH between 5 and 10
- not more than 200 ppm of chlorides
- not more than 1,000 ppm of sulphates
- minimum resistivity of saturated sample 3,000 ohm cm

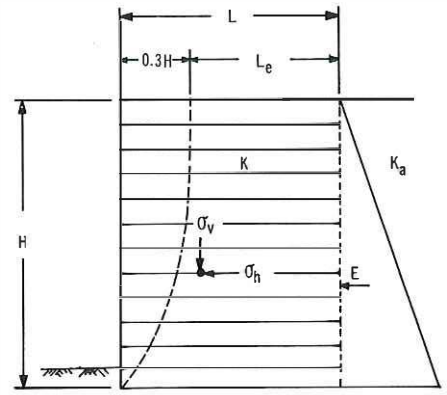
Filling materials investigated for the La Trobe Terrace project included crushed basalt, granitic sand, scoria, quartz sands and gravels, ironstone gravel, sandy limestone, and dune sand. Crushed scoria of 40 mm maximum size from Anakie was selected as the only material available in sufficient quantities at reasonable cost capable of meeting the specified requirements.

The reinforcing strips used were galvanized mild steel ribbed strips 40 mm or 60 mm wide with lengths ranging from 4.5 m to 7.5 m. To minimise the risks of electro-chemical corrosion, clearance of not less than 150 mm was provided between adjoining strips.

The fascia panels used in the walls at La Trobe Terrace are reinforced concrete sections of cruciform shape, with overall dimensions of 1500 mm x 1500 mm x 180 mm thick and approximately 1 tonne mass. Galvanized steel connectors protrude from the inside face to connect to the reinforcing strips.

An exposed aggregate (Werribee basalt) finish has been provided to match the finish on the cast-in-place bridge piers.

The reinforced earth approaches including walls were constructed by a direct labour road construction gang. On average over the period of the work, 30 wall panels were erected each day, with a maximum of 78 panels in one day. Scoria filling was placed at an average rate of 300 m³ loose per day. The approaches were completed in a period of six months, approximately one half of the period which would have been required for construction of conventional retaining walls or crib walls.



COHERENT GRAVITY STRUCTURE HYPOTHESIS

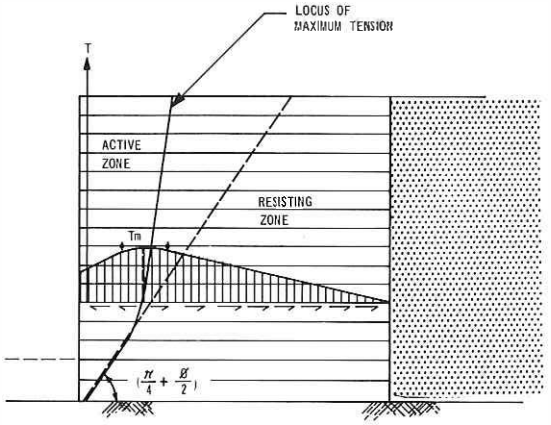
$\sigma_h = K(1 + K_a)\gamma H$

$L \geq L_e \geq L - 0.3H$

for $\phi = 30^0$

$\sigma_h = 1.33K \cdot \gamma H$

Figure 4



REINFORCEMENT TENSION

Figure 5

Tullamarine Freeway emergency shoulder

In March 1978, the emergency stopping lane on the northbound carriageway of the Tullamarine Freeway between Brunswick Road and Moreland Road was converted into a traffic lane to increase traffic capacity and to reduce stop-start conditions experienced by freeway traffic during afternoon peak periods.

Shortly after the conversion, four emergency stopping bays were constructed adjacent to the freeway carriageway to provide refuge for disabled vehicles. The bays were spaced at approximately 500 m intervals; an emergency telephone was provided at each bay.

A review of the traffic operations on this section of the freeway was undertaken in mid-1979. It was concluded that three through lanes were necessary for traffic safety reasons, but improved access for emergency vehicles and better facilities for disabled vehicles were warranted.

A number of alternative measures were considered ranging from enlarging the emergency stopping bays (estimated cost $100,000) to constructing a completely new emergency stopping lane, including bridge widenings (estimated cost $900,000).

The scheme finally adopted involved the construction of a 3 m wide emergency stopping lane adjacent to the existing northbound carriageway.

The emergency stopping lane is discontinuous at each of the three freeway bridges crossing Moonee Ponds Creek and at each of the four overpasses crossing the freeway. Four controlled access points from the local street system were provided to ensure that emergency vehicles can reach any section of the freeway at any time.

Relocation of the existing public lighting was a necessary part of these works, and this provided the opportunity for two major improvements. Firstly, new slip base light poles were used which eliminated the need for a continuous guard fence adjacent to the shoulder; and secondly, the number of poles needed was reduced to one-half by using more powerful lights at a greater mounting height.

The cost of these improvements was approximately $500,000. A preliminary assessment indicates that the new arrangement is working satisfactorily.

Nuclear density/moisture gauges

Compaction standards for road construction are specified in terms of relative compaction, which is defined as the ratio of the measured insitu dry density of the material to the maximum value of dry density obtained in a specified laboratory compaction test on the same material.

Until recently, the determination of insitu dry density has involved the excavation of a small amount of material from the compacted layer. The volume of the hole is measured and the mass and moisture content of the excavated material are determined to enable the dry density to be calculated. Such methods are time-consuming and require to be carried out with great care if accurate results are to be obtained.

For many years attempts have been made to develop instruments using gamma radiation and neutrons emitted from a radio active source to measure density and moisture content.

The Board purchased a nuclear gauge in 1961, but it was found to be unreliable and was eventually discarded. Exhaustive trials have shown that the instruments now available are reliable and can be used with confidence.

Experience has shown that density estimated by a nuclear gauge for a particular site can be substantially different from true density. The factors that introduce this difference appear to operate randomly so that average density determined over a number of sites will have an acceptable accuracy. For this reason when using nuclear meters lot testing is adopted and statistical procedures described elsewhere in this report are used to evaluate results. No particular significance is placed on particular test results by these methods and inadequacy in the determination of individual results is therefore not of consequence. It has also been found that ten nuclear density tests are required to give the same reliability of assessment as six conventional density tests.

Nuclear gauge manufacturers generally recommend the use of a single calibration equation for each material type. Work undertaken by the Board has shown that a more accurate evaluation of results is achieved by calibrating a gauge for each individual material and procedures are used routinely to develop a calibration between gauge reading and density determined by conventional methods at 20 or more test sites.

The Board currently has eight nuclear gauges, six of which have been purchased during the past year. The introduction of these gauges has led to a significant increase in productivity in monitoring standards of compaction achieved on major construction jobs throughout Victoria.

Vibratory compactor trials

The high production rate (up to 3,000 tonnes/day) of the Autograde required compaction plant of similar productive capacity to achieve the high standard of compaction which was specified. Several different types of rollers were appraised by trial and subsequently a Bomag 220A tandem vibrating roller was purchased as ancillary equipment to the Autograde.

The Bomag 220A has an operating weight of 12.22 tonnes and a roll width of 2.438 m. A 112 kW Detroit diesel provides power through hydrostatic drives for propulsion, braking and vibration. Both drums drive and are fitted with vibrating units of variable frequency (range 1700-2400 cycles/min) and variable amplitude (range 0.29 mm-1.04 mm) which can be controlled by the operator and selected to run individually or together. The direction of rotation of the eccentric weights changes automatically when the roller reverses.

The Bomag roller has undergone extensive testing since being commissioned in May 1979, to ascertain the optimum settings of amplitude, frequency, roller speed and number of passes for the particular pavement materials being used on various sections of the Hume Freeway.

The results (Figures 6 and 7) of these trials have shown that optimum compaction was achieved with the roller travelling at 5 km/h with full amplitude and frequency of vibration. Four coverages were applied after spreading and before trimming with the Autograde, followed by further coverages. This procedure was found to produce target Characteristic Relative Compaction after 8 passes of the roller on base material and after 10 passes on subbase material. The major factor influencing the degree of compaction achieved was the number of passes.

The 35 tonne multiwheel rollers and the 12 tonne steel-wheel rollers were found to have only a small influence on increasing compaction when used as back-up rollers after final vibrating compaction.

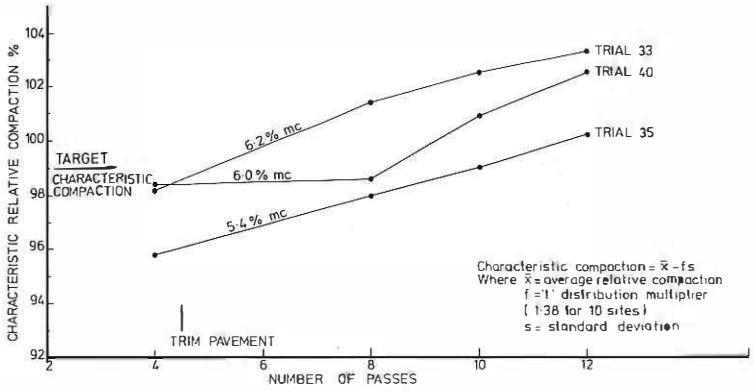


Figure 6: Assessment of final characteristic relative compaction of rhyodacite at Violet Town By-pass. Bomag 220A roller operating at 5 km/h and full amplitude.

