Country Roads Board

68th Annual Report

1980 - 1981

COUNTRY ROADS BOARD
1913
VICTORIA

60 DENMARK STREET KEW
VICTORIA 3101 AUSTRALIA

30th September 1981

The Honourable Robert Maclellan, MLA
Minister of Transport
35 Spring 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 ending 30th June 1981.

The Board wishes to thank you and 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

Country Roads Board Annual Report

This is the sixty-eighth Annual Report of the Board for the year ended 30th June 1981. It is presented to both Houses of Parliament pursuant to the Country Roads Act 1958.

The Country Roads Board is the State Road Authority for Victoria. The Board'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 23,718 comprise the State's principal road network of Country Roads Board declared roads.

The lengths of roads declared or proclaimed under the Country Roads Act are State highways 6,973 km, freeways 353 km, main roads 14,564 km, tourists' roads 798 km, and forest roads 1,030 km.

Summary of activities

During 1980/81 the Board:

- expended $229.9 million on new roads and bridges and the maintenance and improvement of existing roads and bridges
- completed, and opened to traffic, 8.6 km of freeway
- sealed or resealed with bitumen 4,718 km of road
- commenced the construction of 81 new bridges (including 52 commenced by municipal councils with financial assistance from the Board) with a total estimated cost of $21, 617,000
- linemarked 31,301 km of roads
- entered into 282 contracts with a total value of $42,500,000
- allocated $95,461,000 for expenditure by municipalities on main roads and unclassified roads.

Cover: The Princes Freeway bypass of Drouin was opened to traffic on Thursday 12th February 1981 by the Honourable J C M Balfour MP, in the presence of the Honourable Robert Maclellan MLA, the Victorian Minister of Transport and the Honourable R J D Hunt MP, the Commonwealth Minister for Transport. After the ceremony the official party, accompanied by Mr T H Russell, the Chairman of the Board, travelled along a section of the new freeway in a restored Cobb & Co coach.

CONTENTS

Structure of the Country Roads Board

The Board, with its Head Office located at Kew, is organised functionally into three Branches – the Engineer in Chief's Branch, the Secretary's Branch and the Chief Accountant's Branch.

Engineer in Chief's Branch

The Engineer in Chief's Branch carries out the engineering activities of the Board including road construction and maintenance. Specialist sub-branches have been formed under the titles Planning, Road Design, Works, Bridge, Mechanical and Urban Projects.
To facilitate close contact with municipal councils and to decentralise supervision of works under the direct control of the Board, ten regional divisions, each headed by a Divisional Engineer, have been established. Divisional offices are located at Bairnsdale, Ballarat, Benalla, Bendigo, Nunawading (Dandenong Division), Geelong, Horsham, East Kew (Metropolitan Division), Traralgon and Warrnambool. Materials testing laboratories and depots are also established at each of the rural divisional offices.

Secretary's Branch

The Secretary's Branch carries out general administration matters and the promulgation of the Board's decisions and directions as well as a number of specialist activities relating to personnel and training, land acquisition, the control of overweight and overdimensional vehicles, legal and contractual matters, methods studies, public relations and publications.

Chief Accountant's Branch

The Chief Accountant's Branch carries out the recording of the Board's receipts and expenditure, the co-ordination of records with the State Treasury and municipalities, the operation of the Board's costing system, and the control of and accounting for stores.

The Board

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

Branch Heads

K G Moody
BCE, M Eng Sc, Ph D, MIE Aust
Engineer in Chief

G K Cox
LL B, JP
Secretary

R G Cooper
B Comm, AASA
Chief Accountant

From left to right:
Mr R G Cooper, Mr N L Allanson, Mr W S Brake, Mr T H Russell, Dr K G Moody, Mr G K Cox

OVERVIEW

Victoria is the most densely populated State of Australia with 3.8 million people living in 227,600 square kilometres. Over the years an extensive road system has been developed to serve the State and link Victoria with the road systems of neighbouring States.
The Country Roads Board is the State Road Authority for Victoria. The Board's aim is to create an efficient road system within the context of the overall transportation needs of the community.

Development of the Board

The Country Roads Board is a statutory corporation, first constituted under the Country Roads Act 1912. The Board consists of three Members appointed by the Governor in Council, and the powers and responsibilities of the Board are outlined in the Country Roads Act 1958.
Prior to the Board being constituted, local government bodies were generally responsible for the construction and maintenance of roads. However, experience in Victoria and overseas had indicated that if the problems associated with road construction and maintenance in a rapidly developing country were to be adequately planned and overcome, it would be necessary to appoint a central authority with wide discretionary powers to work in close co-operation with the existing machinery of local government. The Country Roads Act 1912 was framed with these requirements in mind, and the Board was constituted and financially endowed in such a way as to preserve its independence, and to enable it to discharge its duties to the greatest benefit of the State as a whole.
The Country Roads Act 1912 was proclaimed to come into operation on 1st January 1913. At that time, the roads in Victoria were generally in a deplorable condition. Many of them, particularly in various hilly areas of the State, were little better than primitive tracks and even those roads which had been well constructed as the principal coach routes before the advent of railways, had been allowed to deteriorate to a very serious extent.
The first task that the Board undertook was an inspection of every municipality to determine the state of roads in Victoria and to advise municipal councils on methods of constructing and maintaining roads. As a result of the investigation, the Board nominated some 8,047 km of roads for declaration as main roads, being the major road classification provided for under the Country Roads Act 1912.
Since those early years, the types and classifications of roads have increased. In 1924, legislation providing for the declaration of State highways was enacted.
In 1955, the Board commenced the duplication of the pavements of certain heavily trafficked sections of State highways, notably on the Princes Highway East between Oakleigh and Dandenong and between Brooklyn and Norlane on the Princes Highway West. With the considerable growth in motor vehicle ownership and the large increase in the volume of traffic using roads, the advantages of high capacity roads with limited access soon became apparent. The first freeway (originally referred to as a bypass road) to be constructed was the Maltby Bypass Road which was completed in 1961.
Tourists' roads and forest roads are other classifications now provided for in the Country Roads Act as the responsibility of the Board.
The Board works in close co-operation with local municipal councils in the maintenance and development of the network of regional and local roads. In addition to financial assistance, the Board is able to offer expert technical knowledge and specialist services to municipal councils and staff.

The road system

As at 30th June 1981, the lengths of roads declared under the Country Roads Act were State highways 6,973 km, freeways 353 km, main roads 14,564 km, tourists' roads 798 km, and forest roads 1,030 km, making a total of 23,718 km.

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.

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.

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.

Forest roads

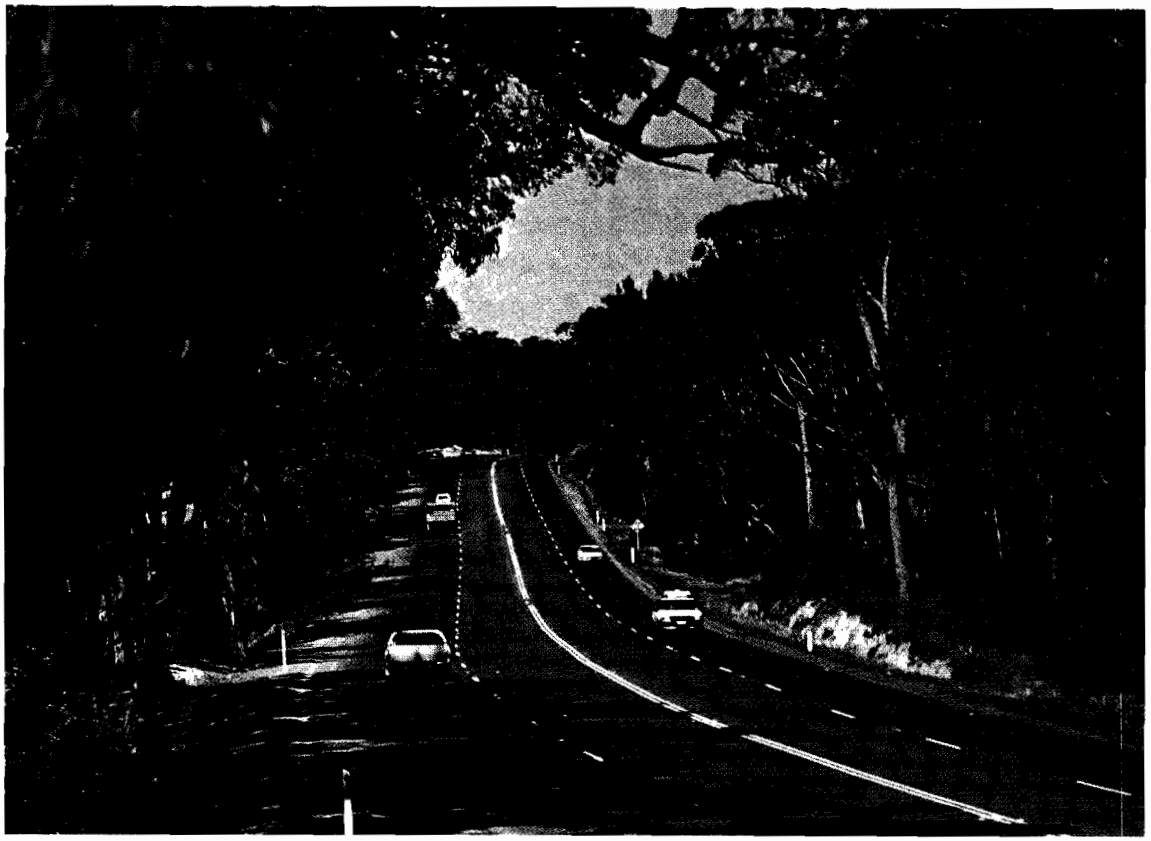
Forest roads proclaimed under the provisions of the Country Roads Act are situated within or adjacent to a State forest or in areas which are considered by the Board to be timbered, mountainous or undeveloped. The Board bears the full cost of works required to cater for the needs of through traffic,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

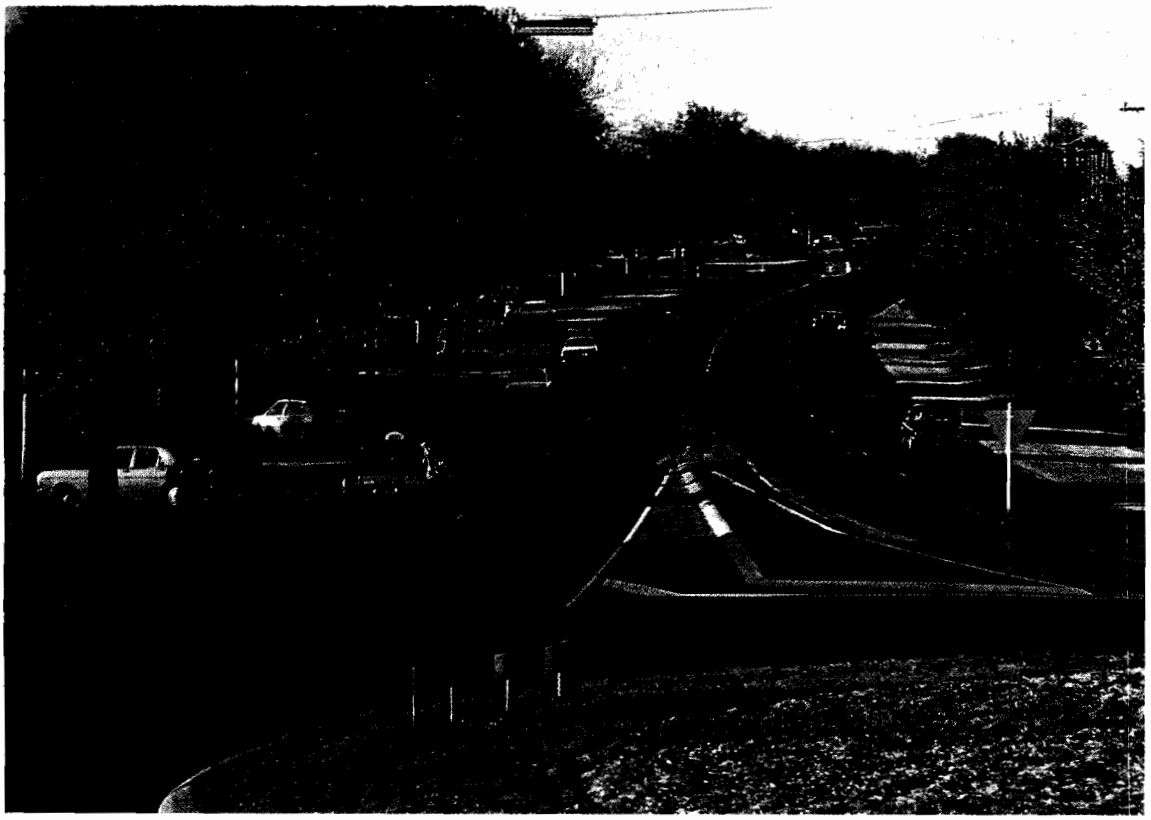
Main roads

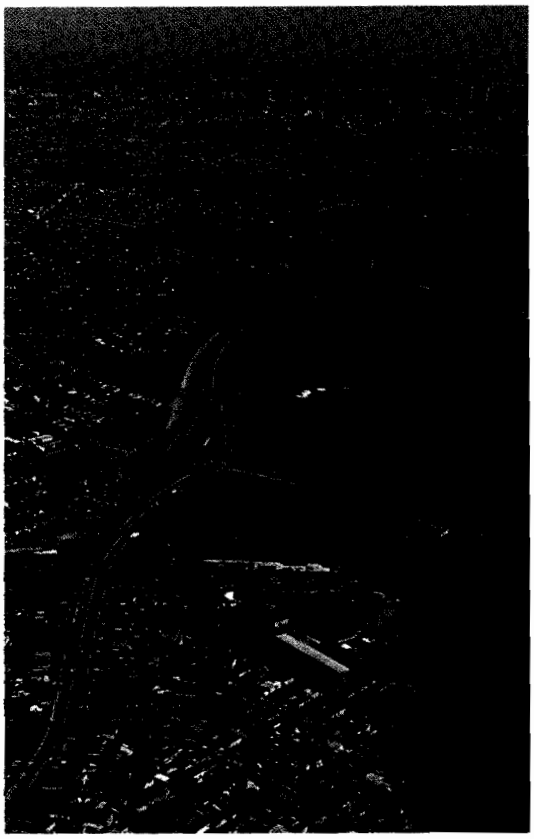
Main roads are roads linking centres of population with other centres or with areas of industry, commerce or settlement. Generally main roads are constructed and maintained by municipal councils to the satisfaction of, and with financial assistance from, the Board. In some cases, at the request of the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