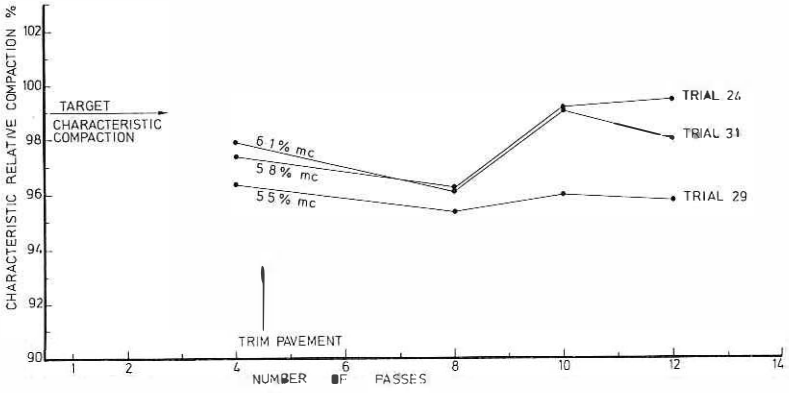


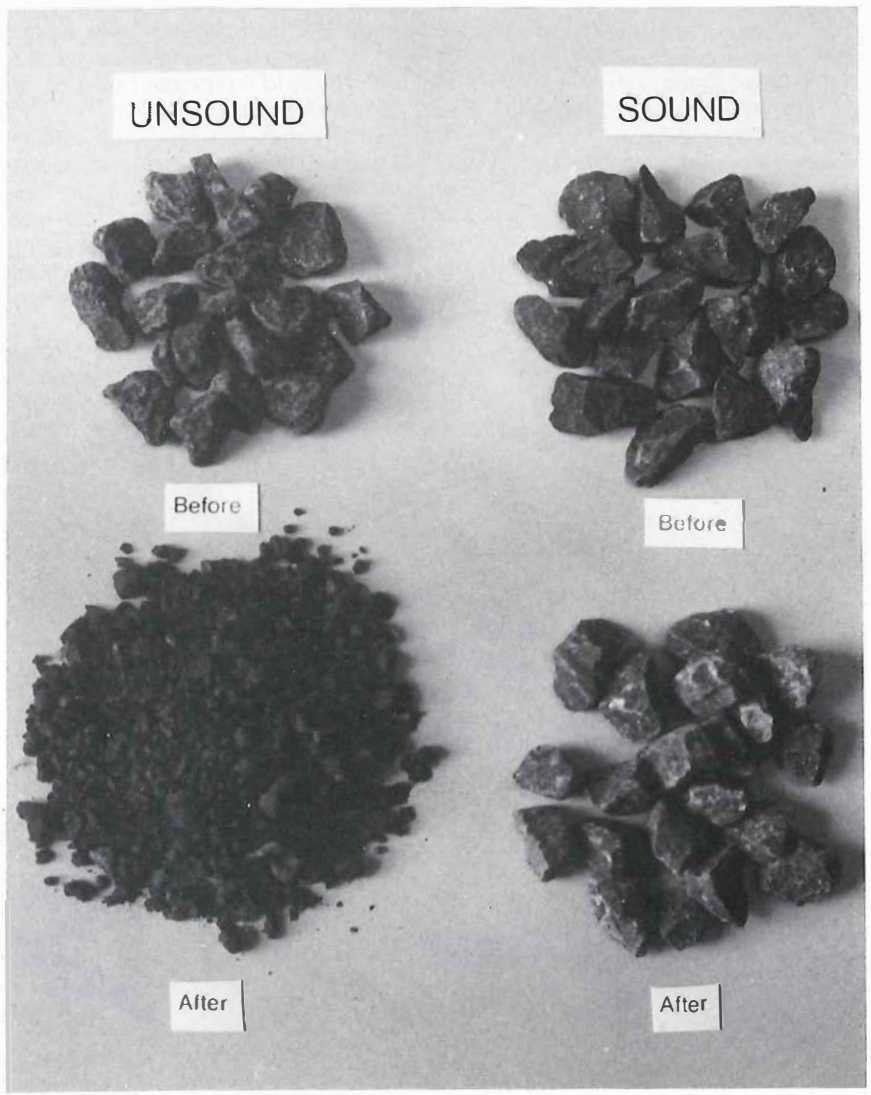
Figure 7: Assessment of final characteristic relative compaction of hornfels at the Seymour Project. Bomag 220A roller operating at 5 km/h and full amplitude

The importance of selecting the correct grading and moisture content for the pavement materials and maintaining these properties at a uniform level became very evident. To this end, the crushed rock was stockpiled well in advance and moisture was added through a pugmill. It has become evident that uniformity of the material being processed is of primary importance if the required standards of construction and high production rates are to be achieved. The use of natural gravels and partially crushed and screened gravels has been accompanied by many problems originating in the inherent non-uniformity of such materials.

Accelerated degradation test for weathered basalts

The principal cause for degradation of basalt aggregates in roads is the presence of expansible clay materials (smectite and swelling chlorite) throughout the rock fabric. The distribution of the clay minerals within the fabric is important because interconnection of the clay minerals allows access of moisture which causes expansion of the clay. As the swelling pressures exerted by the hydration of smectite clay may approach 60,000 kPa, the tension

Figure 8



forces exerted on the rock fabric can cause disruption of the rock if the clay mineral content of the rock exceeds about 30 per cent.

A test method which produces accelerated physical degradation of basalt containing significant quantities of expansible clay minerals relies on the ability of certain organic liquids such as ethylene glycol to readily penetrate and expand the interlayer spacing of the clay minerals within the rock. Ethylene glycol causes an expansion 20 to 30 per cent greater than that produced by water.

The test method used in the past has involved soaking a small rock sample in ethylene glycol at room temperature for periods of up to 30 days. When degradation is noticed, the time elapsed and the degree of degradation is recorded.

It has been found by elevating the testing temperature to the boiling point of ethylene glycol (197°C) that the degradation process is accelerated by a factor of 20. Further acceleration of the degradation process has been achieved by using higher temperatures at elevated pressures.

Factors contributing to acceleration of the process are:

- ☐ increased mobility of ethylene glycol by a viscosity reduction at the higher temperatures
- ☐ increased penetrating power by the more energetic ethylene glycol molecules at the higher temperature and pressure.

By the use of this accelerated degradation test method and potential durability characteristics of basalt can be assessed within a few days. A close relationship has been shown to exist between the secondary mineral content of basalt and its degradation characteristics using this test.

Photographs of the material before and after test illustrating the degradation process which occurs are shown in Figure 8 on page 83.

A study of the correlation between service records of basaltic rocks and the results of the accelerated ethylene glycol degradation test is in progress. It is likely that this test will be developed as a crushed product durability test for basalts.

Arterial Road Extension of Eastern Freeway, Bulleen Road to Doncaster Road

Relocation of Koonung Creek

The arterial road extension of the Eastern Freeway is to be located in the Koonung Creek valley between Bulleen Road and Doncaster Road as shown in Figure 9. The road is currently being constructed and is scheduled for opening in 1982.

The road alignment will sever the existing Koonung Creek channel in many places and the road embankment will reduce the available flood plain within the valley. As a result, the creek must be relocated in a form which will carry expected flood flows of up to 120 m^3/s (100-year flood) without flooding residential properties or endangering the road.

The existing Koonung Creek channel has eroded badly in recent years with the increased urbanization of the creek catchment. The creek carries polluted water within a steep-sided channel, eroded to

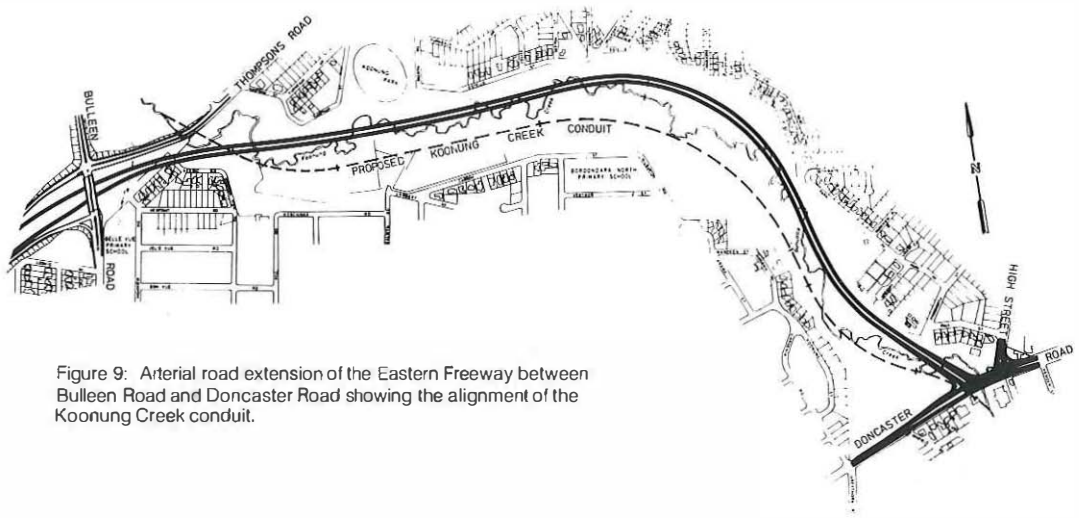


Figure 9: Arterial road extension of the Eastern Freeway between Bulleen Road and Doncaster Road showing the alignment of the Koonung Creek conduit.

depths of five to six metres. Many services which cross the creek are in danger of being undermined in times of flood. Treatments for the proposed relocated creek were required to ensure that these problems would not be re-created.

To assist in the development of acceptable alternative solutions, a Task Force including representatives from the City of Doncaster and Templestowe, City of Camberwell, Melbourne and Metropolitan Board of Works, Ministry for Conservation, Railway Construction Board and Country Roads Board was formed.

Four alternative schemes were considered by the Task Force to be suitable. These schemes were:

- ☐ A lined channel to carry normal flows with a grassed channel to carry flood flows.
- ☐ An underground pipe to carry normal flows with a grassed floodway to carry flood flows.
- ☐ A lined channel capable of carrying normal and flood flows.
- ☐ An underground conduit capable of carrying normal and flood flows.

The cost of implementing any of the alternative schemes, including the cost of land compensation, was estimated to be of the order of $5 million.

The alternative creek schemes and conceptual landscape plans for each scheme were exhibited for public comment. Of 260 respondents to a questionnaire, 97% favoured the underground scheme (Alternative 4). This alternative was subsequently adopted by all parties to the Task Force as the favoured scheme for implementation.

Construction of the conduit is expected to commence in September 1980. The works are scheduled for completion in early 1983.

Form of conduit

The conduit will consist of precast reinforced concrete half arch units placed on a cast-in-place reinforced concrete base slab (see Figure 10). The half arch units, which will be 3.5 m long and have a mass of 13.5 tonnes, will form a three pinned parabolic arch with pin joints at the crown and the base. The arch will have a rise of 4.0 m and a span of 6.6 m, and the base slab will be in the form of a shallow 'vee' to contain low flows.

The arch units on one side of the conduit will be offset by half a unit length relative to the units on the other side of the conduit so the units will be self-supporting during construction. The top pin will consist of a rubber tube located in semi-circular recesses in the half arch units and injected with grout, and the pin at the base will consist of a thin rubber bearing located between a semi-circular recess in the base slab and the arch units.

Along the 2.4 km length of the conduit, thirty municipal drains ranging from 0.75 m to 2.1 m diameter will connect to the conduit through holes in the arch units. The 0.75 m diameter pipes will enter through single units while the larger pipes will enter through two adjacent units.

Hydraulics

As the length of the conduit is substantially shorter than the meandering creek, the grade of the conduit is steeper and hence the velocity of flow is greater. The velocity of flow in the conduit is supercritical for all flows and at the design flow of 120 m^3/sec the velocity is 7 m/sec. The Froude Number is sufficiently high to ensure stability of the flow. The velocities are well above those which would cause siltation of the conduit but some abrasion of the base slab may occur. A sacrificial 50 mm thick layer of concrete will be added to the base slab to allow for this.

At the inlet, the flow will be accelerated down a 22 m long chute on a slope of 1 in 8 to achieve a velocity of 7 m/sec before entering the conduit. At the outlet, an energy dissipator of the Saint Anthony Falls type will slow the flow to an acceptable velocity before the flow enters the natural stream channel.

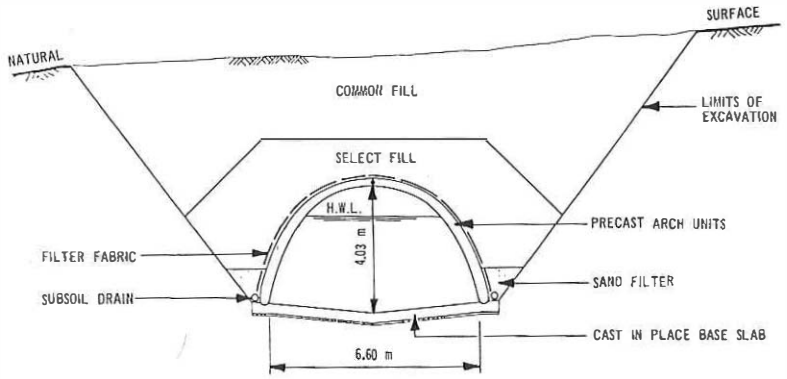


Figure 10: Typical cross section of the Koonung Creek conduit.

An initial proposal was for the conduit to discharge through the existing 4 cell culvert under Thompsons Road into the natural stream. To study the behaviour of the outlet end of this proposal a hydraulic model which included a length of conduit, a transition, the 4 cell culvert, a stilling basin and a length of the natural stream was constructed and tested in the Civil Engineering Department at Monash University.
The model which was constructed from timber and perspex to a scale of 1:30 was tested for five different flow rates up to the design flow of 120 m^3/sec. Both symmetrical flow and non-symmetrical flow caused by a 150 m radius in the conduit were studied. The effect of debris collecting on the ends of the three internal walls of the culvert and total blockage of 1 or 2 cells of the culvert was also studied.
The tests on the hydraulic model indicated that hydraulic problems would occur with debris on the ends of the walls, i.e. the flow was very turbulent, and with two cells blocked the capacity of the culvert was reduced to 60% of the design flow and velocities of up to 6 m/sec were measured at the culvert outlet.
The results of the model study, together with other factors, indicated a better solution would be to extend the conduit to the downstream side of Thompsons Road and bypass the existing culvert. This meant that debris could pass through the conduit into the natural stream with no obstructions and hence the debris trap in the inlet structure simplified with associated cost savings. This proposal was adopted for the final design.

Structural design

An elastic finite element analysis was used to determine moments and forces in the arch units as well as the base slab. Methods used in conventional soil mechanics cannot adequately represent the structural interaction between the conduit and surrounding backfill and foundation, a consideration required for economical design. Sensitivity of moments and forces in the conduit to differences in magnitude and relative stiffnesses between foundation and backfill has been investigated and shows that base slab moments are primarily dependent on foundation stiffness, whereas arch unit effects are dependent on both absolute and relative material stiffnesses. The conduit foundation varies along the length from silurian mudstone to soft silty clay, and has been categorized into three ranges of stiffness, and base slabs have been designed for each range. Variations in arch unit capacities and detailing have been necessary to satisfy various fill heights as well as the possibility of loading from a future railway.

Trends in road construction costs

Recent price increases

Prices of materials, labour and plant hire have continued to increase in the 1979/80 financial year, generally at a rate in excess of the rate of increase of funds provided for road construction and maintenance. In particular, the prices of such basic materials as bitumen, fuel and crushed rock (urban area) increased substantially.
A summary of some price increases (from June 1979 to June 1980) relevant to road construction cost is given below:

Materials

Bitumen	60%
Aggregate (rural)	30%
Distillate	55%
Standard Fuel	46%
Steel	15%
Cement	18%
Box Culverts (urban)	8%
Asphalt	22%
Crushed Rock Products (urban)	30%

Private plant hire

Grader	7.5%
Crawler Tractor	12%

Labour

	Base Rate*	Total Allowances
Construction and Maintenance Worker III	14%	13%
Skilled Builders Labourer	4%	26%
Patrolman II	9%	12%

Sealing

Size 13 Initial Treatment Prime and Seal	20%
Size 13 Reseal	21%
Primerseal	16%

*Includes only one national wage adjustment

Materials

Steel, cement and associated products have increased generally in line with increases in Consumer Price Index and funds available (i.e. 10 to 11 per cent), however greater increases have been recorded for many key items including bitumen (60 per cent), distillate (55 per cent) and sealing aggregate (30 per cent). The price of crushed rock products in the metropolitan area increased 30 per cent.
Asphalt has been affected by increased bitumen and aggregate prices and its price rose by 22 per cent.

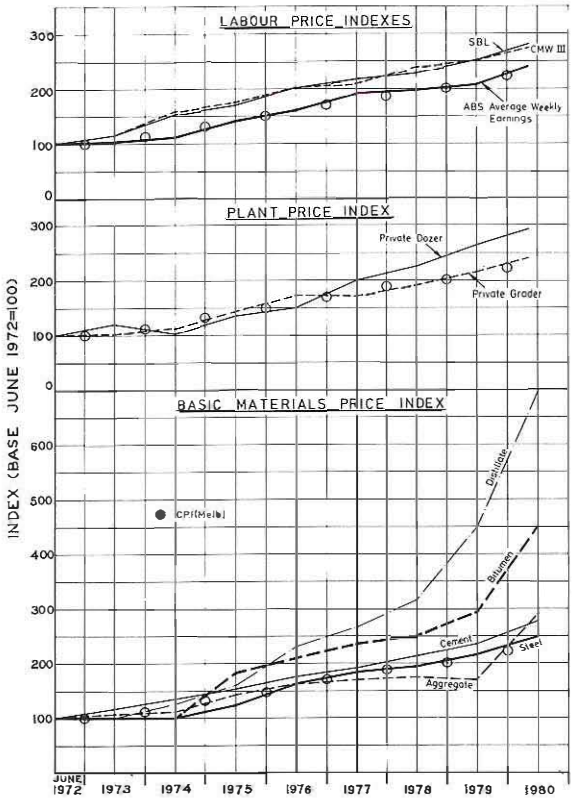


Figure 11

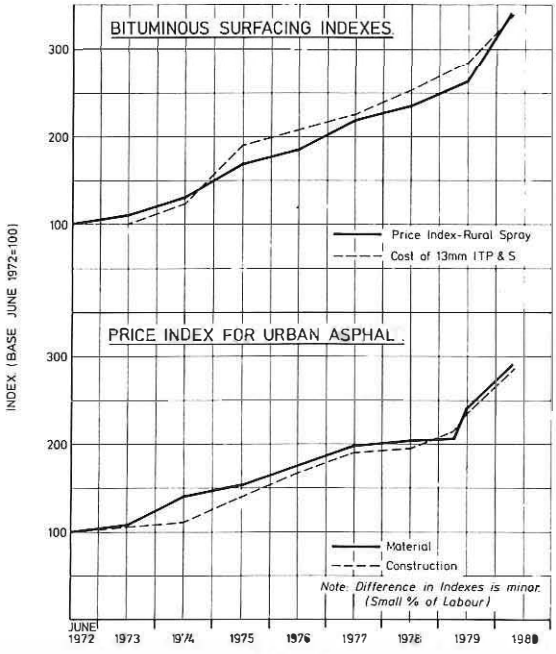


Figure 12

Plant hire
The cost of private plant hire increased generally 10 per cent after an increase of about 15 per cent in the 1978/79 financial year. Hire rates for 1980/81 may be expected to increase again due to increased fuel charges and the increasing cost of financing the purchase of plant.

Labour
The increased cost of labour results from increases in base rates and allowances. It should be noted that the increases in base rates include only one national wage adjustment.

Price trends — materials, labour, plant hire
The trend of price increases in the cost elements of materials, labour and plant hire for the period 1972 to 1980 is set out in Figure 11, which enables the recent price increases to be put in perspective.

Bituminous surfacing

Asphalt (Urban)
The price of asphalt in the urban area increased by 22 per cent. This has occurred at a time when, according to the industry itself, demand is at a low level, and hence prices should be competitive. Figure 12 shows the Asphalt Material and Construction Price Index since 1972.

Sprayed work (Rural)
The Price Index for rural sprayed work, and the indexed value of the cost of 13 mm ITP&S work is also shown in Figure 12 for the period since 1972. It is apparent that productivity has been maintained over the period, and in the 1979/80 period some increase in productivity may be indicated, as although the cost of sprayed work increased by 20 per cent, the price index increased by 26 per cent in this year.

Rural road construction
The Board produces both a Price Index and Cost Index for Rural Road Construction. *The Rural Road Construction Price Index* is a composite price index constructed to reflect the effect that changes in the price of inputs such as labour, plant hire, materials, etc. have had on the cost of rural road construction. These price changes are currently measured quarterly. *The Rural Road Construction Cost Index* is constructed to reflect as far as possible the total change in the output cost of construction of rural roads. In addition to changes in the price of the various inputs into road construction measured by the Price Index, this index takes into account other

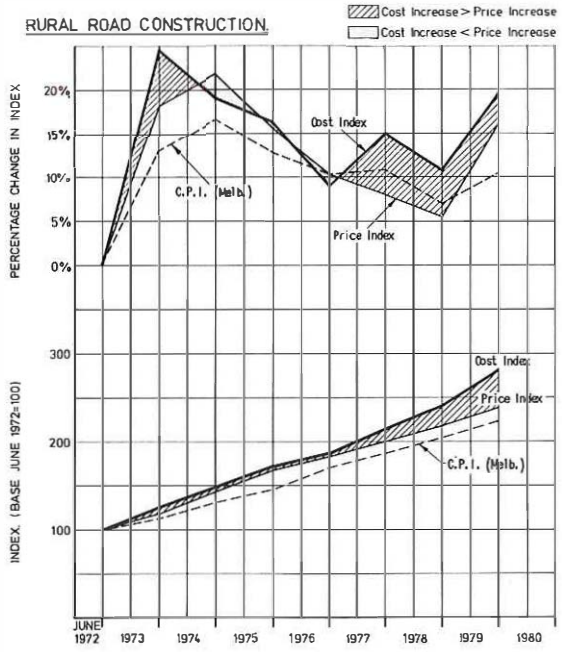


Figure 13

factors such as movements in productivity, technology and changes in the standard of construction required. This index is prepared annually.

These indexes are shown for the period from 1972 in Figure 13 and in comparison to the CPI (Melb). The actual index from year to year and the percentage increase each year are shown separately.

A divergence of Cost and Price Index from 1976/77 is evident, indicating cost increases in excess of price increases.