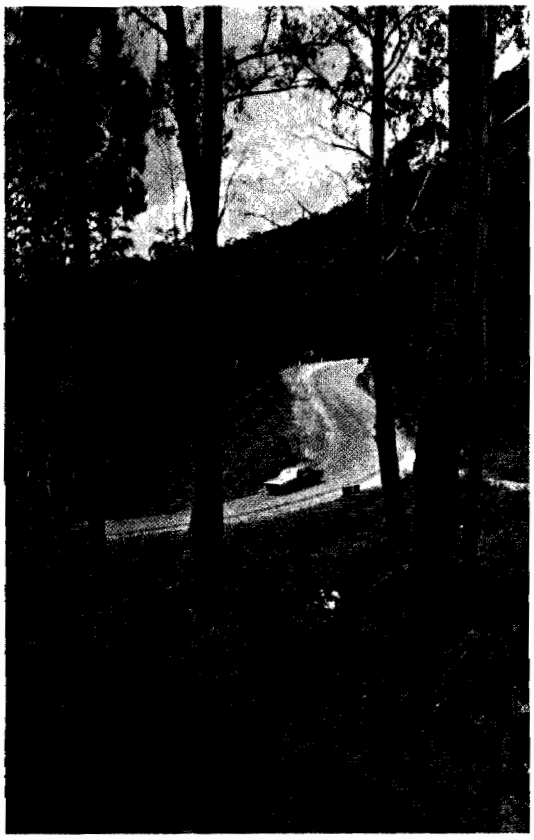
Unclassified roads

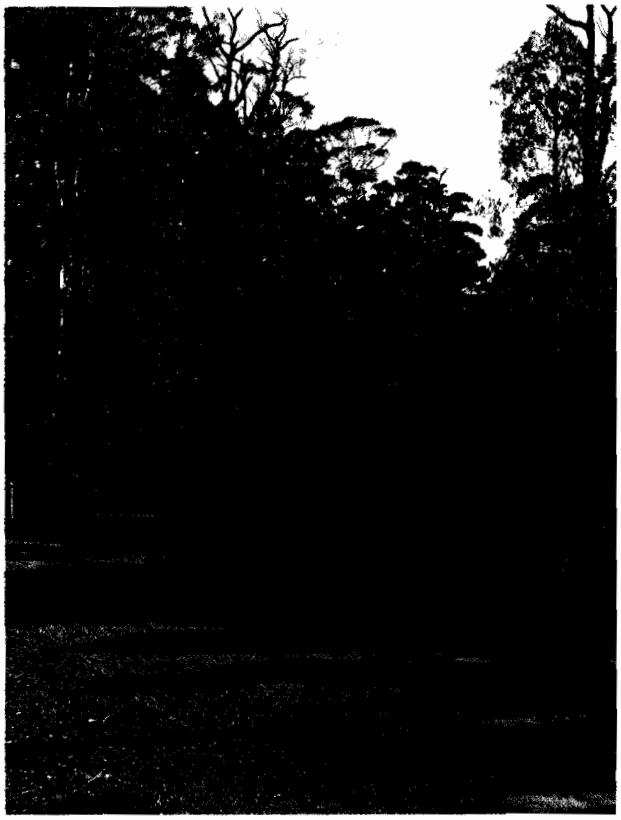
Roads which are not included in the Board's declared and proclaimed road system are referred to as unclassified roads. These roads are the responsibility of municipal councils, but each year the Board allocates financial assistance towards the cost of construction and maintenance works, generally in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











Above: Bogong High Plains Road (Tourists' road)

Above left: Eastern Freeway, Collingwood to Bulleen with construction on the arterial road extension in the foreground (Freeway)

Left: Warburton–Woods Point Road (Forest road)

Top, opposite: Calder Highway through the Black Forest, near Macedon (State highway)

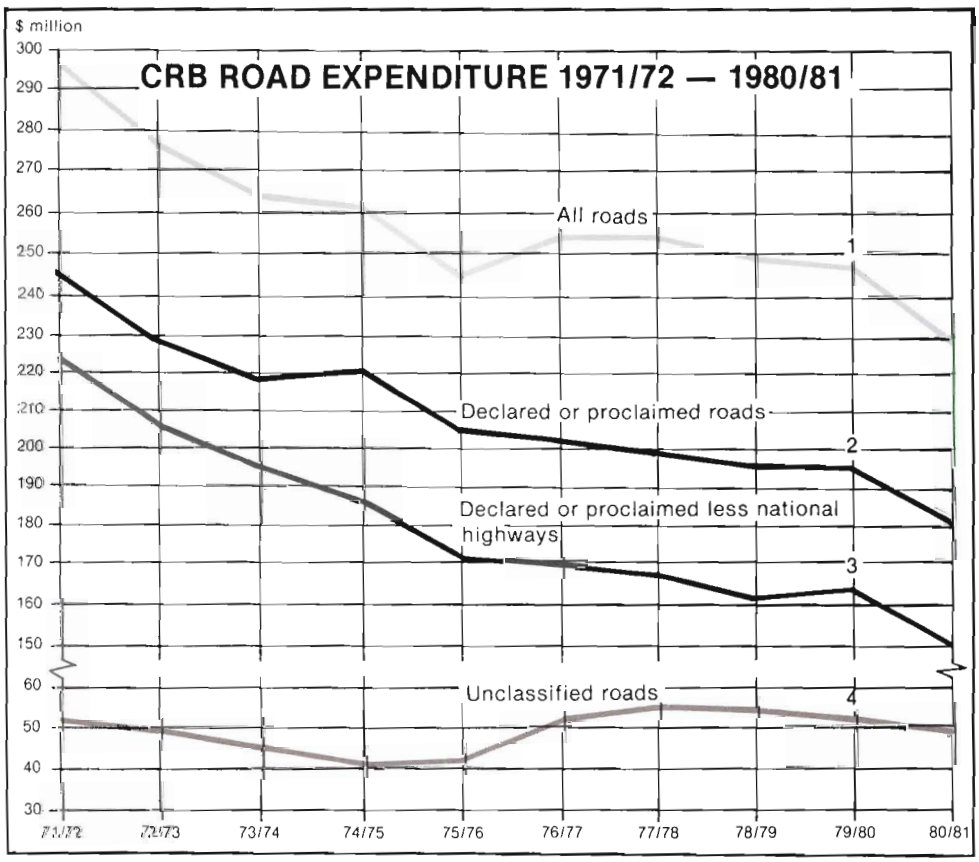
Below, opposite: Colac–Ballarat Road, Ballarat City (Main road)

Road expenditure trends

Victoria's road system has a vital role to play in the continued growth and development of the State, and in the well-being of its people, by providing the basis for safe, reliable, convenient and economic transport. A high standard road system and a consequent high level of mobility are essential requirements for the development of the State's agricultural, industrial, commercial, energy and natural resources and to cater for people's social, cultural, educational and other needs. However, in the past ten years, the real value of total expenditure from funds available to the Board from State and Commonwealth sources on the construction and maintenance of roads in Victoria decreased by approximately 22% whilst during the same period the total amount of travel on roads increased by approximately 66%. In 1980/81, the Board's total revenue increased by approximately 8% over the preceding financial year, whilst the Board's direct works and salary price index increased by approximately 15%. This trend is likely to continue in 1981/82 with the rate of cost inflation in the road industry estimated to increase by 13% and revenue estimated to increase by only 6.2% if the present rates of motor registration fees and fuel licence fees are retained.

Unless this trend is arrested it is inevitable that, in the long term, conditions for traffic on roads throughout the State will deteriorate. In addition, the commencement of many important proposed new road projects will be delayed and the progress of existing major projects will be retarded.

The following graph shows expenditure on roads in Victoria over the decade 1971/72 to 1980/81, expressed in 1980/81 constant values:



Shows the following expenditures:

(1) total road and bridge expenditure from CRB funds and including expenditure by MMBW on roads between 1971/72 and 1973/74.

(2) direct road and bridge expenditure by the CRB and by Councils from allocations made by the Board on the construction and maintenance of the declared road system including expenditure by the MMBW on roads between 1971/72 and 1973/74.

(3) expenditure as set out in (2) above excluding expenditure on national highways. As the Hume and Western Highways were only declared as national highways in July 1974, expenditure on those highways between 1971/72 and 1973/74 has also been excluded for comparative purposes.

(4) expenditure from CRB funds on unclassified roads.

The graph clearly shows the worsening position in road funding. In particular, it will be noted that the total expenditure on the declared road system in constant 1980/81 values has declined by approximately 26% since 1971/72. Further, if expenditure on those sections of State highways which have been declared as national highways under the Commonwealth Roads Grants legislation is omitted, expenditure on the remainder of the declared road system has declined by about 33% in real terms since 1971/72, even though there has been approximately 66% increase in traffic using these roads in the same period.

On unclassified roads, the trend has been quite different as the expenditure of the Board's funds on unclassified roads declined by only 5% in real terms and is much less than the decrease in expenditure on the Board's declared and proclaimed roads.

A number of factors have contributed to the decline in the real value of expenditure on Victorian roads. The higher rate of cost inflation in the road industry is demonstrated by the significant increases which have occurred in the prices of materials for roadworks and in the cost of labour and the level of plant hire rates. During 1980/81, there were substantial increases in the prices of such materials as bitumen (12.5%), distillate (15.9%), standard fuel (10.4%), aggregate (37.2% urban), pipes (20.5% urban and 21.6% rural), steel (14.1%) and box culverts (21.6% urban and 19.2% rural). Field and depot labour costs increased between 11.1% and 12.8%.

Despite the increasing cost of operating motor vehicles, the total traffic on the State's roads is still increasing, leading to increasing demands on the road network. It is particularly significant that an increasing proportion of the total movement of freight is by large vehicles. In Victoria, between 1976 and 1979:

- the number of articulated trucks, with a tare mass of 11 tonnes or more, increased by 91%
- the average annual distance travelled per vehicle increased by 32% for articulated trucks with a tare mass of less than 11 tonnes, and 15% for articulated trucks with a greater tare mass
- the total annual tonne/kilometreage increased by 51% for articulated trucks with a tare mass of less than 11 tonnes and 132% for articulated trucks with a greater tare mass.

It is expected that demands on the road system will continue to increase. Even allowing for a marked increase in fuel prices, the amount of travel on the Melbourne metropolitan road network is expected to increase by a further 40% by the end of the century. The number, size and use of heavy trucks is expected to continue to increase as a result of higher permissible loads, deregulation of the road freight industry and reductions in some rail services.

The rapidly increasing demands on the road system (particularly from heavy vehicles) causes an accelerating rate of deterioration of the overall condition of road pavements and a correspondingly increasing requirement for maintenance works. This requirement, compounded by the generally increasing costs of roadworks, is further limiting the level of funds available for improving the road system.

Unless road funds available to the Board can be substantially increased, and having regard to the rapidly increasing costs of maintaining the existing road system, there will be an ever-declining level of funds in real terms available for improvement to the road system. The total traffic on the State's roads is still increasing and if this trend continues, which is likely, there will be a consequent reduction in the level of service which road users can expect from the road system. The results of this reduction will include:

- increased travel time and delays, particularly in urban areas
- increased vehicle operating costs (including increased fuel usage), particularly in urban areas
- slowing down in the rate of road safety improvements
- increased traffic on residential streets due to congested arterial roads in urban areas
- increased transport costs resulting in increased freight costs (and hence increased prices of commodities)
- serious reduction in the rate of desirable improvements in the rural road and bridge system.

New symbol

The Board's Chairman, Mr T H Russell, announced the introduction of the Board's new symbol at the opening of the Mulgrave Freeway from Huntingdale Road, East Oakleigh to Warrigal Road, Chadstone on Wednesday 24th June 1981.

The new symbol was designed to be both pleasing to the eye and to depict the Board as Victoria's road authority. It replaces the previous CRB symbol which contained the letters "CRB" in an oval and which had been used by the Board since the mid 1940s on vehicles and plant. The old symbol became the Board's general purpose symbol in the early 1960s.

The new symbol was designed by the Board's Public Relations Section and will be gradually introduced over the next two years.

Opening ceremonies

During the year the Board opened two new sections of freeway.

Princes Freeway, Drouin

On Thursday 12th February 1981, the Honourable J C M Balfour MP officially opened the section of the Princes Freeway bypassing Drouin. Mr Balfour unveiled a plaque and cut a ceremonial ribbon in the presence of the State and Commonwealth Ministers of Transport, the Honourable Robert Maclellan MLA and the Honourable R J D Hunt MP.