The interpretation of these indexes is very dependent on the method of preparation of the indexes and the costing information used, however in this case a definite trend is apparent.

The comparisons shown in Figure 13 indicate that cost increases in rural road construction are considerably in excess of the CPI increases; and whereas the cost and price indexes were virtually equivalent in 1976/77 both in annual and cumulative increase, by 1979/80 a cumulative variation of 17 per cent had developed with a divergent trend.

Effect of increased fuel prices

The substantial increases in the cost of fuel both motor spirit and distillate, have significantly affected the cost of all aspects of road construction and maintenance and to a lesser extent the cost of bridgeworks.

From 1972 to 1978, fuel accounted for 8 to 11 per cent of the cost of private plant hire of crawler tractors (D6, D7 size). Currently, this percentage has risen to about 20 per cent. If fuel prices increase at 20 per cent per annum and other factors influencing plant hire rates at 10 per cent per annum, then by 1985 fuel would account for 27 to 30 per cent of private plant hire. Similar data would apply to other large earthmoving equipment.

This has placed even greater emphasis on the need to use plant efficiently.

The increased costs of earthworks will affect the manner in which road design standards are applied and the increased cost of pavement materials and of pavement construction will intensify the need for increased productivity in pavement construction work, and the examination of alternative forms of pavement construction, including concrete.

West Gate Freeway (South Melbourne Section)

Construction and testing of prototype segments

Part of the West Gate Freeway (South Melbourne Section) will consist of twin bridges constructed from precast concrete box girder segments erected in a balanced cantilever sequence. Design of this type of structure requires a very detailed understanding of the physical properties of the concrete used in the precast segments as concrete deformation characteristics influence the behaviour of segments during erection, and stressing and creep in the concrete is a major factor in the long term performance of the bridges.

Usually, laboratory tests for modulus of elasticity, creep and shrinkage are performed on standard test specimens under controlled conditions of environment and loading. These values are then used to predict performance of the structure, but the relationships used in the design codes are imprecise and it was considered necessary for this project to construct a full scale segment and stress it to provide direct measurement of deformation.

Construction and testing of two single cell prototype segments, each of approximately 35 tonnes, was undertaken to enable confirmation of design assumptions and to provide data in relation to the structural behaviour of the segments, as well as to examine practical design aspects.

Specific aims of the testing programme were:

- ☐ to observe casting operations with a view to improvements to mix design, reinforcement details and formwork details.
- ☐ to confirm practical working clearances for prestressing operations;
- ☐ to test the adequacy of proposed sealing rings to seal ducts between segments;
- ☐ to demonstrate practical controls to be used in application of epoxy adhesives on segment joints;
- ☐ to study resultant stress distribution across the section for comparison with computed values;
- ☐ to measure strain distribution in the vicinity of jacking points;
- ☐ to determine creep, shrinkage and shortening responses of concrete in a full scale element.

Construction

Each segment was constructed using timber formwork moulds and a concrete slab and steel support system incorporating four 20 tonne capacity skates to allow the segments to be jacked apart from match casting. Concrete for both units was pumped into the formwork.

The first segment (see Figure 14) was cast using a conventional concrete mix. Small diameter internal vibrators were necessary because of the concentration of reinforcement, ducts and anchorage assemblies in the webs and anchorage blisters. Compaction was assisted by the use of external form vibrators.

Stripping of the first segment indicated some areas where concrete had not been successfully placed and compacted and in particular highlighted the difficulty in obtaining sound concrete at the re-entrant angle formed by the junction of the webs and base of the unit.

Because of this, some formwork modifications were made before casting the second unit. It was also decided to cast one of the webs using a superplasticizing admixture so that a slump of the concrete was 225 mm, and was placed without vibration.

After the concrete in the units had acquired the required strength, the two units were jacked apart approximately 400 mm. Prior to casting, a release agent had been applied to the end face of the first unit to prevent bonding between the two units.

Rubber sealing rings were installed in recesses cast into the concrete at the end of each pre-stressing duct and, following the application of a suitably formulated epoxy resin to one of the joint faces, the units were drawn together using temporary stressing rods installed through cored holes provided for temporary erection in the web diaphragm outstands.

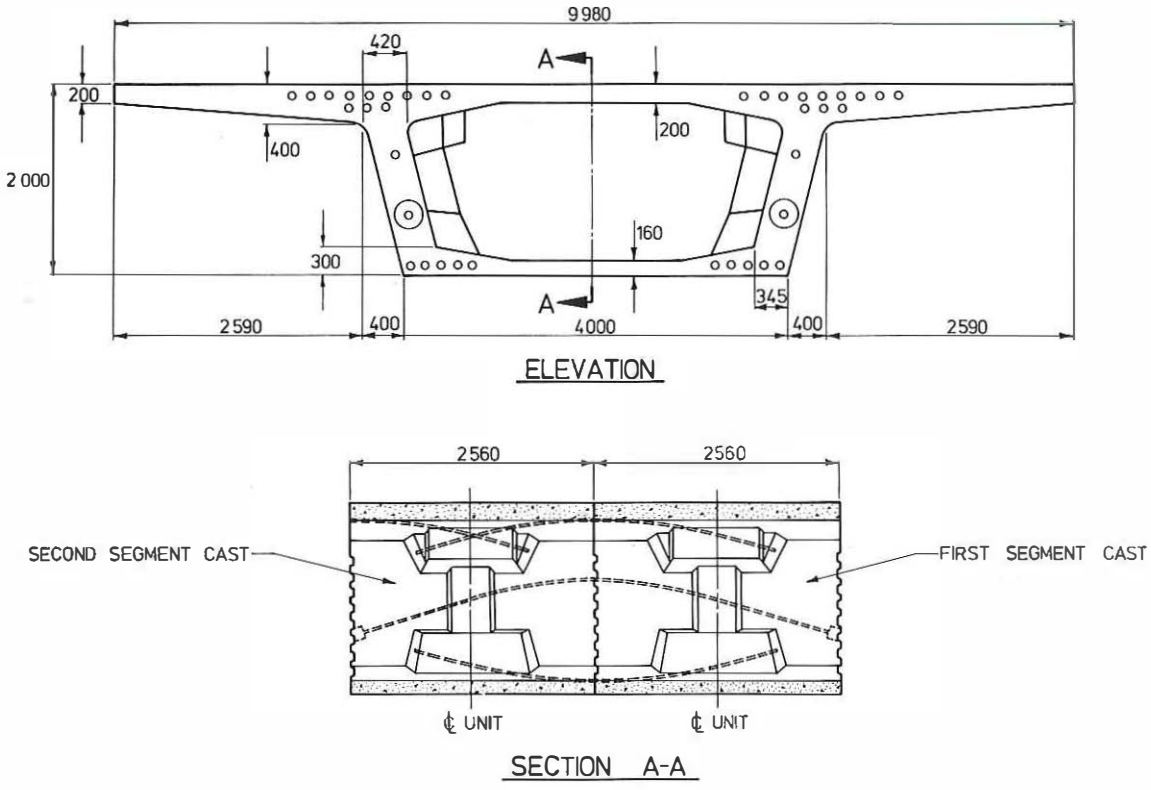


Figure 14.

After the resin had cured, the full prestress was applied using the permanent web and blister anchorages provided. The pattern and application of stressing forces was designed to allow maximum stresses to remain in the units throughout the period of testing and monitoring.

The units were stressed with six 19-tendon cables each having a nominal capacity of 2800 kN at 80% of ultimate strength. Overload tests were carried out on two anchorages prior to carrying out the overall stressing of the units.

To test the effectiveness of the rubber ring provided for sealing prestressing ducts at the segment joint, the free ends of unused ducts were sealed off and water introduced under pressure.

These construction trials confirmed a number of practical aspects of design detail such as the provisions for prestressing jack clearance and sealing of prestressing ducts. Potential difficulties associated with reinforcement placement, location of prestressing ducts and anchorages and the casting of concrete were highlighted. Modifications have been made to the proposed web and blister reinforcement details, reinforcement bending tolerances were reviewed, and a curved re-entrant corner introduced at the bottom of the web.

Testing

A number of concrete components and mix designs were evaluated and the results for 50 MPa mixes are summarized in Table 2. Werribee Newer Basalt was chosen as the source of coarse aggregate for construction of the two prototype segments.

Table 2:
Compressive Strength and Modulus of Elasticity

Aggregate Source	Modulus of Elasticity (GPa)			Compressive Strength (MPa)	
Age (Days)	14	28	56	28	56
Wollert Hornfels	40	41	43	57.0	61.0
	40	40	43	51.5	55.0
Werribee N. Basalt	32	35	35	53.5	62.5
	32	34	35	59.5	66.0
Kilmore N. Basalt	37	39	40	48.0	54.0
	40	40	41	52.0	60.0

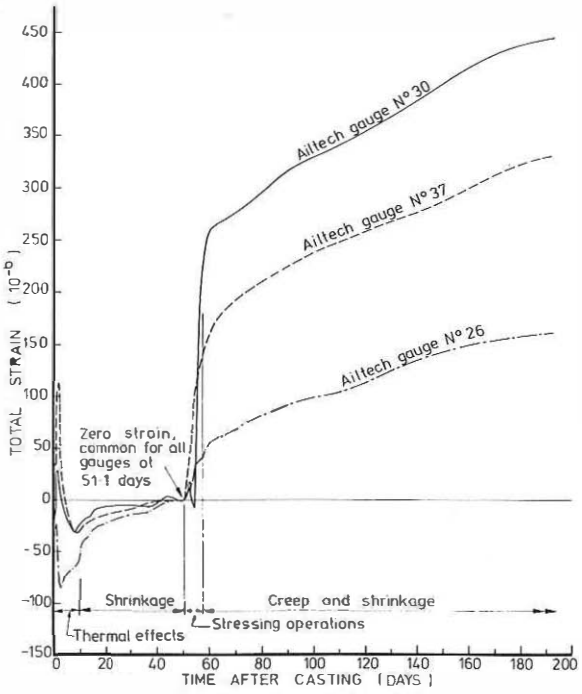


Figure 15

All instrumentation was connected to a logger which scanned and recorded 100 channels of data. For much of the monitoring period of 6 months the logger was controlled, and the data processed, by a Nova mini-computer in the Materials Research Laboratory. Figure 15 shows the strain-time records of three embedded strain gauges, and from these records and the response of unstressed slabs over the same period creep and shrinkage effects were determined.

Figure 16 shows the strain distribution across the deck section at various times after stressing, and the shape of this strain profile is very similar to the stress distribution calculated using a finite element programme.