Mr Balfour, the former Victorian Minister for Minerals and Energy, had a close association with the area for many years, having been the local member of Parliament since 1955.

This 7 km section of the freeway between Robin Hood and the existing Princes Highway, east of Drouin, provides two lanes plus emergency stopping lanes for traffic in each direction.

The project included the construction of bridges at the Princes Highway, Robin Hood, at Main Neerim Road and at Buln Buln Road and cost approximately $12 million.

Following the opening of this section of freeway the Board commenced preliminary work for the construction of the 7 km freeway bypass of Warragul which is expected to be completed in 1985.

Below: The Hon J C M Balfour MP opens the Princes Freeway, bypass of Drouin, watched by the Victorian Minister of Transport, the Hon Robert Maclellan MLA and the Commonwealth Minister for Transport, the Hon R J D Hunt MP

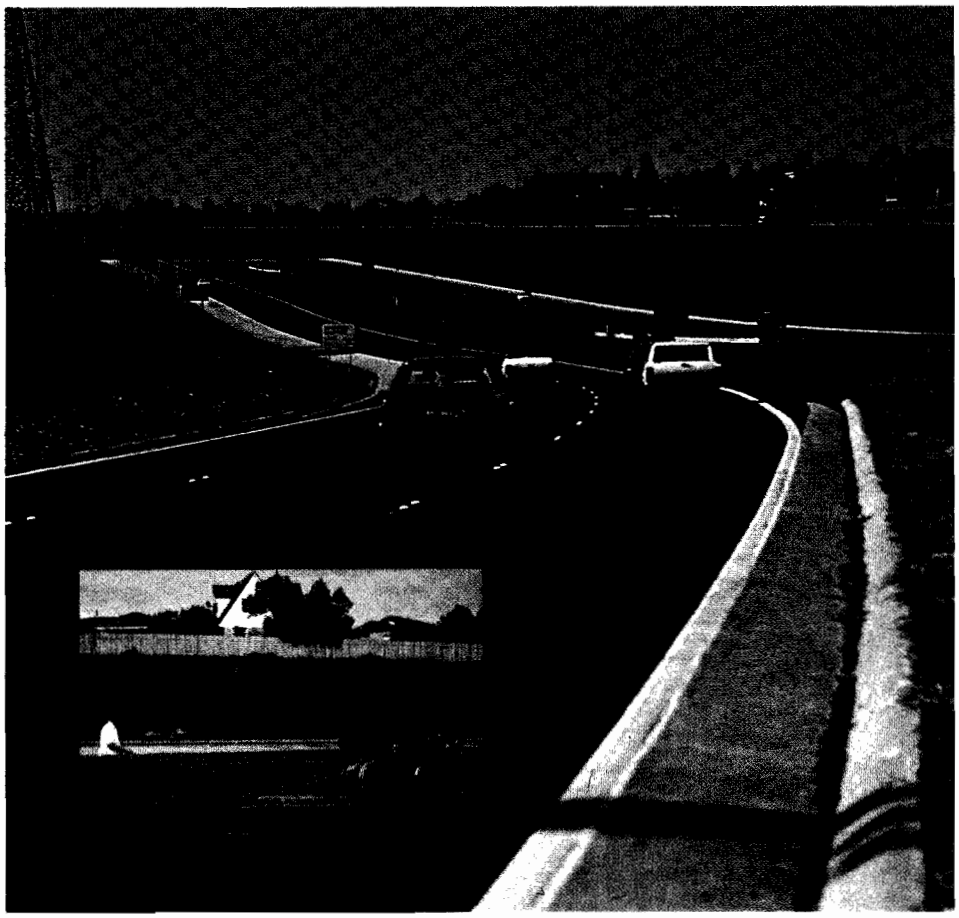
Mulgrave Freeway

The section of the Mulgrave Freeway between Huntingdale Road, Oakleigh East and Warrigal Road, Chadstone was opened to traffic by the Honourable Robert Maclellan MLA, Minister of Transport on Wednesday 24th June 1981.

This 1.6 km section of freeway was the final section of the Mulgrave Freeway to be constructed and was opened one week after the 20th anniversary of the opening of Victoria's first freeway, the Maltby Bypass Road near Werribee, on 16th June 1961.

The new section of freeway provides two lanes plus emergency stopping lanes for traffic in each direction. The project included the construction of a bridge to overpass the freeway at Atkinson Street and a pedestrian overpass at Jacana Street and cost approximately $11 million.

The Mulgrave and South Gippsland Freeways now provide 25 km of continuous freeway conditions between Warrigal Road, Chadstone and the South Gippsland Highway at Hampton Park.



Above: The newly-opened section of the Mulgrave Freeway, looking east, between Warrigal Road and Huntingdale Road

Inset: with modern machinery unable to work in the wet conditions, a horse-drawn harrow was brought in to prepare the median for grass planting

Two decades of freeways

Nineteen eighty-one marks 20 years of operation of Victoria's first freeway, the Maltby Bypass Road, which was opened to traffic on 16th June 1961. The 10 km bypass of Werribee, constructed by the Board, completed the provision of dual carriageways on the Princes Highway from Melbourne to Geelong. Traffic surveys carried out shortly after the opening to traffic of the Maltby Bypass Road indicated that it was attracting about 5700 vehicles per day or about 84 per cent of the through traffic.

Today, the Maltby Bypass Road carries much larger volumes of traffic, with a recent traffic count indicating an average daily volume of about 18,000 vehicles.

The Maltby Bypass Road is just one part of Victoria's freeway network which is approximately 353 km in length and includes freeways in both urban and rural areas.

An essential feature of freeways is the elimination of intersecting traffic which ensures a safer and more efficient facility with an accident rate approximately one-quarter to a sixth of the accident rate applicable to a two lane rural or urban arterial road.
It is estimated that Victoria's freeway construction programme has saved approximately 140 lives and 1800 injuries in rural areas and approximately 90 lives and 2900 injuries in urban areas, based on comparisons of accident and traffic volume figures in relation to freeways and arterial roads.
In urban areas, freeways facilitate greater mobility to the areas which they serve and take through traffic out of streets whose proper function is to serve residential, business, commercial and industrial development as well as the needs of local traffic, including pedestrian movements.
Savings in commercial vehicle operating costs through the use of freeways can result in reduced costs for a wide range of commodities that are transported by road. Transportation is responsible for approximately one-fifth of the cost of every item sold in Australia. Road transport plays a vital role in the freight transport system and in Victoria accounts for approximately 78% of the tonne-kilometres of goods transported by land. Approximately 99.5% of freight distribution in the urban area is carried by road transport.
An important feature of the Board's rural freeway programme has been the construction of a number of town bypasses. The opening of several town bypasses in Victoria has demonstrated that removal of through traffic from towns situated on heavily trafficked routes, results in improved amenity within the towns by enabling local traffic and pedestrians to proceed without interference from through traffic.

Commonwealth Roads Grants Act 1981

Since 1923, the Commonwealth Government has made grants available to the various States to assist their road programmes.
In 1926, the Commonwealth Government adopted the principle of road grants being made proportional to the use of petrol, the petrol tax being increased in that year and a definite amount per gallon 'hypothecated' for roads. This principle was retained for 33 years until in 1959 the Commonwealth Aid Roads Act severed the connection between petrol tax and road grants and made provision for allocations from consolidated revenue for distribution to the States.
The Commonwealth Aid Roads Act 1959 established the method of providing funds to the States for road construction and maintenance over a five year period. It was followed by the Commonwealth Aid Roads Act 1964 and the Commonwealth Aid Roads Act 1969. However the Roads Grants Act 1974 only provided funds for a three year period, as did the States Grants (Roads) Act 1977. The period was further reduced under the Roads Grants Act 1980 which only provided funds for the 1980/81 financial year.
The grant to Victoria for 1980/81 was $126,359,000.
In May 1981, 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 1981/82 to be provided under the Commonwealth Roads Grants Act 1981.
The grant to Victoria for 1981/82 is $137,828,000 out of a total of $685,000,000 to the States and the Northern Territory.
The grant to Victoria for 1980/81 under the Roads Grants Act 1980 increased by 11.15% over the 1979/80 grant, while the grant to Victoria for 1981/82 has been increased by 9.076% over the 1980/81 grant. Victoria's proportionate share of the total Commonwealth grants for 1981/82 remains at 20.12%.

The following table compares the Victorian grants for 1979/80, 1980/81 and 1981/82:

	1979/80 $'000s		1980/81 $'000s		1981/82 $'000s
National highway-construction	29,886	National roads	48,469	National roads	**52,868**
National highway-maintenance	3,449	Urban arterial	34,040	Arterial roads	**52,599**
National commerce roads	5,977	Rural arterial	14,182	Local roads	**32,361**
Urban Arterial Roads	31,548	Local roads	29,668		**137,828**
Urban Local Roads	4,200		126,359		
Rural Arterial Roads	12,759				
Rural Local Roads	21,841				
Minor Traffic Engineering and Road Safety Improvements	4,023				
	113,683				

Under the Commonwealth Roads Grants Act 1981, the number of categories of roads has been further reduced from four to three, i.e. national roads, arterial roads and local roads. This will result in a greater flexibility for the Board in the use of Commonwealth road funds, and will reduce the administrative work associated with the Act.

While the main purpose of the Commonwealth Roads Grants Act 1981 is to provide Commonwealth grants for road works for 1981/82, the Act also appropriates minimum levels of funds for national roads for 1982/83 and 1983/84. The Act does not specify the grants in these years for arterial and local roads. The minimum grants for Victoria for national roads under the Act will be $52,868,000 for 1982/83 and $37,008,000 for 1983/84. National Roads in Victoria for the purposes of the Commonwealth Act are the Hume Highway and the Western Highway which are National Highways and the Princes Highway East between Dandenong and Traralgon which is a Developmental Road.

A significant feature of the Commonwealth Roads Grants Act 1981 is the abolition of the quota requirements provided for in previous Commonwealth Acts under which each State, in order to qualify for a Commonwealth grant, had to expend from its own resources the sum fixed by the Act as its quota.

The increase to Victoria in Commonwealth grants of only 9.076%, compared to the grant for 1980/81, will be inadequate to maintain in real terms the necessary expenditure on road and bridge construction and maintenance in Victoria. The current level of cost inflation in road construction and maintenance is approximately 15% p.a. Accordingly, unless additional Commonwealth funds are forthcoming, the increased Commonwealth grant for 1981/82 will in fact mean a reduction in the volume of work which the Board is able to undertake using Commonwealth funds.

Rural road needs

To cater for current and future traffic demands in rural areas the Board's strategy is:

(i) to maintain the existing road system including routine reconstruction and resealing;
(ii) to improve existing roads, intersections and roadsides in order to reduce the number and severity of traffic accidents;
(iii) to improve or replace bridges that are narrow, structurally deficient or of inadequate water-way;
(iv) to stage develop a system of divided roads and rural freeways, including town bypasses, on the more heavily-trafficked routes;
(v) to develop roads of recreational and tourist interest, including the provision of a system of wayside stopping places and rest areas;
(vi) to apply traffic management techniques in provincial cities and towns on all classes of roads with a view to optimising traffic flow on arterial roads, limiting the amount of traffic on local roads and protecting the environmental quality of local areas; and
(vii) to develop an adequate system of arterial roads.

The Board's rural strategy must, of course, be pursued within financial constraints.

Major rural roadworks

Major works under construction in rural areas include:

- Hume Freeway, bypass of Seymour and Avenel
- Hume Freeway, Barnawartha to Wodonga including a bypass of Wodonga
- Western Freeway, bypass of Wallace and Bungaree
- Princes Highway East – extension of duplication easterly from Pakenham
- Latrobe Terrace, Geelong – duplication and rail overpass.

Rural road planning

Some of the major projects currently being investigated for construction in the future, if sufficient funds become available, are listed below:

- Hume Freeway, Baddaginnie to Barnawartha including bypasses of Benalla and Wangaratta
- Princes Freeway – Pakenham, Tynong, Longwarry, Warragul, Morwell and Traralgon Sections
- Western Freeway, Melton Section
- Calder Highway, Keilor to Gisborne including bypasses of Diggers Rest and Gisborne
- New bridge over the Barwon River, Geelong between Latrobe Terrace and Settlement Road
- New bridges over the Murray River at Mildura, Echuca and Tocumwal.

Melbourne's road needs

The metropolitan road network is essential in enabling people and goods to be moved freely and efficiently within Melbourne and into the surrounding country areas. The Melbourne metropolitan area comprises some 2000 square km of relatively low density city and suburban development, with a population of 2.7 million people.

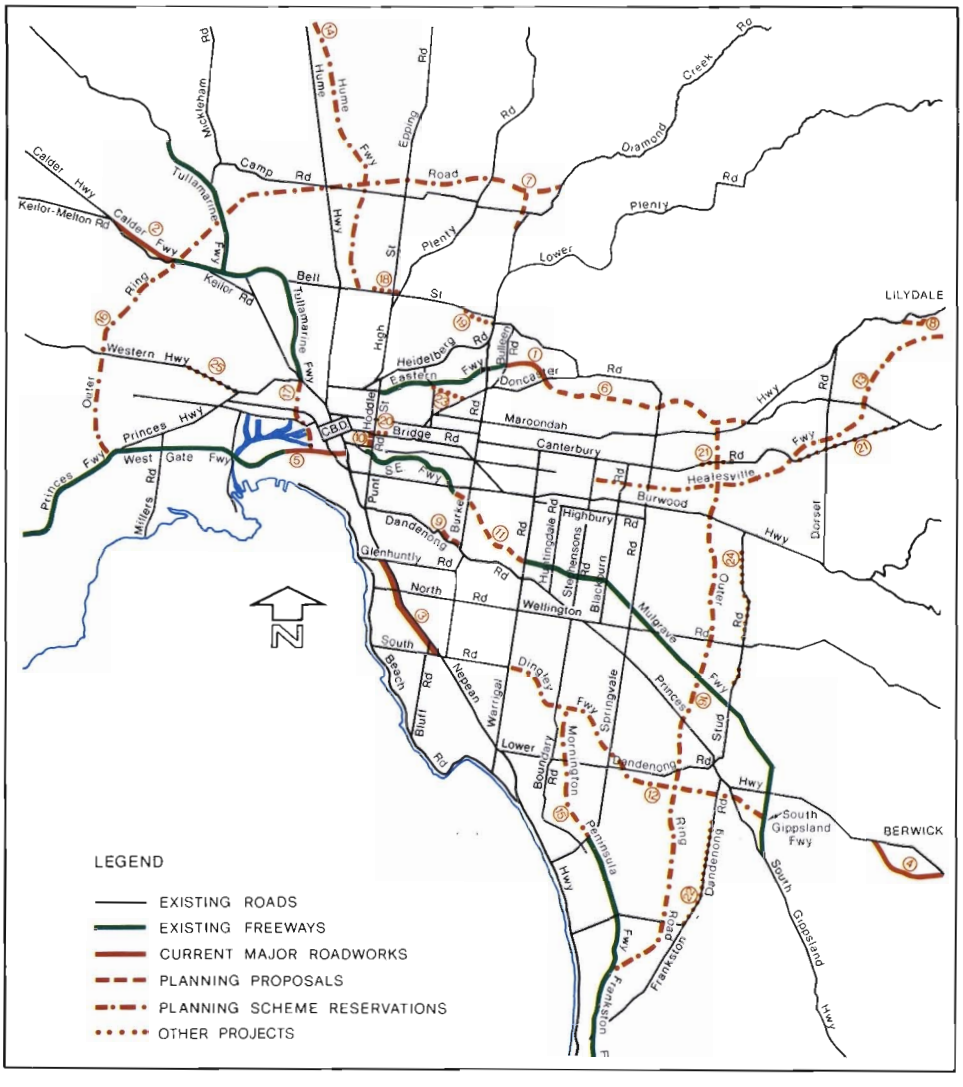
Approximately 90% of all journeys made by people in the metropolitan area are by motor vehicle, and virtually all freight movements (99.5%) within this area are by road. In addition, the road system provides the infrastructure for road-based public transport, including buses and taxis.

During the 1970s, traffic volumes increased by about 5% a year due to such factors as increased population, increased availability of motor vehicles and changes in living patterns. In the future, road travel is expected to continue increasing although the rate of increase should be somewhat lower than at present – with escalating petrol prices as a contributing factor.

Many improvements to the existing road system designed to improve safety and to assist traffic flow are effected by using relatively low-cost traffic management measures. These measures include the installation and linking of traffic signals, the widening and channelisation of intersections, the construction of roundabouts and the improvement of linemarking and signing.

Significant improvements in traffic flow can be provided by the co-ordination of traffic signals and the Board is currently implementing a major traffic signal computer linking project known as SCRAM (Signal Co-ordination of Regional Areas in Melbourne).

Where new residential or industrial areas are being established, provision must be made for future arterial road needs. Many of today's roads would not exist were it not for such planning in the past. Due to the limited availability of funds, it is neither practical nor generally economically justifiable to construct arterial roads before new areas develop.



To cater for current and future traffic demands, the Board's strategy in the Melbourne metropolitan area is:

(i) to develop selected arterial roads in order to provide reasonable continuity of high capacity movement on an integrated road system;
(ii) to develop or provide other arterial roads to the maximum extent possible, generally within existing road reservations, in order to provide adequate distribution and circulation of traffic through and around suburban centres and bypassing the Central Business District;
(iii) to place emphasis on the application of traffic management techniques, including the linking of traffic signals, both along selected arterial roads and on an area-wide basis in order to optimise traffic flow on arterial roads and to protect the environmental quality of local areas;
(iv) to consider the construction of freeways where other forms of road improvements are not capable of catering for high volume traffic flows in order to meet business and social road transportation needs while minimising community disruption and environmental impact;
(v) to protect options for future roads by seeking adequate road reservations in the Melbourne Metropolitan Planning Scheme; and
(vi) to comply with Government road development policies.

This strategy must be pursued within financial constraints. Road construction costs are increasing much faster than the funds available for roadworks and, because of this, the works programme often falls below community expectations.

Current major urban roadworks

Significant works under construction in the Metropolitan area include:

1. Arterial Road Extension of the Eastern Freeway, between Bulleen Road and Doncaster Road
2. Calder Freeway, Keilor Section
3. Nepean Highway, Elsternwick to Moorabbin
4. Princes Freeway, bypass of Berwick
5. West Gate Freeway, South Melbourne Section

Urban road planning for the future

Some of the major projects currently being investigated for construction in the future, if sufficient funds become available, are listed below:

6. Eastern Freeway, Doncaster to Ringwood
7. Freeway F5, Greensborough
8. Maroondah Highway, Lilydale
9. Princes Highway East, Caulfield to Malvern
10. Punt Road, Richmond
11. South Eastern Freeway, Malvern Section.

In addition to the above road planning proposals, investigations have been, or are being, carried out so that appropriate road reservations can be included in the Melbourne Metropolitan Planning Scheme and so that development can proceed with the knowledge of the location of the following proposed future road facilities:

12. Dingley Freeway
13. Healesville Freeway
14. Hume Freeway, Coburg to Craigieburn
15. Mornington Peninsula Freeway, Heatherton to Keysborough
16. The Outer Ring Road
17. Western Bypass of the CBD.

Many other projects are planned to improve traffic flow. Some will be carried out by the CRB, in close liaison with municipal councils, and some will be undertaken by councils with CRB financial assistance. Examples of such projects are:

18. Bell Street, James Street to O'Keefe Street - duplication
19. Bell Street–Banksia Street connection
20. Bridge Road, Richmond - widening
21. Canterbury Road - extend duplication
22. Dandenong–Frankston Road - completion of duplication
23. Route E6, Eastern Freeway to Harp Road - construction
24. Stud Road - completion of duplication
25. Western Highway, Princes Highway to Ashley Street - duplication.

- Various projects to eliminate railway level crossings.
- Other generally smaller projects to extend or complete duplication or to improve intersections throughout the metropolitan area.

ROADWORKS

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 the work completed increased the total length of dual carriageways on freeways, State highways, and main roads throughout the State to 819 km.
In addition work continued on many projects including 9 major projects each having an estimated cost of at least $5 million.

The more important major projects in progress or completed during the year included:

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.
At the end of the year, construction of the carriageways and the reconstruction of the Doncaster Road–High Street intersection were well advanced. The relocation of Koonung Creek in an underground conduit was also in progress. A pedestrian overpass at Kenneth Street was completed during the year.
The total estimated cost of the arterial road extension including the reconstruction of the Doncaster Road–High Street intersection and the undergrounding of the Koonung Creek is $22 million at 1981 prices.
Subject to the availability of funds, the roadworks are expected to be completed in mid 1982 and the undergrounding of the creek in late 1982.

Calder Freeway

Keilor Section

Work continued during the year on the Calder Freeway, Keilor Section from Erebus Street, Keilor East to Highland Road, Keilor North, a distance of 6 km.
Earthworks in the vicinity of Arundel Road, including a connection to St Albans Road commenced during the year and were well advanced at the end of the year.
Construction continued on the twin freeway bridges over the Maribyrnong River and on the Fosters Road bridge.
The first section of the freeway between Erebus Street and Arundel Road is expected to be completed in early 1982.
The total estimated cost of the project is $24 million at 1981 prices and completion is expected in 1984.

Hume Freeway

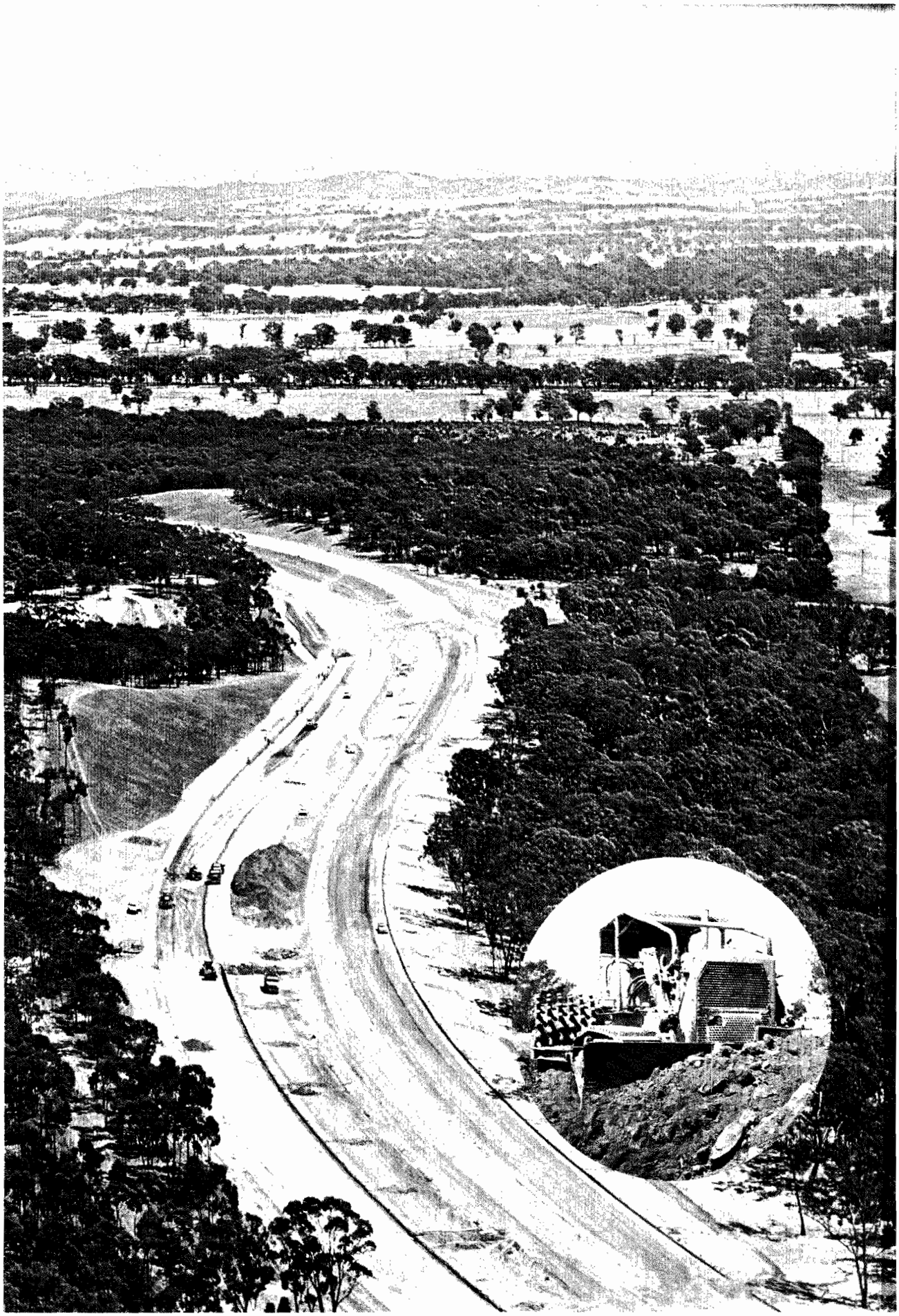
Avenel and Seymour Sections

Work continued on the construction of the 25 km Hume Freeway bypasses of Avenel and Seymour.
During the year earthworks and drainage works on the 16 km bypass of Avenel were completed and pavement construction on the freeway carriageways between the Goulburn Valley Highway and north of Avenel was substantially completed.
Construction of three bridges at the Goulburn Valley Highway interchange was also completed during the year.
Major earthworks and drainage works on the 9 km bypass of Seymour continued and were well advanced at the end of the year. Construction of eight bridges, including three twin bridges across the Goulburn River and its floodplain, commenced during the year.
The whole project is estimated to cost $49 million at 1981 prices. The bypass of Avenel is expected to be completed in late 1981 and the bypass of Seymour in 1983.

Barnawartha to Wodonga Section

Work commenced during the year on the duplication of 12.7 km from Quarry Road to Parkers Road and on the construction of a 4.8 km bypass of Wodonga.
Construction of the embankment approaches to the North Eastern Rail overpass and Lagoon Crossing on the bypass of Wodonga was completed during the year.
The whole project is estimated to cost $26.5 million at 1981 prices and completion is expected by 1986.

Right: Hume Freeway under construction, north of Seymour
Inset: a bulldozer and roller at work on the Hume Freeway



Latrobe Terrace, Geelong

During the year, 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 2.8 km.

The roadworks between Hope Street and Kilgour Street were completed in early 1981 and the reconstruction of the remaining length between Kilgour Street and Fyans Street is expected to be completed by late 1982.

The project includes the construction of twin 15 span, 269 metre long road over rail overpasses from the Princes Highway West near York Street to Latrobe Terrace at Hope Street.

The whole project is estimated to cost $14.8 million at 1981 prices and is expected to be completed in late 1982.

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 6.0 km. The existing highway carriageway will be converted into a service road.