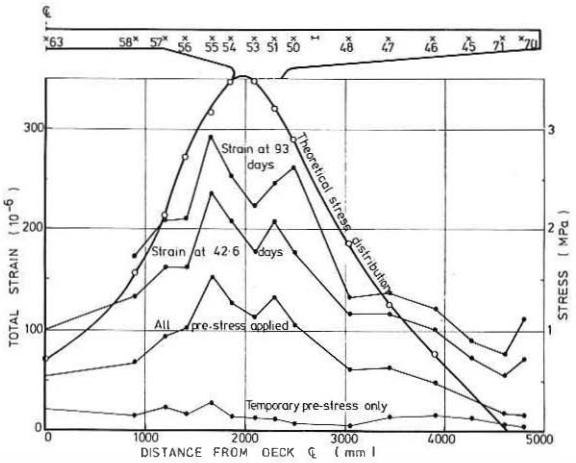


Figure 16

Development of rock socket inspection device

The construction of the elevated section of the West Gate Freeway (South Melbourne Section) involves the construction of over 400 piles socketed into Silurian mudstone or basalt rock. The rock sockets will be excavated using three methods:

- ☐ Classification 1 piles (about 210) — sockets drilled under water, then dewatered and inspected.
- ☐ Classification 2 piles (about 20) — sockets progressively mined and lined.
- ☐ Classification 3 piles (about 190) — sockets drilled under bentonite drilling mud.

Because of the uncertainty concerning the effect on load capacity of debris on the base, the sockets of Classification 3 piles have been designed assuming zero base resistance.

A device has been developed to enable the base of rock sockets to be inspected and thereby to determine the efficiency of methods used by the contractor to clean out the debris. This device, shown in Figures 17 and 18, consists of a colour television camera enclosed in a water-proof housing, mounted on top of a diving bell. Compressed air displaces the drilling fluid from the diving bell and enables the camera to clearly view, and record on video-tape, any material on the socket base. The diving bell is also fitted with a depth indicator for soft debris and a pair of water jets that can assist in the identification of debris by washing the rock surface clean.

During the construction of piles on the project, experiments have been conducted on the different methods of cleaning the base of the sockets, which are rotary drilled with conventional drilling buckets. Various designs of air lifting equipment and cleaning buckets are being used in base cleaning trials on Classification 3 piles.

If an adequate cleaning technique can be developed the socket inspection device will be used to verify the cleanliness of sockets of Classification 3 piles and this will permit base resistance of sockets to be taken into account with significant reductions in depths of rock sockets and savings in cost and construction time. Its application to the inspection of Classification 1 and 2 piles will also eliminate the risk involved in the manual inspection procedure.

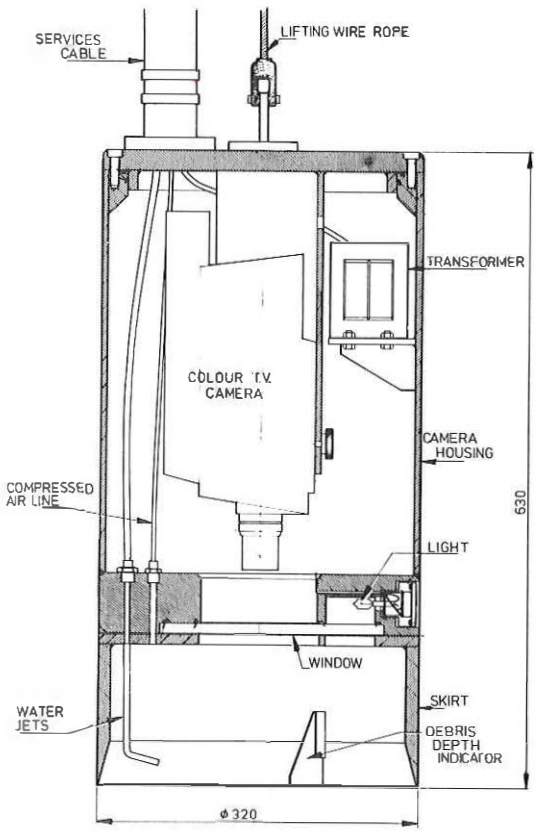


Figure 17: A cross section of the Socket Inspection Device.

Trial embankment

The approaches to the West Gate Freeway require the construction of embankments 40 m wide and up to 1.5 m above the natural surface.

These embankments will be built on the natural material in the area which is soft silty clay locally known as Coode Island Silt. This material, up to 20 m deep, is very compressible and exhibits significant long term settlement under constant load.

Settlement predictions for various embankment heights are shown in Table 3. The predictions were based upon laboratory tests of undisturbed samples and the performance of other embankments in the area, including the Kings Bridge approaches.

Table 3:

Embankment height (m)	1.5	2.0	4.0
Immediate Settlement (mm)	50	65	135
Primary Consolidation (mm)	100	280	1040
Long term Settlement for 100 yrs (mm)	150	300	Not calculated
Total Settlement (mm)	300	645	> 2000

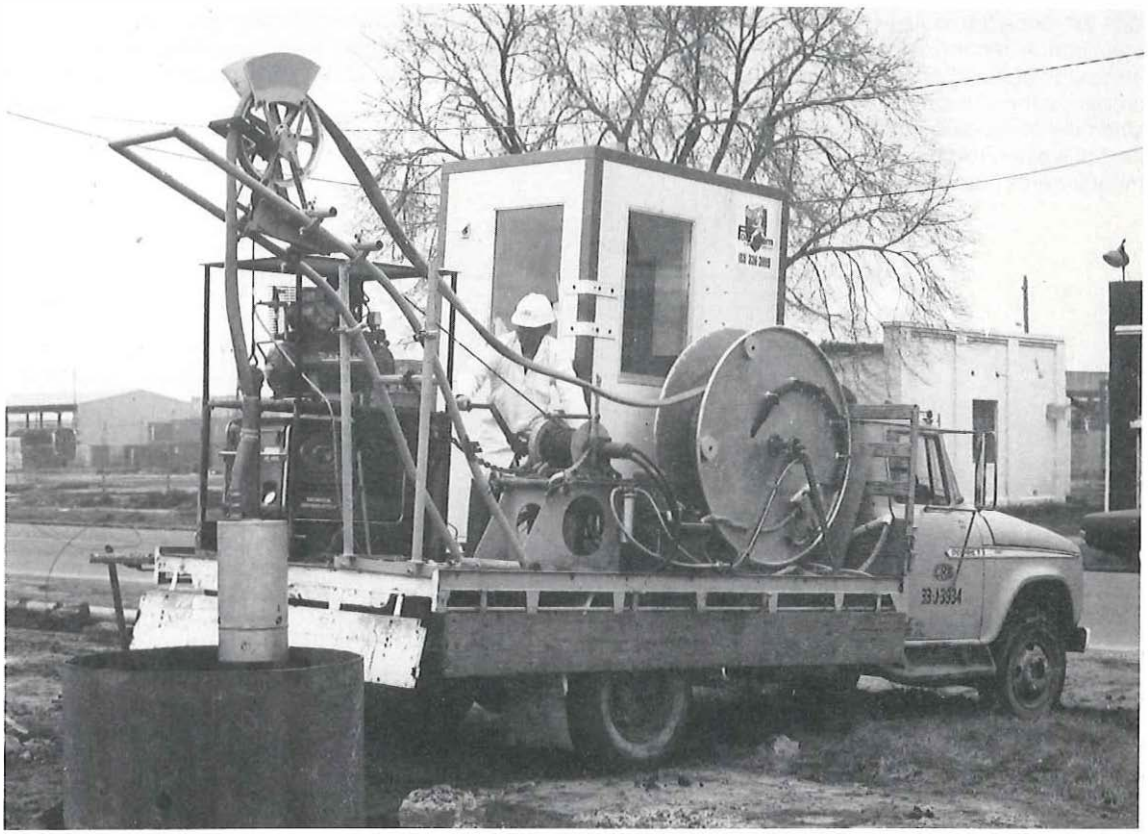


Figure 18: The Socket Inspection Device in operation.

To limit settlement to an acceptable level, a maximum finished height of embankment of 1.5 m was adopted. It was also decided to surcharge the embankment areas to accelerate settlement and eliminate long term settlement. This required the placing of additional filling 2-2.5 m deep over the 1.5 m embankments. Stability considerations limit the maximum height of any embankment with 2:1 batter slopes to 4.0 metres.

To check the rate of settlement and the accuracy of settlement predictions, a trial section of embankment was constructed on the western approaches to the freeway structure and instrumented with remote reading settlement gauges and piezometers. One section of the embankment was constructed over a reinforced concrete floor slab, approximately 100 mm thick. This slab was typical of many floor slabs left along the route of the freeway after building demolition. A second remote reading settlement gauge was placed beneath the floor slab. By comparing the settlement of the slab to the settlement of the embankment in a slab free area the effect of leaving the slabs in place beneath the embankments could be observed.

Up to June 1980, 600 mm of settlement has been recorded at the centre line of the embankment. Figure 19 shows the recorded settlement and fill height at the centre line of the embankment plotted against time.

No significant differential settlement is evident between the settlement of the fill placed over the concrete floor slab and the settlement in an area free of slabs.

The embankment is still settling, but at a reducing rate. Surcharging has accelerated consolidation to such an extent that the recorded settlement is now equivalent to the settlement which might have occurred in the first 100 years after construction of a 1.5 m high embankment. In addition accurate measurement of elastic settlements and primary consolidation rates have been obtained. This information has allowed a more accurate determination of the minimum surcharge times required for other embankments on the project.

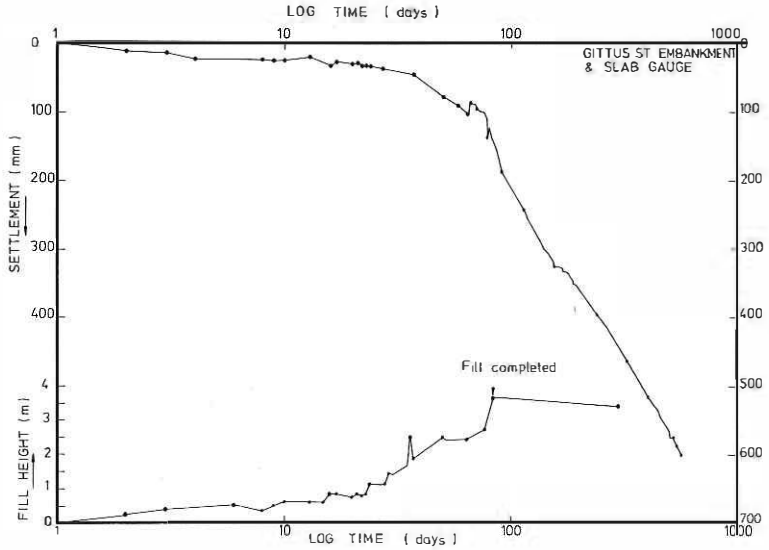


Figure 19

Traffic Accident Reduction System (TARS)

Road accidents continue to be of major concern to the Board and the community. In Victoria, in 1979 there were 847 people killed in 760 fatal accidents with a further 13,962 personal injury accidents. Notwithstanding this level of accidents, several initiatives such as seat belt wearing legislation, drink/driving legislation, and the METCON/STATCON programme, along with the continued application of sound traffic and geometric design standards throughout the Board's work have kept fatality accident rates for Victoria consistently below the average for Australia.

An Investigations Group has been established in Traffic Engineering Division to provide expertise in the utilization of road accident data in the planning, design and implementation of road improvements and the satisfactory operation and maintenance of the road and traffic system.

The Traffic Accident Reduction System (TARS) is summarized schematically in Figure 20. It comprises two parts — Data Preparation and Data Utilization.

Data Preparation consists of accident reporting by the police (Form 513A), checking and editing police reports by RoSTA and assembling an accident data bank within the CRB.

Data Utilization consists of a number of procedures which range from the simple task of supplying raw data to the complex tasks whereby accident "blackspots" are detected following every update of the data bank.

The Traffic Accident Report Forms are obtained from RoSTA once a week and microfilmed. A computerized index enables quick and easy access to particular microfilm records. A copy of the microfilm and computerized index is supplied to RoSTA.

Most of the items of information on the Traffic Accident Report Form are coded by RoSTA and transferred to computer tapes. Copies of these tapes known as "long format" tapes are obtained by the Board each quarter.

Data essential to the Board's needs is extracted from the "long format" tapes, and stored on "short format tapes".

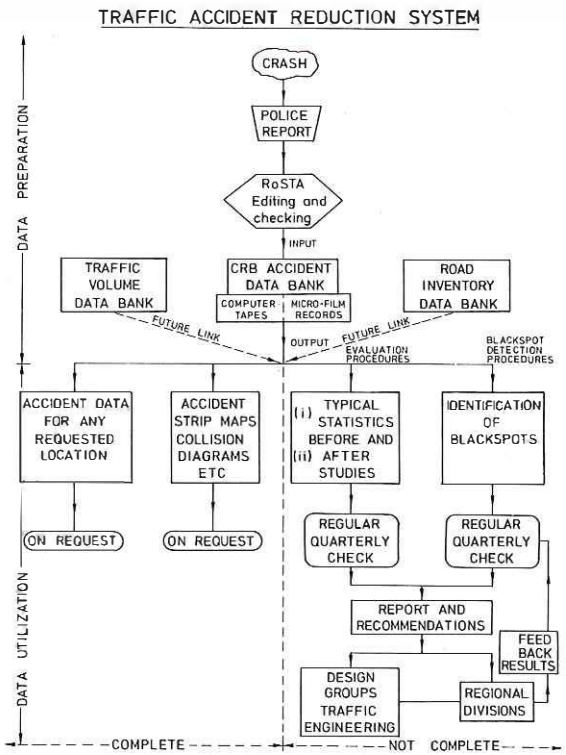


Figure 20.

The data base is used in the following manner:

Supply of raw accident data

Accident data at intersections and midblocks is supplied easily and quickly on request.

Supply of accident strip maps, collisions diagrams, accident rates

These require the combination of accident data with available traffic volume data. It is a manual task at present.

Evaluation and blackspot procedures

These two phases of TARS (i.e. evaluation and blackspot detection) are proceeding, but considerable development work remains to be done.

Evaluation

An important function of TARS is to evaluate the effect that the Board's works have on safety. Traffic engineering improvements in particular are often designed to improve safety and should therefore be monitored to determine whether in fact these have been effective. The most common way to evaluate 'improvements' is to carry out 'Before and After' Studies.

Some examples of recent 'Before and After' studies are—

☐ Roundabouts
Preliminary results from a before and after study at 51 roundabouts mainly in urban areas has shown a 75% reduction in casualty accidents since the installation of the roundabouts. Further work is still progressing to ascertain whether a similar reduction in the accident rate has occurred.

☐ Staggered T Intersection Treatments
The conversion of cross intersections into staggered T intersections, and of Y junctions to T intersections, have greatly reduced the accidents at these sites. A recent study of eight staggered T intersections has shown an 80% drop in casualty accidents since their conversion from cross intersections.

☐ Lighting
A study of the Princes Highway East — Blackburn Road to Chandler Road showed that there was a reduction in night time casualty accidents and the casualty accident rate but it was found not to be statistically significant.

☐ Five-lane treatment
A study of 19 five-lane treatment sites indicates that there has been a 33% increase in casualty accidents at the intersection but when traffic volumes are considered, there is no statistically significant change in the accident rate.
Preliminary results at mid-block locations on the legs of the five-lane treatments show significant large increases in casualty accidents and casualty accident rates. Further work is necessary to ascertain whether these increases have also occurred at control sites over the same period of time.
Another important function is to produce 'typical statistics' which are useful in the evaluation of accident records, for example wet to dry ratios, night to day ratios, accident rates, road user movement frequencies. These statistics enable non-typical locations to be identified.

Identification of Blackspots
The identification of blackspots is often a two-way process.
☐ Using the accident data base, the Traffic Engineering Division identifies blackspots and advises regional divisions.
☐ A regional division suspects that a particular location is a blackspot and obtains accident information from the Traffic Engineering Division for confirmation.
It is often necessary to arrange site visits with divisional officers before any recommendations are made on the treatment of blackspots.
The Traffic Engineering Division supplies a list of highest casualty accidents numbers for intersections and midblocks to each regional division; the sites at the top of the list have the highest number of casualty accidents.
To determine more easily any change in accidents that have occurred after improvements have been made at a particular site, sites are ranked by the casualty accidents occurring in the last 3 years of data in the accident data bank.
This listing is commonly referred to as the 'Blackspot' list.

SCRAM project — traffic signal systems

As previously reported, the Board has adopted the DMR, NSW traffic signal co-ordination system SCATS (Sydney Co-ordinated Adaptive Traffic System) for two regional signal linking systems in the Melbourne metropolitan area. The installation of SCATS is being carried out as part of the Board's major effort in signal linking under the project name of SCRAM (Signal Co-ordination of Regional Areas in Melbourne).
During the year the Board purchased two regional mini-computers now installed at Blackburn and St Kilda, and is progressively connecting the traffic signals at intersections along the Maroondah Highway, the Nepean Highway and the Princes Highway (Dandenong Road) to provide signal linking systems along these major arterials. These systems will be extended to other major roads in these regions.
Provision of an additional regional mini-computer was arranged for mid-1980 to provide system development and testing facilities at the Board's Syndal Depot.
Planning has commenced for the expansion of the system to include further regional mini-computers, as demand and funding permits, to provide a system for the traffic signals on major arterial roads under the Board's control.

Johnston Street Collingwood bus lane

In 1978, a steering committee including representatives of the Country Roads Board, Transport Regulation Board and Melbourne and Metropolitan Tramways Board was formed to examine the feasibility of creating bus lanes on certain arterial roads in the Collingwood/Fitzroy area. Consultants were engaged and subsequently recommended that a bus lane be created along Johnston Street, Collingwood from east of Nicholson Street to west of Wellington Street, a distance of approximately 1.2 km.

The bus lane was installed by the Board for a trial period of six months on 19 March 1980.

Signs indicating the special use of the kerbside lane in peak hours (see Figure 21) were installed and the operation involves placing and removing traffic cones twice daily to separate traffic in the peak and off-peak directions. The arrangement provides two lanes and a bus lane in the peak direction and one lane in the off-peak direction. The system operates from 7-9 am and 4.45-6.30 pm.

Before and after studies relating to bus times and patronage, traffic volumes, travel times, parking durations and the effects on adjacent business are being undertaken as part of the trial.

Low cost traffic management

Investigations have been carried out on a number of heavily trafficked primary arterial routes in the metropolitan area to determine locations where significant improvements to the traffic capacity and/or safety may be made at a low cost.

Initially, an assessment is made of the road under consideration to note areas where congestion occurs (particularly during peak hours) and locations where there is a high accident record. Following the preparation of preliminary proposals, the comments of municipal engineers are sought to determine the local acceptability of the treatment and to obtain additional background information.

Improvements resulting from this process have been or are being installed on Princes Highway East between St Kilda and Clayton, Canlerbury Road in Camberwell and Box Hitl, Punt Road between Richmond and St Kilda, and Warrigal Road between Box Hill and Mordialloc.

Figure 21: The Johnston Street, Collingwood bus lane.

Princes Highway East

1. Traffic signals in St Kilda and Prahran are being linked to the computer at St Kilda Junction to provide co-ordination of signals along the highway.
2. The linemarking on the eastbound carriageway between Orrong Road and Wattletree Road has been altered to discontinue the left hand lane where the road narrows.
3. The intersection with Normanby Road has been signalized.
4. The intersection with Station Street and Glendearg Grove has been channelized to rationalize the priorty to the through highway traffic.
5. At the Tooronga Road intersection work is being carried out to provide a separate right-turn lane which will reduce delays.

Items 3 and 5 are being provided as interim measures until major widening proposals in the area are resolved.

Canterbury Road

1. A five-lane treatment, i.e. the provision of a painted separate right-turn lane, will be installed at the Balwyn Road intersection, and at the intersection with Wattle Valley Road.
2. A right-turn phase and a five-lane treatment has been provided at the Union Road intersection.
3. A five-lane treatment has been provided at the Warrigal Road intersection.
4. Five-lane treatments will also be installed on all approaches of the Canterbury Road/Elgar Road and Canterbury Road/Station Street intersections.

Punt Road

A five-lane treatment has been provided at the Commercial Road intersection.

Many of these improvements involve the use of five-lane treatments. These have proved to be particularly effective and are readily accepted by the public. A typical treatment costs about $1,500 and can be installed where the pavement is wider than 13.5 m.

Extent of work

Table 4 shows that 5,027 km of all types of bituminous surfacing work was completed in 1979/80 compared with 4,897 km in 1978/79. The length of roadway treated increased by 130 km and the area treated has increased by approximately 1,386,000 m².

In 1979/80 the length of sealed road on the Board's declared system was increased by 75 km and the Board contributed to increasing the length of unclassified roads by 430 km, as shown in Table 5. Reconstruction of previously sealed pavements and the restoration of the seal coat amount to 346 km of the declared system, 1.6 per cent of the sealed length, compared with 1.4 per cent in 1978/79. Retreatment on declared roads amounted to 1,803 km (8.3 per cent of the sealed road length), compared to 1,598 km (7.4 per cent) in 1978/79.