In conjunction with the project the Gardenvale Railway Bridge had to be lengthened to span the new highway carriageways. This work was completed during the year by the Victorian Railways Board.

The estimated cost of the project is $49 million at 1981 prices and upon completion of the project in 1984, a continuous divided highway facility will be available from St Kilda Junction to Mordialloc.

Princes Freeway

Bypass of Berwick

Work continued during the year on the construction of a 7.3 km freeway bypass of Berwick, between Narre Warren and May Road, Beaconsfield.

The work involves the construction of dual carriageways separated by a wide median, bypassing Berwick and Beaconsfield, and the construction of seven bridges and three large culverts.

During the year large culverts were completed at Berwick Town Drain and the Casey Airfield Drain and at the end of the year the earthworks between Soldiers Road and the railway crossing at Narre Warren were well advanced.

The project is estimated to cost $15.6 million at 1981 prices, and is scheduled for completion in early 1984.

Bypass of Warragul

Preliminary work commenced during the year on the construction of the 7 km freeway bypass of Warragul between the eastern terminal of the Princes Freeway bypass of Drouin and east of Warragul. The project includes the construction of bridges at the railway interchange (western terminal), Lardners Track, King Street and the Warragul-Korumburra Road.

The project is estimated to cost $17.5 million at 1981 prices and is expected to be completed by mid 1985.

Western Freeway

Wallace to Bungaree Section

Work continued on the construction of the 11.9 km freeway section bypassing the townships of Wallace and Bungaree.

During the year major bridge and culvert works were completed and earthworks and drainage works were substantially completed. Pavement construction for the carriageways was commenced.

The project is estimated to cost $23 million at 1981 prices and is expected to be completed in early 1983.

West Gate Freeway

South Melbourne Section

Work continued on the 3.6 km West Gate Freeway between Graham Street, Port Melbourne and Grant Street, South Melbourne including the construction during the year of 267 foundation piles to carry the 1.85 km elevated section of the freeway.

The project is estimated to cost $100.5 million at 1981 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 towards the end of 1984 and the whole of the freeway project completed towards the end of 1985.

The following two new sections of freeway were opened during the year:

Princes Freeway

- A 7 km bypass of Drouin between Robin Hood and the Railway Interchange east of Drouin.

Mulgrave Freeway

- A 1.6 km section between Huntingdale Road, East Oakleigh and Warrigal Road, Chadstone.

A more detailed account of the opening of these sections of freeway is on pages 10 and 11.

Contracts

Details of the types and numbers of contracts carried out under the Board's direct supervision and for which formal tenders were called, showing respective values together with a comparison with those in financial year 1979/80, are shown in the following table:

	1979/80		1980/81	
Type of contract	No. of contracts	Value $	No. of contracts	Value $
Road construction				
1. Over $1M	2	4,231,893	1	3,670,194
2. $100,000 to $1M	4	2,081,438	5	2,447,047
3. Under $100,000 (not including quotation contracts)	4	176,858	Nil	Nil
Supply of roadmaking materials	176	13,821,787	148	10,070,577
Bituminous treatment and supply of materials	79	15,965,001	51	17,713,976
Bridge construction				
1. Over $1M	2	6,838,763	1	2,294,113
2. $100,000 to $1M	7	2,095,355	6	1,355,969
3. Under $100,000	5	181,472	1	24,975
Components and fabricated steel	22	1,479,365	21	2,240,055
Building construction	2	89,700	3	99,297
Construction equipment	40	4,270,379	12	712,787
Divisional facilities	1	278,150	Nil	Nil
Miscellaneous stores	7	8,070,487	12	1,241,651
Miscellaneous services	51	2,857,354	21	677,946
Total	402	62,438,002	282	42,548,587

Significant works

State highways and freeways

Significant works completed or substantially completed during the financial year 1980/81.

Borung Highway

Donald Shire: Reconstruction of 2.4 km west of Jeffcott.

Calder Highway

Bulla Shire: Reconstruction of 1 km including the construction of climbing lanes at Gap Hill.

Gisborne Shire: Intersection treatment at Willowbank Road south of Gisborne. Intersection treatment at Howey Street, Gisborne. Construction of a roundabout at the Bacchus Marsh-Gisborne Road intersection, Gisborne.

Keilor City: Reconstruction of 0.4 km south of Diggers Rest.

Mildura City and Shire: Construction of a roundabout at the intersection of Fifteenth Street and Deakin Avenue in Mildura.

Newham and Woodend Shire: Widening of 2.7 km to provide four lanes through the Black Forest south of Woodend.

Swan Hill/Walpeup Shires: Widening 8.3 km west of Mittyack.

Cann Valley Highway

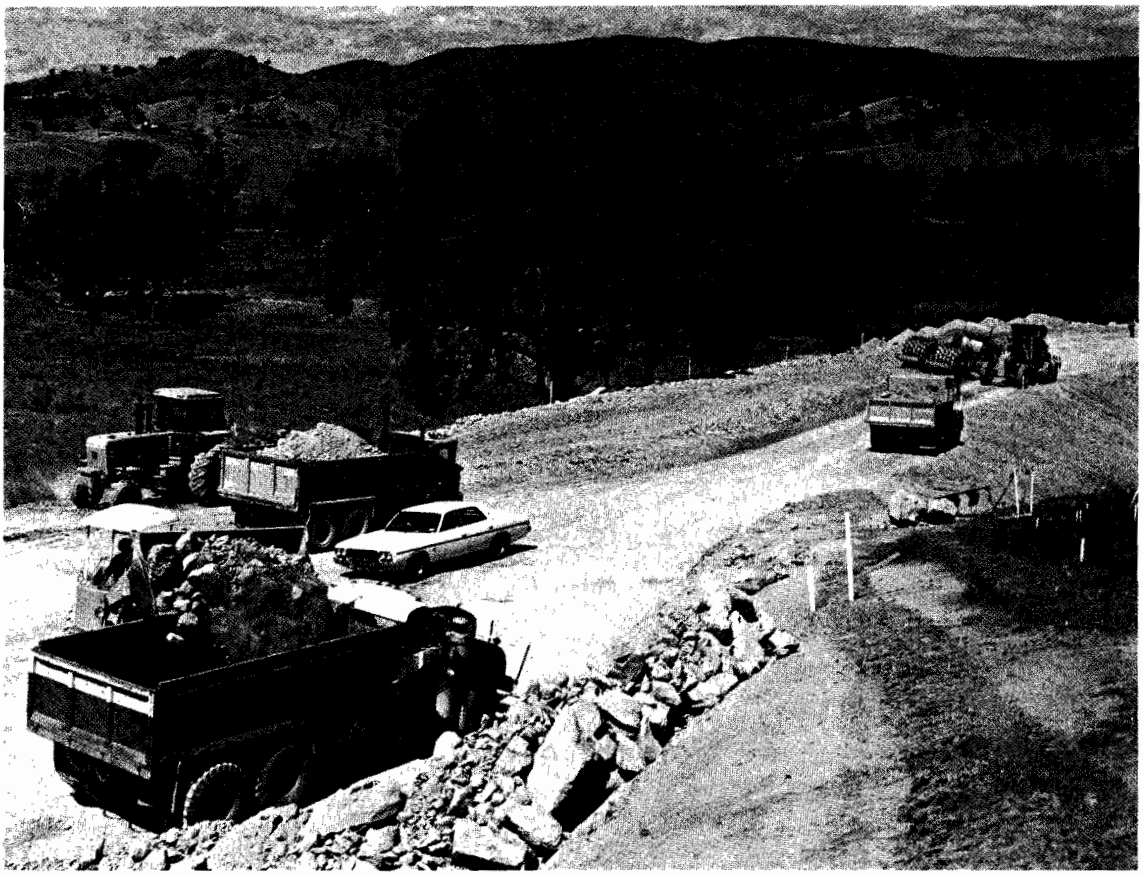
Orbost Shire: Realignment and construction of 1.3 km between Chandlers Creek and Fiddlers Green Creek including the construction of a three span prestressed reinforced concrete bridge over Fiddlers Green Creek.

Glenelg Highway

Hampden Shire: Reconstruction of an existing six span masonry and steel bridge over Mt Emu Creek at Skipton.

Hamilton Highway

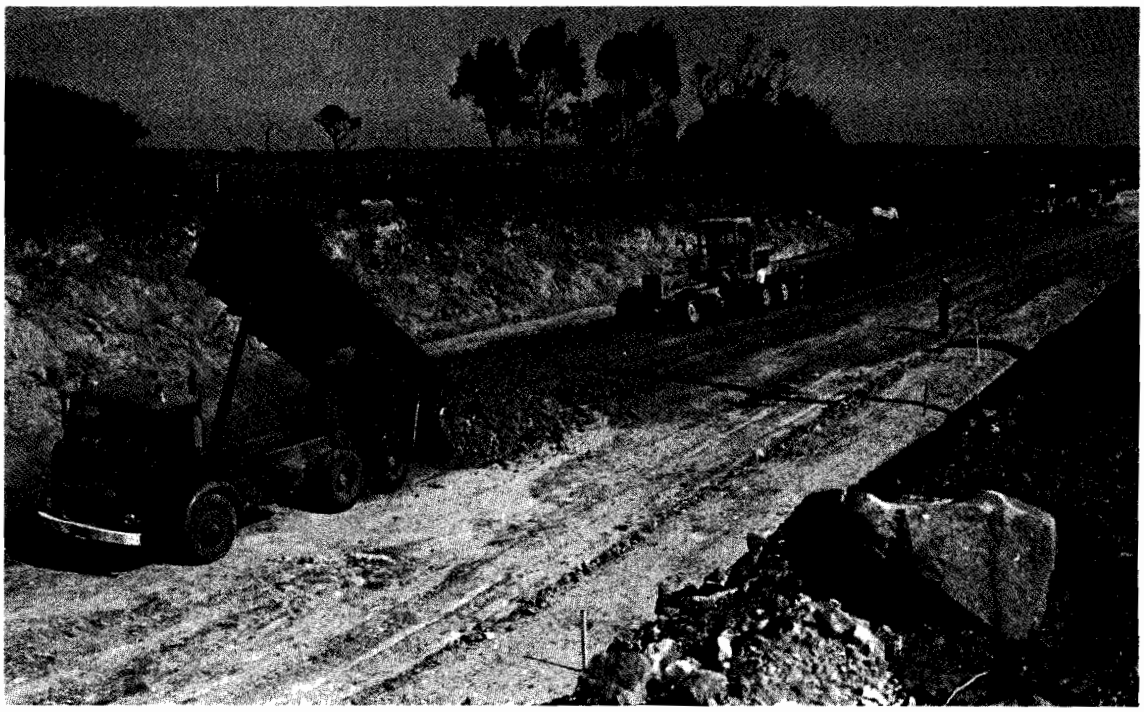
Bannockburn Shire: Reconstruction and widening of 0.6 km including the construction of a major culvert west of Inverleigh.



Above: Construction on the Maroondah Highway at Acheron

Left: Steel reinforcing cage for pile foundations being lowered into a shaft on the West Gate Freeway, South Melbourne Section. Inset: final preparation of cage prior to casting concrete

Below: Constructing a deviation of the Princes Highway West, near Bolwarra



Henty Highway
Portland Shire: Reconstruction of 6.3 km south of Branxholme.

Hume Highway
Benalla City: Reconstruction between Clarke Street and Arundel Street, Benalla.
Wangaratta City: Reconstruction of 2.4 km south of Wangaratta. Reconstruction and duplication between Newman Street and Sisely Avenue, Wangaratta.
Wodonga City: Reconstruction at Melrose Drive intersection, Wodonga.

Maroondah Highway
Alexandra Shire: Reconstruction and realignment of 2.3 km at Acheron including a new reinforced concrete bridge over Connellys Creek.
Nunawading City: Improvements to the service roads and the construction of bus bays at Mitcham Road intersection, Mitcham.

Midland Highway
Benalla Shire: Reconstruction and widening of 1.8 km north of Swanpool.

Murray Valley Highway
Tallangatta Shire: Reconstruction and realignment of 5.9 km at Granya Gap.

Nepean Highway
Chelsea City: Widening to four lanes between Hearle Avenue and Aspendale Railway Station.
Flinders Shire: Duplication between Third Avenue and Rosebud-Flinders Road, including intersection improvements at Rosebud-Flinders Road, Rosebud. Reconstruction and widening between Carrigg Street and Hodgkinson Street, Dromana.
Frankston City: Reconstruction of the Portsea bound carriageway betwen Ithaca Road and Old Mornington Road, Mt Eliza.

Omeo Highway
Omeo Shire: Construction of a three span prestressed reinforced concrete bridge over the Bundara River, north of Omeo.

Ouyen Highway
Walpeup Shire: Widening 13.1 km east and west of Tutye.

Princes Highway East
Buln Buln/Pakenham Shires: Construction of a four span prestressed reinforced concrete bridge over the Bunyip River.
Narracan Shire: Construction of 2 km of four lane undivided road at Trafalgar East. Construction of a five span reinforced concrete bridge over the Moe River.
Orbost Shire: Reconstruction and realignment of 2.7 km east of McKenzie River.
Pakenham Shire: Replacement of a culvert at Deep Creek, east of Pakenham.
Warragul Shire: Construction of a three span reinforced concrete bridge over the Little Moe River.

Princes Highway West
Colac Shire: Construction of climbing lanes for east and west bound traffic east of Colac.
Portland Shire: Construction of a 4.1 km deviation at Bolwarra.
Warrnambool Shire: Construction of a 2.8 km deviation including a new bridge over Brucknell Creek at Cudgee.

South Gippsland Highway
Alberton Shire: Widening 3.7 km near Giffard West.
Cranbourne Shire: Widening 2.4 km to four lanes at Kooweerup.
Korumburra Shire: Construction of a passing lane at Jeetho Road, east of Loch.

Sunraysia Highway
Birchip Shire: Reconstruction and widening of 1.4 km at Kinnabulla.
Karkarooc Shire: Realignment of 1.3 km north of Lascelles.
St Arnaud Town: Construction of a roundabout at the Bendigo-St Arnaud Road intersection, St Arnaud.

Warburton Highway
Lillydale Shire: Construction of a climbing lane and improvements to the Clegg Road intersection, Wandin North.

Western Highway
Horsham City: Reconstruction of 1.2 km between O'Callaghans' Parade and Baillie Streets, Horsham, including intersection improvements.
Kaniva Shire: Reconstruction of 1 km west of Lillimur.
Stawell Shire: Reconstruction and regrading of 1.3 km north of Deep Lead.

Wimmera Highway
Arapiles Shire: Widening 1.7 km in Natimuk.

Tourists' roads

Significant works completed or substantially completed during the financial year 1980/81.

Alpine Road
Bright Shire: Widening between "The Meg" and Dargo Road.

Bogong High Plains Road
Bright Shire: Reconstruction and widening of 2 km at Bogong.

Great Ocean Road
Otway Shire: Reconstruction of 1km including approaches to a new bridge over Skenes Creek.

Marysville-Woods Point Road
Healesville Shire: Reconstruction and realignment of 2.5 km between Cumberland Creek and Cumberland Junction.

Forest roads

Significant works completed or substantially completed during the financial year 1980/81.

Avon Shire
Dargo Road: Reconstruction and realignment of 1.4 km south of Dargo.

Huntly Shire
Epsom-Fosterville Road: Intersection improvements at Golf Links Road, Epsom.

Tallangatta Shire
Benambra-Corryong Road: Reconstruction and minor realignment of 5.8 km.

Bituminous surfacing

Bituminous surfacing forms an important part of road construction and maintenance work.
A total amount of $39.6 million was spent in surfacing 4,718 km of road during the year.
Approximately 96.5% 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, the sprayed seal process provides an economical, safe and skid resistant surface.
The Board's 18 mobile bituminous surfacing units together with plant owned by municipal councils and contractors, completed 4,229 km of sprayed work at a cost of $25.9 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 151 km of plant mix work at a cost of approximately $11 million using 276,800 tonnes of asphalt.

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

- 221 km of sealing widened pavements
- 21 km of initial sealing on dual carriageways
- 512 km of restoration of seal coats on recontructed sections
- 480 km of final sealing on initial treatments
- 2,672 km of maintenance retreatments
- 471 km of extensions to the bituminous sealed road system including 46 km of roads declared or proclaimed under the Country Roads Act
- 341 km sealed on behalf of other State and municipal authorities.

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

Material	Quantity
Bitumen for sprayed work	35,900 tonnes
Bitumen for asphalt	14,000 tonnes
Aggregate for sprayed work	289,000 cubic metres
Aggregate for asphalt	187,000 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 $17,752,000 for land required for the construction of new roads and the widening or deviation of existing roads.

The expenditure incurred included $2,502,000 for land required for the West Gate Freeway, South Melbourne Section and $1,539,000 for land required for the widening of 6 km of the Nepean Highway between Cochrane Street, Elsternwick, and South Road, Moorabbin.

An amount of $2,229,000 was also spent on the purchase at the owners' request and on hardship grounds of properties affected by the proposed South Eastern Freeway, Malvern Section.

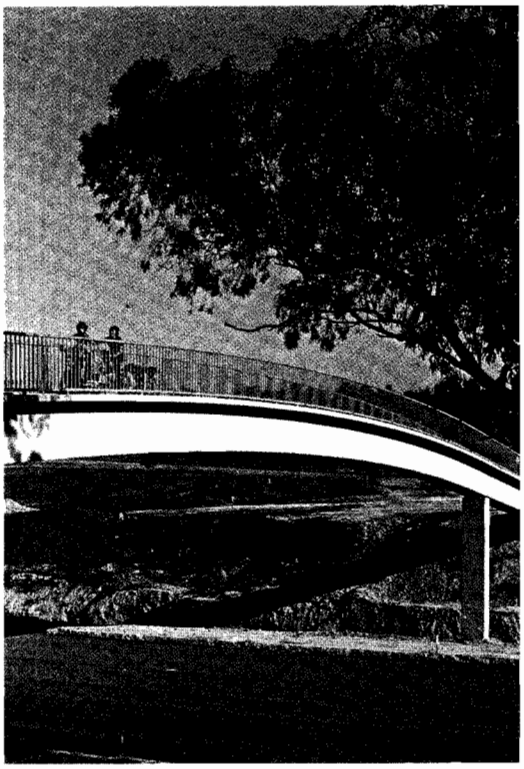
The following table shows expenditure on land purchase in relation to the Board's road classifications and the Commonwealth road categories on which the expenditure was incurred.

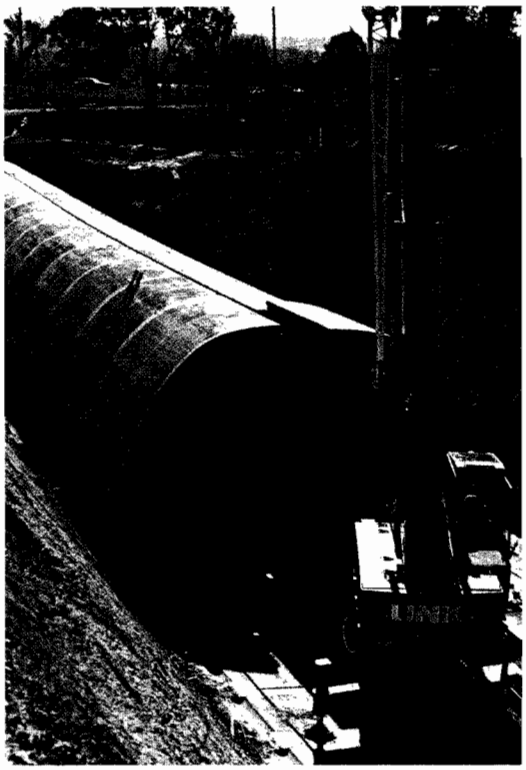
	Commonwealth road category				
CRB road classification	National roads	Urban arterial roads	Rural arterial roads	Local roads	Total
	$'000s	$'000s	$'000s	$'000s	$'000s
Freeways	2,343	9,799	207		12,349
State highways	194	2,274	440		2,908
Tourists' roads			18	4	22
Forest roads			2	1	3
Main roads		1,324	232	98	1,654
Unclassified roads		230	12	574	816
Totals	2,537	13,627	911	677	17,752

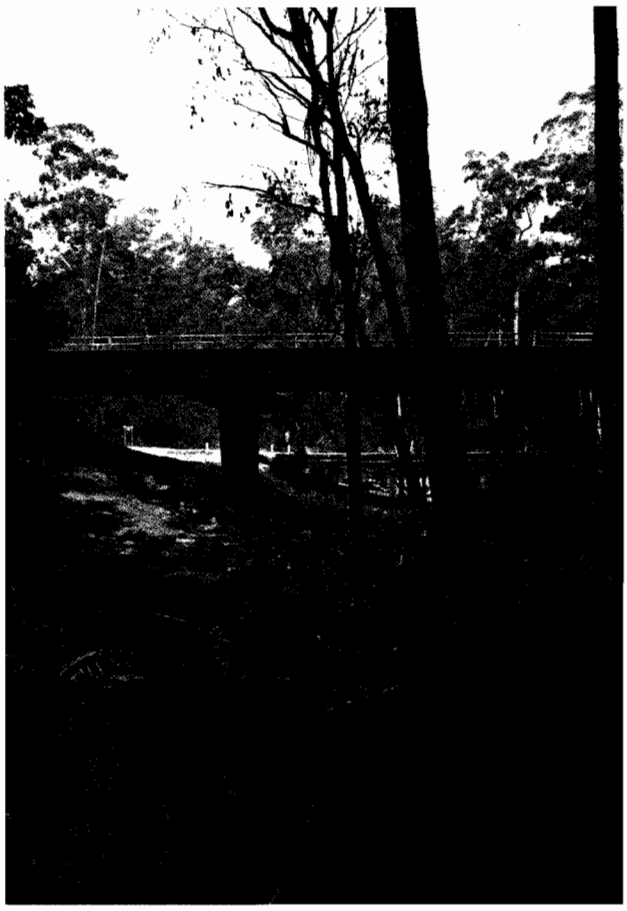
The table below shows the number of land purchase transactions completed and the amount of compensation and associated costs paid by the Board for the period 1976/77 to 1980/81.

	1976/77	1977/78	1978/79	1979/80	**1980/81**
Number of land purchase cases settled	671	786	629	558	**527**
Compensation and associated costs paid by the Board	$20.97m	$22.53m	$22.95m	$17.45m	**$17.75m**
Land purchase expenditure on unclassified roads under council supervision	$0.74m	$1.26m	$1.70m	$0.84m	**$0.73m**

Of the $17.75 million expended on compensation and associated costs during the year, $7.35 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 $2,418,783 from 964 rented residential or commercial properties and 80 separate areas of vacant land. During the year 66 separate areas of surplus land were sold for $979,651. Ten residential properties surplus to requirements were sold for $533,350 and 8 houses were sold for removal for $25,765.







Above: Construction of a conduit for the undergrounding of Koonung Creek adjacent to the arterial road extension of the Eastern Freeway from Bulleen Road to Doncaster Road

Above left: Pedestrian overpass spanning the arterial road extension of the Eastern Freeway

Left: New bridge carrying the Cann Valley Highway across Fiddlers Green Creek

BRIDGEWORKS

Construction of new bridges

Eighty-one new bridges estimated to cost $21.6 million were commenced during 1980/81. The following table gives a comparison between the number and estimated cost of bridge projects commenced in 1980/81 and those for the preceding financial year.

Description	1979/80		1980/81	
	No.	Est. cost $'000s	No.	Est. cost $'000s
New bridges commenced under the supervision of the Board's staff	47	25,276	29	16,537
New bridges commenced under municipal supervision with financial assistance from the Board	72	4,716	52	5,051
Miscellaneous - Sign structures, poles, footings, stone beaching and block facing		167		29
Total bridges commenced	119	30,159	81	21,617

Major bridges completed in rural areas

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

Western Freeway, Wallace to Bungaree

Wallace Street

A two span prestressed concrete 'T' beam and reinforced concrete bridge 67 metres long and 7.3 metres between kerbs.

Omeo Highway

Bundara River

A three span prestressed concrete beam and reinforced concrete bridge 54.9 metres long and 8.6 metres between kerbs.

Princes Highway East

Bunyip River

A four span prestressed concrete beam and reinforced concrete bridge 67 metres long and 11.6 metres between kerbs being one of three high strength bridges constructed on the Princes Highway to cater for SEC large loads en route to Loy Yang.

Barrabool Shire/South Barwon City

Barwon Heads - Ocean Grove Road

Barwon Heads Bridge - strengthening and placement of a reinforced concrete deck overlay on the existing 50 year old timber bridge, 308 metres long and 7.3 metres between kerbs plus a footway.

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

Ararat Shire

Moyston-Great Western Road

Spears and Curtis Creeks - a three span reinforced concrete U-slab bridge 35.6 metres long and 7.6 metres between kerbs.

Bendigo City

Knight Street

Bendigo Creek - a three span reinforced concrete U-slab bridge 34.8 metres long and 7.4 metres between kerbs, plus two footways each 1.8 metres wide, and a bicycle path 2.4 metres wide.

McIvor Shire

Heathcote-Redesdale Road

Wild Duck Creek - a three span reinforced concrete beam and slab bridge 45 metres long and 8.6 metres between kerbs.

Oxley Shire

Glenrowan-Milawa Road

Woodberrys Bridge over Horseshoe Creek - a three span reinforced concrete U-slab bridge 30.9 metres long and 8.6 metres between kerbs.

Bridges and overpasses in the metropolitan area

Large bridges and overpasses completed in the metropolitan area during the year under the direct supervision of the Board's staff included:

Calder Freeway, Keilor

Fosters Road overpass

A two span prestressed concrete 'T' beam and reinforced concrete bridge 68 metres long and 22 metres between kerbs plus two 2.4 metre wide footways.

Mulgrave Freeway, Waverley

Atkinson Street overpass

A two span continuous post tensioned concrete box girder and reinforced concrete bridge, 37.5 metres long and 12.8 metres between kerbs plus two 1.8 metre wide footways.

Nepean Highway

Elster Creek Bridge

Strengthening of the existing structure by the attachment of a reinforced concrete overlay to the deck 41 metres long by 6.5 metres wide and enlargement of the footings.