Table 4
Bituminous surfacing work completed

Category of road and plant used	1978/79		1979/80	
		km		km
Work on roads to which the Board contributed funds:				
CRB declared roads:				
Board's plant	2046		2352	
Municipal plant	98		101	
Contractor's plant	223		220	
		2367		2673
Unclassified roads				
Board's plant	1750		1659	
Municipal plant	208		173	
Contractor's plant	203		205	
		2161		2037
Subtotals:		4258		4710
Work done for other Authorities by the Board's plant (no Board contributions for these works):				
Municipalities	359		311	
State Instrumentalities	9		6	
Commonwealth works	1		—	
		369		317
Totals		4897		5027

Table 5:
Bituminous surfacing work on various road categories (on roads to which the Board contributed funds during 1979/80)

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	.88	20.77	25.09	25.49	72.23	427.05	499.28
Plant mix work	—	3.01	—	—	3.01	2.78	5.79
Reconstruction of lengths of previously sealed pavements							
Sprayed work	110.89	—	8.78	206.99	326.66	251.15	577.81
Plant mix work	5.05	1.74	—	12.52	19.31	20.82	40.13
Widening of existing sealed pavements							
Sprayed work	76.70	19.12	.87	51.93	148.62	74.21	222.83
Plant mix work	8.70	.80	.20	3.13	12.83	7.62	20.45
Duplication of existing sealed pavements							
Sprayed work	15.03	.52	—	1.78	17.33	—	17.33
Plant mix work	1.63	—	—	11.98	13.61	2.54	16.15
Final seal							
Sprayed work	114.91	3.95	16.05	110.39	245.30	187.08	432.38
Plant mix work	3.80	2.40	—	5.43	11.63	6.61	18.24
Retreatment							
Sprayed work	667.48	48.94	86.49	927.64	1730.55	1025.51	2756.06
Plant mix work	21.06	27.41	.55	23.39	72.41	31.20	103.61
Totals	1026.13	128.66	138.03	1380.67	2673.49	2036.57	4710.06

Types of work

Sprayed work (initial treatments and retreatments) was again the principal type of work, amounting to 95.7 per cent of the total length of the work.
The plant mix work completed in 1979/80 was 204 km, i.e. 4.3 per cent of the total length and 7.0 per cent of the total area.
The 1979/80 expenditure on plant mix work was equivalent to 32 per cent of the total expenditure on bituminous surfacing. For the plant mix work a total of 364,000 tonnes was supplied and spread by contractors.

Cost of work

The average unit costs for sprayed work done by the Board's 18 bituminous surfacing units are shown in Table 6. The average overall cost of all types of sprayed work was 89 cents per square metre compared with 72 cents in 1978/79, an increase of 23 per cent.
The average cost per tonne for asphalt supplied and laid was approximately $34.26 per tonne in the Melbourne and Geelong areas, and approximately $40.20 per tonne in other areas of the State. The average cost per tonne was $34.80, compared with $27.19 in 1978/79.

Table 6:
Average costs of sprayed bituminous surfacing done by CRB plant
(On roads to which the Board contributed funds during 1979/80)
(Costs in cents per m²)

	Nature of work													
Item	ITP&S Size 13 & over	ITP&S Size 10	ITP&S Size 7	ITP&S Size5 & Sand	ITP&S 2Appln Seal	IT Primer-seal	ITSO&ITFS & Reseal Size 13	ITSO&ITFS & Reseal Size 10	ITSO&ITFS & Reseal Size 7	ITSO&ITFS & Reseal Size 5	BSRS Reseal Size 13	BSRS Reseal Size 10	Reseal 2 Appln	Surface Enrichment
Square metres costed	1,358,479	901,643	7,322	75,176	77,359	2,362,772	4,060,374	8,934,952	6,225,160	742,731	517,941	369,854	67,716	235,833
Material														
Cents	75.9	76.1	49.8	55.2	147.4	51.7	62.9	50.5	42.3	42.6	84.5	64.7	144.0	18.4
%	57.6	61.6	58.6	53.8	65.3	61.4	61.3	60.2	60.5	63.3	60.2	53.6	71.0	68.4
Stores														
Cents	6.2	4.4	2.1	4.7	7.7	3.1	4.0	3.4	2.8	2.4	5.2	6.5	5.9	0.5
%	4.7	3.6	2.5	4.6	3.4	3.7	3.9	4.0	4.0	3.6	3.7	5.4	2.9	1.9
Plant														
Cents	21.3	18.7	13.0	18.4	31.7	12.4	14.2	11.8	10.0	9.1	17.8	17.4	23.1	3.1
%	16.2	15.2	15.318.0	m'.1	1r.7	13.8	14.0	14.3	13.5	12.7	14.4	11.4	11.5	
Labour														
Cents	28.4	24.2	20.0	24.2	38.7	17.0	21.5	18.3	14.8	13.2	32.8	32.1	29.7	4.9
%	21.5	19.6	23.6	23.6	17.2	20.2	21.0	21.8	21.2	19.6	23.4	26.6	14.7	18.2
Totals														
Cents	131.8	123.4	84.9	102.5	225.5	84.2	102.6	84.0	69.9	67.3	140.3	120.7	202.7	26.9
%	100	100	100	100	100	100	100	100	100	100	100	100	100	100

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

Materials

(a) Aggregate
The total quantity of covering aggregate was approximately 273,600 cubic metres on sprayed work undertaken by the Board, and 35,700 cubic metres on sprayed work undertaken by municipalities and contractors. Table 7 details the average prices of aggregates over the last five years and illustrates that the average price in 1979/80 was $1.74 per cubic metre higher than the average price in 1978/79.

(b) Bitumen
The Board purchased 37,700 tonnes of bitument by contract with four suppliers at a cost of $7,817,000. Bitumen prices increased by 56 per cent between July 1979 and June 1980. Nevertheless sprayed seals remain the most economical road surfacing.

Table 7:
Average price of aggregate for bituminous surfacing (in roadside stacks)

Material Prices/cubic metre	75/76	76/77	77/78	78/79	79/80
	$	$	$	$	$
Screenings	11.19	12.66	13.00	14.11	15.73
Gravel	11.36	12.55	11.97	12.09	14.72
Sand	5.23	4.89	6.40	7.07	8.95
Scoria	6.51	6.41	21.38	7.80	8.55
Average price all aggregate	11.01	12.42	12.92	13.69	15.43

Report on previous experimental work

Road and location	Nature and reason for work	Date work done	Conclusion to date
North Road, Ormond	Evaluation of performance of white coloured artificially produced aggregate, calcined pyrophillite, as a single application seal	April 1974	The seals have performed very well. The sections containing calcined pyrophillite have much higher skid resistance values than the section of older basalt. The calcined pyrophillite has retained its light colour.
Glenferrie Road, Hawthorn	Evaluation of calcined pyrophillite/rhyodacite aggregate mixture for light coloured delineation of pedestrian crossing approach	March 1977	Delineation was not as great as hoped. Blackening occurred due to the severe stresses of braking and accelerating traffic and the high rate of application of binder necessary to hold the aggregate in place.
Wellington Street, Kew	Evaluation of light coloured artifically produced aggregate pressed into various shapes to reduce wastage by crushing	Feb 1976	Stripping occurred due to either the shape or adhesion properties of the artificial aggregate. A further trial with the same material in crushed form gave slightly better results but significant stripping still occurred.
Springvale Road, Keysborough	Evaluation of open graded friction course asphalt with varying grades and proportions of bitument binder	April 1975	Open graded friction course has remained porous and retained a high level of skid resistance. Sections with lower binder contents and hard binder are now starting to deteriorate. Tests on binder indicate that the binder film thickness is the most important factor in the rate of hardening of the binder. A softer initial grade of binder may give a longer life except that drainage of binder from aggregate can occur during transport and placing.
Various roads Shire of Grenville	Surface enrichment seal	Dec 1975	The application of a bituminous binder without cover aggregate can extend the life of an existing seal, reduce stripping of aggregate and seal minor surface cracks. The process is generally only applicable to low traffic density roads. Binder may be applied in the form of cutback bitumen or bitumen emulsion.
Nepean Highway, Mordialloc	Asphalt with bitumen scrap rubber seal and bitumen scrap rubber binder	Dec 1977	An open graded asphalt followed by a bitumen scrap rubber seal is more effective than conventional asphalt surfacing in resisting reflective cracking when placed over a cracked Portland cement concrete pavement. The use of bitumen scrap rubber as binder in the asphalt is inconclusive at this stage. A further trial section was placed over a concrete pavement on the Maroondah Highway at Ringwood in December 1979.

Hydraulically powered vibrating trench compactor

A hydraulically powered vibrating plate compactor has been developed to compact graded filter material in subsoil drainage trenches.
Commercially available compaction units were either too large to fit in the trench or too small for the task.
The specification for the compactor is as follows:
1600 mm long overall x 185 mm wide x 190 mm high, 1200 mm x 185 mm wide flat contact base surface
Total mass 110 kg
Amplitude of vibration 0.70 mm
Hydraulic motor — Power 3 kW, Torque 4.5 Nm, Flow 30 litres/min
Pressure 8300 kPa at 5,000 rpm
Eccentric power unit — mass 2.35 kg, eccentricity 29.4 mm,
centrifugal force 19,000 kN at 5,000 vpm
The vibrating power unit is mounted longitudinally in the compactor. The hydraulic motor is directly coupled to the eccentric shaft and supplied through flexible hoses from the hydraulic system of the tractor.
The compactor can be towed by any self propelled plant item with a suitable hydraulic power source. It has been designed to couple to a wheeled tractor fitted with front end loader which is used to lift the compactor in and out of subsoil drainage trenches.
The compactor is towed along the trench by the tractor from a horizontal outrigger boom mounted in place of the bucket on the front end loader arms. The tractor is able to travel alongside the trench and allow the operator a reasonable view of the compactor.
The compactor was tested using three types of filter material — washed concrete sand, crushed basalt and crushed basalt with fines below 5 mm screened out. Good compaction for depths up to 350 mm was achieved with all three materials after using four to six passes of the compactor. Filter materials are placed in layers not exceeding 300 mm loose depth.

Roadmarker development

The Board's linemarking plant includes five small three-wheeled self propelled roadmarkers. These units are 3200 mm long, weight 1.5 tonnes, are propelled by a 5 kW petrol engine. They carry enough paint for about 12 km of standard stripe. They are used for the shorter lengths of centre-line and edge-line work, and because of their size and manoeuverability, they are very useful for intersection work.

An improved unit has been designed and built to increase productivity and reduce machine downtime and maintenance costs. It retains the best characteristics of the existing units and has a 12 kW engine and a paint capacity for 30 km of standard stripe (see Figure 22).