Sunshine City

Wright Street

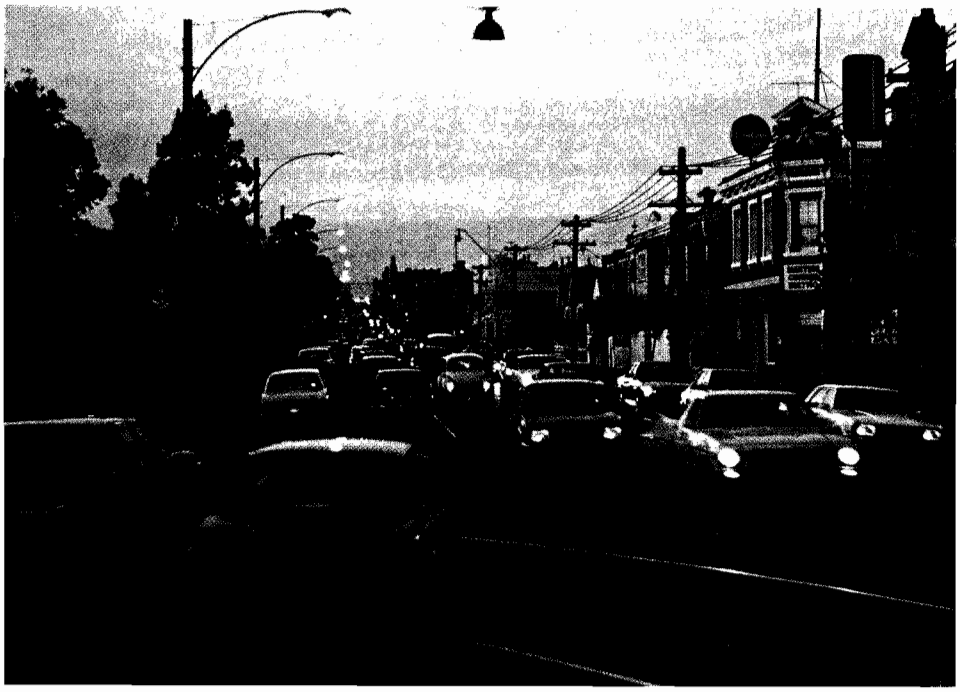
Kororoit Creek–a three span prestressed concrete beam and reinforced concrete bridge 70 metres long and 13 metres between kerbs plus two 1.8 metre footways.

Grade separated pedestrian crossings

A grade separated pedestrian crossing was completed by the Board during the year, restoring pedestrian access to Kenneth Street, across the arterial road extension of the Eastern Freeway. The new three span overpass is a pretensioned concrete beam and reinforced concrete overpass, 81 metres long and 1.85 metres wide.

Elimination of railway level crossings

In 1954, the State Government established the Level Crossings Fund with a view to providing finance to assist with the elimination of dangerous railway level crossings. Contributions were also made by the Board and the Victorian Railways towards the cost of projects. Since 1st July 1974, the total cost of this work has been charged to the Transport Fund. Since the inception of the scheme, 67 road overpasses or underpasses have been constructed to eliminate railway level crossings.
Work continued during the year on twin 15 span road over rail overpasses, each 269 metres long and 8.6 metres between kerbs at Latrobe Terrace, Geelong. Construction of the overpasses, which commenced early in 1979, is expected to be completed in late 1982.



Above: Punt Road between Bridge Road and the Yarra River

Below: Testing compacted material on the Princes Freeway, bypass of Berwick

The road planning function of the Board is an essential and important activity, 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, Board officers use specialised equipment to 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:

Eastern Freeway, Bulleen to Ringwood

Since 1959, the Melbourne Metropolitan Planning Scheme has included a reservation for a proposed main road, generally in the vicinity of the Koonung Creek extending easterly from Bulleen to Ringwood.

In 1975, a joint study was undertaken by the Ministries of Transport, Planning and Conservation, the Melbourne and Metropolitan Board of Works and the Country Roads Board with an independent study manager, to examine and make recommendations on future transport needs in the eastern corridor. The study, known as the Eastern Corridor Study, involved an extensive public participation programme.

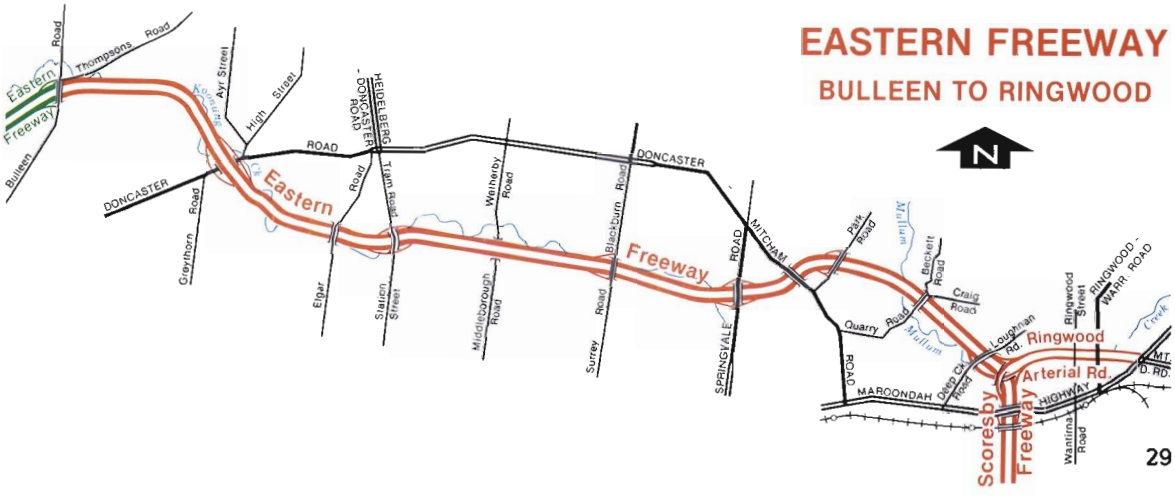
In January 1976, the Government adopted the recommendations of the Eastern Corridor Study, which included the retention and amendment where necessary of the Planning Scheme Reservation, to provide for a six lane freeway from the Eastern Freeway at Bulleen to the Scoresby Freeway reservation at Ringwood, generally along the line of, and incorporating where possible, the existing main road planning scheme reservation. The recommendations also included provision for a six lane arterial road bypass of Ringwood from the freeway to the Maroondah Highway, incorporating the main road planning scheme reservation along the Mullum Mullum Creek.

The Government also decided to extend the Eastern Freeway as a four lane arterial road from Bulleen Road to Doncaster Road, the route being along the Koonung Creek Valley and within the existing Metropolitan Planning Scheme Reservation. The arterial road construction was to be suitable for use as part of a possible long term freeway. The construction of the four lane arterial road extension of the Eastern Freeway is currently in progress, with completion of the roadworks expected in mid 1982.

The Board subsequently developed plans as the basis for a Planning Scheme Amendment for the Eastern Freeway from Bulleen to Ringwood in accordance with the recommendations of the Eastern Corridor Study as adopted by the State Government. These plans are contained in a booklet entitled "Eastern Freeway: Bulleen to Ringwood: Drawings Including Preliminary Ideas for Corridor Development".

In August 1980 the Board held meetings with local members of Parliament and municipal representatives to outline the proposals. Following these meetings, two public displays of the preliminary layout plans were held to enable the general public to make comments on the proposals.

Many comments were received following the public exhibition of the plans, and the freeway proposals are being reviewed in the light of these comments. Following the review the Board will seek an amendment to the Melbourne Metropolitan Planning Scheme and, at that stage, the community generally will have the opportunity to submit formal objections to the Melbourne and Metropolitan Board of Works on any aspect of the proposal.



Calder Highway, Melbourne to Bendigo

In February 1981, the Board adopted a strategy for the future development of the Calder Highway from Melbourne to Bendigo. The Board's current planning is proceeding on the basis of the Calder corridor being progressively developed to a four lane highway as the main route between Melbourne and Bendigo. Improvements will include upgrading sections of the existing carriageway and providing progressive duplication, with possible long term conversion of the section between Melbourne and Mt Macedon Road, Gisborne to freeway conditions, as traffic requires and as finance permits.

Planning investigations for various sections are proceeding with a view to determining the likely ultimate development so that any major works can, as far as practicable, fit in with the overall ultimate proposals. In conjunction with councils, action will be taken where required to control access to proposed developments by adopting measures such as specifying building setbacks and providing frontage reserves generally in accordance with the Government's Statement of Planning Policy No. 5.

The total estimated cost to implement the upgrading to four lanes is $109 million at 1980 prices.

The current status of proposals as part of the strategy is as follows:

Section	Proposed treatment	Estimated cost
Keilor (16.0 km-21.0 km)	Construction of dual carriageways for a freeway bypass to the north of Keilor (work proceeding)	$20.0m (to complete)
Gisborne to Woodend (55.9 km-69.3 km)	Upgrading the existing highway to provide four lanes through the Black Forest (work proceeding)	$1.5m (to complete)
Ravenswood to Big Hill (133.9 km-138.3 km)	Construction of a new carriageway to provide a four lane divided highway	$3.0m
Keilor to Diggers Rest (21.0 km-31.2 km)	Construction initially of a four lane divided highway with ultimate upgrading to freeway standards	$10.0m
Gisborne (50.2 km-55.9 km)	Construction initially of a four lane divided arterial road with at-grade intersections to the north of Gisborne with ultimate upgrading to freeway standards	$12.0m
Diggers Rest (31.2 km-34.4 km)	Construction of a four lane bypass to the north-east of Diggers Rest incorporating grade separation of the Melbourne-Bendigo railway	$10.0m
Big Hill to Kangaroo Flat (138.3 km-143.4 km)	Development of the existing highway to four lanes	$2.0m
Diggers Rest to Gisborne (34.4 km-50.2 km)	Construction of a new carriageway to provide a four lane divided highway with ultimate upgrading to freeway standards	$10.0m
Kyneton (82.8 km-90.8 km)	Construction of a four lane bypass to the north of Kyneton with fully restricted access and at-grade intersections	$13.0m
Porcupine Hill to Ravenswood (126.0 km-133.9 km)	Development of the existing highway to four lanes	$6.0m
Woodend to Kyneton (73.7 km-82.8 km)	Development of the existing highway to four lanes	$4.5m
Woodend (69.3 km-73.7 km)	Development of the existing highway through Woodend to four lanes	$2.0m
Kyneton to Elphinstone (90.8 km-107.5 km)	Development of the existing highway to four lanes	$4.5m
Elphinstone to Porcupine Hill (107.5 km-126.0 km)	Development of the existing highway to four lanes	$10.0m
	Total Cost	$109.0m

The above list of proposed major improvements generally sets out a possible order of priorities for work in the corridor. In some cases separate projects may be carried out concurrently.

Punt Road widening

During the year the Board concluded a preliminary investigation of possible road improvements in the Punt Road corridor between Victoria Street, Collingwood and St Kilda Junction to assess the need for improved traffic conditions, the options available and their major implications for the traffic patterns and the environment of the area.

The major findings of the investigation were that improvements to the section of Punt Road between Bridge Road and the Yarra River should be given high priority and that widening and reconstruction of this section to a divided arterial road standard would be the most appropriate form of improvement, considering both environmental factors and traffic needs. The estimated cost of this work is approximately $9 million at 1981 prices.

The design favoured by the Board for the widening of Punt Road between Bridge Road and the Yarra River is generally confined within the existing Melbourne Metropolitan Planning Scheme road widening reservation and generally along the west side of Punt Road and would avoid any major structural alteration to the rail bridges near Swan Street.

Punt Road/Hoddle Street is the major north-south arterial road and river crossing to the east of the central city and also intersects with major east-west arterials such as the Eastern and South Eastern Freeways, Victoria Parade and Brunton Avenue.

Over the section of Punt Road between Bridge Road and the Yarra River, a number of different inter-regional traffic movements coincide - north to south, east to west and north to west - resulting in the traffic volume in Punt Road varying from 42,000 vehicles per day south of Alexandra Avenue to over 90,000 at Swan Street.

Severe congestion in both peak periods is a feature of many sections of Punt Road and on the roads with which it intersects. In some sections of Punt Road, this congestion extends over much of the day. The congestion is due to a lack of adequate road capacity, particularly between Bridge Road and the Yarra River.