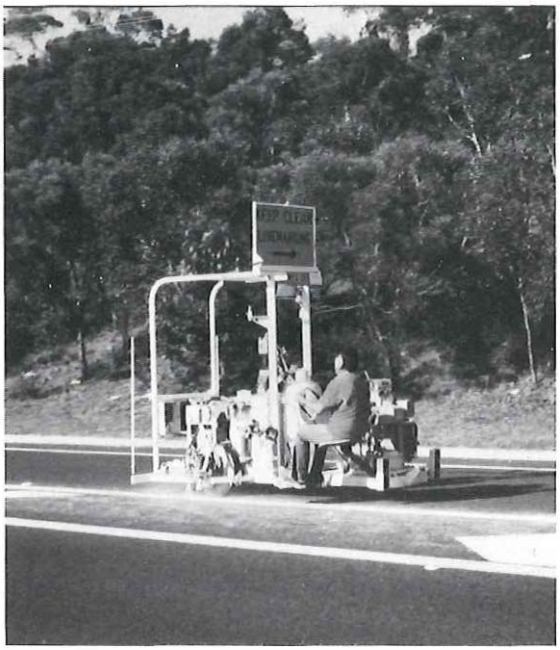


Figure 22: The Board's improved three-wheeled self-propelled roadmarker.

To minimise downtime the new machine has been designed with major assemblies such as the propulsion unit and the auxiliary power unit incorporated as change-over units. These units can be changed by removing only a few bolts.
The propulsion unit is mounted in a large diameter ball race turntable and drives the single wheel through a hydrostatic transmission. The wheel motor hydrostatic system eliminates all belts and chains, and helps to produce a low centre of gravity. The hydrostatic transmission eliminates all routine adjustments and drastically reduces regular mechanical maintenance. It permits the operator to select any road speed, whilst still maintaining full engine power, from a simple single lever system. Since this system provides engine braking, the maintenance of the conventional brake system, provided only for parking and emergencies, is virtually eliminated.
The airless spray system used produces a better line definition and virtually eliminates overspray resulting in paint savings, a cleaner machine and less pollution.
Glass beads are fed from a pressurised hopper and air boosted during application to give excellent coverage with virtually no losses due to wind.
For night work the machine is equipped with full lighting and an overhead internally illuminated warning sign.

Bomag Stabiliser — Model MPH 100

Two Bomag MPH 100 soil stabilisers have been purchased to provide more effective means of pulverising and blending pavement foundations and mixing additives to increase load bearing capacity of pavements.
Each unit is powered by a 226 kW Detroit diesel engine with hydrostatic drives for both traction and rotor action.
A mechanical reduction provides two forward speeds, 0-1.1 metre/second for working and 0-23 km/hour for travelling. Two rotor speeds, 0-150 rpm for pulverising and 0-280 rpm for mixing, are provided with a 2,007 mm width of cut by the rotor to a maximum depth of 368 mm.
Two types of cutting teeth are available — standard hardfaced teeth, which are applicable to high impact use but will wear rapidly in abrasive conditions; and premium, carbide-faced teeth which suit abrasive materials but the carbide facing can be shattered by impact with large, hard stones.
The stabilisers are complete with systems to suit water/lime slurry or asphalt additives.

Publications

The following papers by officers in the Engineer in Chief's Branch were presented or published in the 1979/80 year—

"Drainage Construction with Maintenance in Mind".
G M Anderson, Engineer, Road Planning Division.
Published in *Highway Engineering in Australia* February 1980.

"Stage Development of Traffic Capacity Improvements to Major Rural Roads in Victoria."
D J Berry, Road Planning Engineer
G J Both, Transport Economist, Advance Planning Division.
Presented at the Bureau of Transport Economics' Workshop on the Economics of Road Design Standards, Canberra, May 1980.

"Finite Element Analysis of a Slope at Illawarra Escarpment."
S Valliappan, Associate Professor, School of Civil Engineering (Materials), University of New South Wales
R S Evans, Scientific Officer, Materials Research Division.
Presented at the Third Australia-New Zealand Conference on Geomechanics, Wellington, May 1980.

"Saturation Flows: Lane Utilization and Other Design Problems."
T C Miller, Engineer, Traffic Engineering Division
P R Cornwell, Traffic Engineer, Road Safety and Traffic Authority
R Akcelik, Senior Research Scientist, Australian Road Research Board.
Presented at the Australian Road Research Board Workshop on Capacity of Signalized Intersections, Melbourne, December 1979.

"Procedures Adopted by the Country Roads Board in the Environmental Review of Works Programmes."
R E Saunders, Leader, Environmental Studies Section.
Published in *Australian Road Research* Vol 10 No 2, June 1980.

"How a State Road Authority Assesses the Sociological Aspects of Alternative Road Proposals."
R E Saunders, Leader, Enironmental Studies Section
L A Douglas-Smith, Sociologist, Environmental Studies Section
Presented at the Australian Road Research Board Workshop on Measuring Social Behaviour in Road Research, Melbourne, April 1980.

"An Urban Corridor Roading Study — An Example from Melbourne, Australia."
R T Underwood, Chief Planning Engineer.
Published in *The Highway Engineer,* Vol 27 No 2, February 1980.

"Environment Assessment Procedures for Road Proposals."
R T Underwood, Chief Planning Engineer.
Published in *Australian Road Research* Vol 10 No 1, March 1980.

"Fuel Economy — Road and Traffic Engineering."
R T Underwood, Chief Planning Engineer.
Presented at the Society of Automotive Engineers, Australia, Seminar on Petrol Economy, Melbourne, May 1980.

"Hume Freeway — Development in Victoria."
R T Underwood, Chief Planning Engineer.
Published in *Civil Engineering Transactions,* Vol 22 No 1, 1980.

"New Urban Roads — A Case for Keeping Future Options Open."
R T Underwood, Chief Planning Engineer.
Presented at the Transportation Conference of the Institution of Engineers, Australia, Adelaide, November 1979.

"Roads in Urban Areas — National Report."
R T Underwood, Chief Planning Engineer.
Presented at the XVIth World Congress of the Permanent International Association of Road Congresses, Vienna, September 1979.

"Some Energy Considerations in Road Building."
R T Underwood, Chief Planning Engineer.
Published in *Australian Road Research,* Vol 9 No 3, September 1979.

"Principles of Side Resistance Development in Rock Socketed Piles"
A F Williams, Engineer, Materials Research Division.
Presented at the Third Australia-New Zealand Conference on Geomechanics, Wellington, May 1980.

"Stress Distributions in Rock Socketed Piles."
A F Williams, Engineer, Materials Research Division
I B Donald, Associate Professor, Department of Civil Engineering, Monash University
H K Chiu, Post Graduate Student, Department of Civil Engineering, Monash University.
Presented at the International Conference on Structural Foundations on Rock, Sydney, May 1980.

"The Design and Performance of Cast-in-situ Piles in Extensively Jointed Silurian Mudstone."
A F Williams, Engineer, Materials Research Division.
M C Ervin, Engineer, Materials Research Division.
Presented at the Third Australia-New Zealand Conference on Geomechanics, Wellington, May 1980.

"The Design of Socketed Piles in Weak Rock."
A F Williams, Engineer, Materials Research Division
I W Johnston, Lecturer, Department of Civil Engineering, Monash University
I B Donald, Associate Professor, Department of Civil Engineering, Monash University.
Presented at the International Conference on Structural Foundations on Rock, Sydney, May 1980.

"The Design of Side Resistance Piles in Sedimentary Rock"
A F Williams, Engineer, Materials Research Division
P J N Pells, Senior Lecturer, School of Engineering, University of Sydney.
Presented at Concrete '79, Canberra, August 1979.

"Properties of Soft Rock Relevant to Socketed Pile Design."
I W Johnston, Lecturer, Department of Civil Engineering, Monash University
A F Williams, Engineer, Materials Research Division
H K Chiu, Post Graduate Student, Department of Civil Engineering, Monash University.
Presented at the International Conference on Structural Foundations on Rock, Sydney, May 1980.

The following papers were presented or published in the 1978/79 year but were not recorded in last year's report —

"Is the Maintenance of Drainage Systems Necessarily a Laborious Task?"
G M Anderson, Engineer, Road Planning Division.
Presented at the Second Conference, Road Engineering Association of Asia and Australasia, Manila, October 1978.

"Street Lighting."
E V Barton, Traffic Engineer.
Presented at Monash University Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1979.

"Bituminous Surfacing — Sprayed Seal Work by the Country Roads Board, Victoria, Australia."
J D Bethune, Asphalt Engineer
R G Allen, Assistant Asphalt Engineer
W P Holtrop, Engineer, Asphalt Division.
Presented at the Second Conference, Road Engineering Association of Asia and Australasia, Manila, October 1978.

"Signs and Pavement Markings."
K D Freeman, Engineer, Traffic Engineering Division.
Presented at Monash University Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1979.

"Traffic Surveys."
I L Mackintosh, Engineer, Traffic Engineering Division.
Presented at Monash University Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1979.

"Traffic Design — Roadway Elements."
T C Miller, Engineer, Traffic Engineering Division.
Presented at Monash University Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1979.

"Management of the Effects of Major Road Facilities in Urban Areas."
B J Negus, Senior Traffic Design Engineer.
Presented at the Second Conference, Road Engineering Association of Asia and Australasia, Manila, October 1978.

"Traffic Signal Co-ordination and Area Control."
B J Negus, Senior Traffic Design Engineer.
C K Mottram, Engineer, Traffic Engineering Division.
Presented at Monash University Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1979.

"Roundabout Design."
E Richardson, Engineer, Traffic Engineering Division.
Presented at Monash University Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1979.

"Vehicle Characteristics: Effect on Traffic Design."
E Richardson, Engineer, Traffic Engineering Division.
Presented at Monash University Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1979.

Also published in 1979/80 were —
Research Memorandum No 24
Lateral Load Tests on Large Bored Piles Series 1
P McDonald, Research Engineer
Materials Research Division
G Scott, Research Engineer
Materials Research Division
Technical Bulletin No 30
Guidelines for the Design and Construction of Roundabouts
Technical Report No 65
Effect of Percentage Fines in Crushed Rock on Long Term Performance
P D White, Engineer
Materials Research Division
Technical Report No. 66
Recalibration of Trip Distribution Model for Melbourne
J Ford, Engineer
Road Planning Division
Technical Report No 67
CRB Asphalt Mix Design: The State of the Art
W R Sherwin, Experimental Officer
Materials Research Division

Staff

As at 30 June 1980 personnel in the Engineer in Chief's Branch numbered:

Technological Staff (Professional)	625
Technical Staff	618
Administrative Staff	436
Supervisory Staff — Field	177
— Depot	70
Clerks of Works	71
Construction and Maintenance	2243
Workshop and Depot	593
	4833