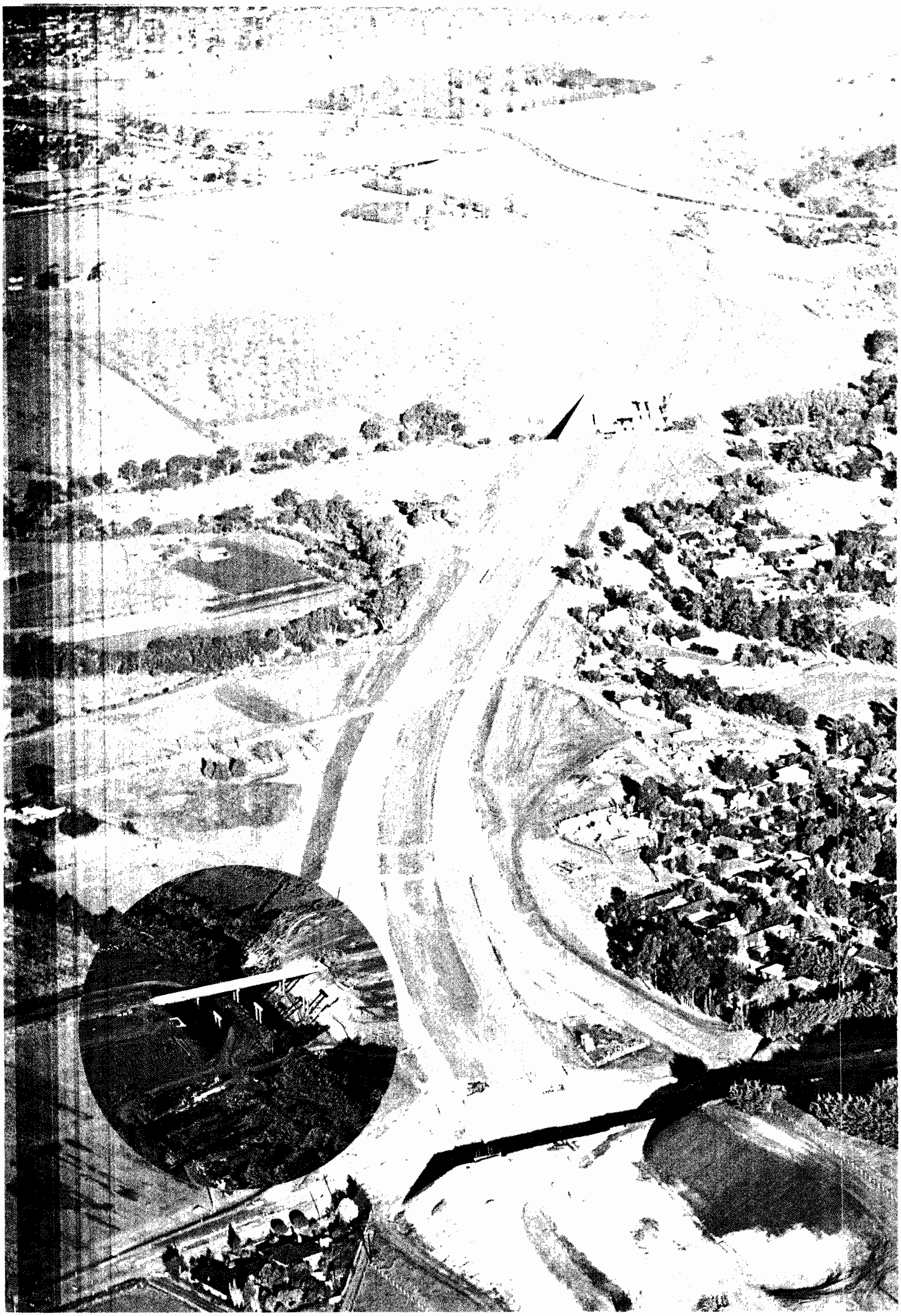
The Board presented the results of its preliminary investigations in a Summary Report which was distributed in June 1981 to the municipal councils and other authorities concerned as a basis for discussion and comment. In late June the Board held meetings with local members of Parliament and municipal representatives to outline the results of the preliminary investigations and public displays were to be held in July for the purpose of inviting comments and suggestions for alternative treatments or modifications to the Board's favoured design.

Following an examination of any comments and suggestions received, a detailed road improvement project will be prepared, with a view to reaching agreement with the relevant municipalities. The Board will then take action to seek an amendment to the planning scheme if necessary.

General

In addition to the road planning studies described, other planning investigations on which work was undertaken during the year included:

- Princes Freeway, Berwick to Bunyip River - a new route south of the Princes Highway from Berwick to east of Pakenham and initial duplication with provision for long term conversion to freeway standard from east of Pakenham to Bunyip River.
- Princes Freeway, bypass of Morwell - to provide a southern bypass of Morwell.
- Princes Freeway, bypass of Traralgon - to provide a southern bypass of Traralgon.
- Hume Freeway, Barnawartha Section - duplication of the existing highway from Barnawartha to Wodonga West plus a bypass of Wodonga.
- Road transport planning information for the Victorian Transport Study, 1980.
- Road transport information for the Draft Strategy Plan being prepared by the Latrobe Valley Task Force - study of the effects of development in the Latrobe Valley on road transport.



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 accordance with current practice
- to initiate applied research into problem areas or on special topics which might advance the field of understanding of environmental issues.

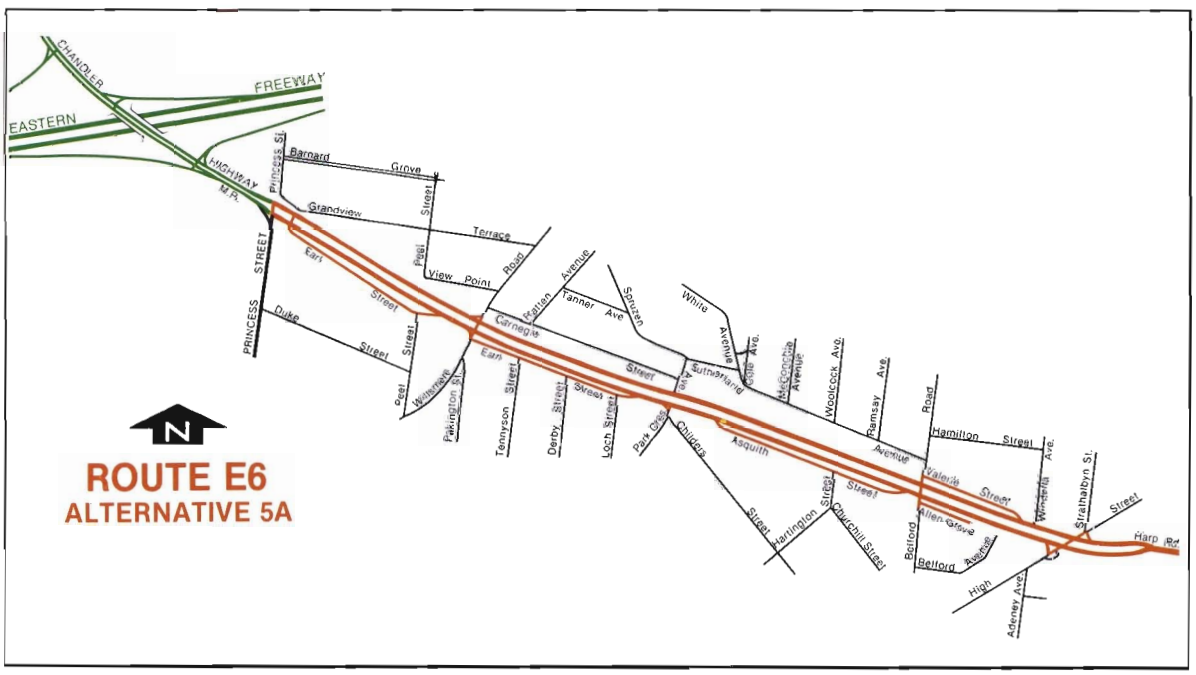
During the year, the Environmental Studies Section took part in a number of research projects. Two major Environment Effects Statements were published and made available for public information and comment.

Route E6

As part of the development of the Eastern Freeway corridor, 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, East Kew. 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.

The Board completed the preparation of the Statement in November 1980, when it was forwarded to the Ministry for Conservation for assessment. The Statement, which was prepared in accordance with the guidelines laid down by the Ministry for Conservation and the Environment Effects Act 1978, examined eight alternative proposals for a link between the Eastern Freeway and Harp Road.



Left: An aerial view of the Calder Freeway, bypass of Keilor
Inset: bridges under construction to carry the Calder Freeway across the Maribyrnong River

These alternatives were:

Alternative 1 - The use of existing roads, Valerie, Asquith and Earl Streets, with intersection improvements.

Alternative 2 - A two lane two way road involving reconstruction of the streets in Alternative 1 with provision for parking.

Alternative 3 - A four lane clearway involving reconstruction and widening of existing roads.

Alternative 4 - The duplication of existing roads to provide a westbound carriageway with a median separating a new eastbound carriageway.

Alternative 5 - A new four lane road located within the E6 reservation with existing streets retained as service roads.

Alternative 5A - As for Alternative 5, but with a central median.

Alternative 6 - A depressed expressway generally below ground level with two through lanes plus a breakdown lane in each direction.

Alternative 7 - A new two lane road within the E6 reservation with existing streets being retained as one way service roads.

The Board's favoured alternative was Alternative 5A which in the Board's view would improve traffic flow, maintain access to and from the local area and complement the existing adjacent residential area.

The Route E6 Environment Effects Statement was placed on public exhibition in February 1981 by the Ministry for Conservation, to allow all interested individuals and groups to read the Statement and submit comments to the Ministry for Conservation.

The Ministry subsequently assessed the Statement and the comments received. In its Assessment Report, the Ministry for Conservation concluded that it favoured Alternative 5A. The Assessment also recommended that a landscape plan be developed by the Board in conjunction with Kew City Council to ensure that the landscape development of the road reservation is integrated with the adjacent land uses.

Alternative 5A is also the scheme favoured by the Kew City Council.

The Assessment Report will be taken into consideration by the Government in deciding which alternative is to be adopted.

The Government's decision may require an amendment to the Melbourne Metropolitan Planning Scheme to be sought to reserve any additional land necessary for the road. Depending on the alternative adopted, further detailed investigation may be required in close liaison with the Kew City Council and the authorities involved to determine details of the most suitable development in the vicinity of High Street, including access to properties, provision for public transport, parking and pedestrian facilities. Construction of Route E6 will not proceed before the completion of the detailed investigation and any necessary amendment, of the Melbourne Metropolitan Planning Scheme.

Omeo-Mitta Mitta road link

The possibility of constructing a low level deviation of the Omeo Highway between Omeo and Mitta Mitta has been under consideration for many years. An inspection of a possible route was carried out as early as 1952 as a result of which the Board decided to develop the existing highway. Part of this route was subsequently submerged by the Dartmouth Dam.

Following a request in 1972 by the Omeo and Tallangatta (formerly Towong) Shire Councils that the Board make a survey of a possible new road link in north-east Victoria via the Dartmouth Dam acccess road, the Board investigated the feasibility of various alternative routes. These investigations resulted in the Board concluding that the desirable course of action would be to develop and improve the existing highway in preference to constructing a low level deviation.

The Board's decision, which took account of the large amount of funds which would need to be expended before a new route could be used by highway traffic, the need to retain access to the Bogong High Plains Road, the limited advantages (if any) of an alternative route and the general shortage of road funds, was conveyed to councils and other interested parties in January 1974.

As a result of representations made to the Honourable the Premier, discussions were held in 1976 between various government departments and authorities and further investigation was undertaken into the relative merits of the alternative routes for an all-weather link.

Following continuing representations regarding the matter, on 1st May 1979 the Government referred to the Parliamentary Public Works Committee the question of whether a low level deviation of the Omeo Highway between Omeo and Mitta Mitta should be constructed. This enquiry was later transferred for investigation by the Parliamentary State Development Committee in August 1979. Evidence was presented to the Committee by the Board and other interested parties. The Committee's report is expected early in financial year 1981/82.

As a new low level deviation would be constructed in virgin bushland and would require considerable lengths of major cuttings and embankments involving the likelihood of erosion, there would be a major effect on the environment. In the process of upgrading the existing Omeo Highway there would be some environmental disturbance. However, this would be minimal as the progressive nature of the upgrading would allow the re-establishment of vegetation and keep disturbance to relatively minor lengths and to a relatively narrow band along the highway.

In view of the possible environmental effects, the Minister for Conservation and the Minister of Transport agreed that an Environment Effects Statement should be prepared regarding the possible alternative routes between Omeo and Mitta Mitta under consideration by the Parliamentary State Development Committee.

Preparation of an Environment Effects Statement relating to the alternatives was completed by the Board in August 1980 after consultation with officers of other authorities and departments and, in particular, the Ministry for Conservation.

The Statement was placed on public display in September 1980 and interested persons and parties were invited to forward to the Ministry for Conservation their comments on the alternative routes and the Statement. Both the Statement and the assessment of it by the Ministry for Conservation will assist the Parliamentary State Development Committee in making a recommendation to Parliament.

Landscaping

The 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 1980/81 financial year.

Divisions	No. of trees and shrubs	Purchase cost $
Bairnsdale	240	160
Ballarat	—	—
Benalla	5,000	2,000
Bendigo	6,500	3,300
Dandenong	29,000	14,000
Geelong	6,300	3,100
Horsham	2,000	1,600
Metropolitan	29,700	27,100
Traralgon	13,000	6,000
Warrnambool	4,500	3,000
Projects		
Eastern Freeway	400	600
Mulgrave Freeway	600	1,400
West Gate Freeway	300	1,000
Total	**97,140**	**62,660**

TRAFFIC SERVICES

Linemarking

During the 1980/81 financial year the Board spent $2.7 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 - 16,372 km or 38,214 km of equivalent standard stripe.
- Other Board declared or proclaimed roads - 10,788 km or 18,824 km of equivalent standard stripe.
- Unclassified roads - 4,141 km or 7,719 km of equivalent standard stripe.

The term "equivalent standard stripe" means a solid stripe 3 m long and 75 mm wide with a 10 m gap.

The cost of this work was:

- $37.30/km of standard stripe.
- $74.20/km of 75 mm wide solid stripe.

The cost of extending and maintaining the system of raised pavement markers on declared roads was $152,300 and 45,261 reflective markers were laid.

Below: Linemarking on the Bogong High Plains Road

"Keep Left Unless Overtaking" signs

In February 1981, the Board announced the introduction of a new "Keep Left Unless Overtaking" sign, to encourage more motorists to use the left lane on multi-lane roads so that less lane changing is required with consequent improvement in traffic flow and safety.

Installation of the new signs began in February at climbing lanes on single carriageway rural State highways. At these locations, use of the new signs will avoid the implication given by the previously used "Slow Vehicles Use Left Lane" sign, that only slow vehicles should use the left lane. Many motorists do not consider themselves to be driving slow vehicles.

The new signs will be gradually introduced on multi-lane divided highways and freeways and on some other major roads where incorrect lane use is shown to be a problem.

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 mass 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 vehicles exceeding the mass, height, length and width limits prescribed by the Motor Car Act –

(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 in the Motor Car Act.

The following table illustrates the number and types of permits issued during the year compared with those issued during the financial year 1979/80.

	1979/80	1980/81
Single trip permits	20,183	**23,812**
Annual permits	3,058	**3,537**
*NAASRA permits	6,300	**9,106**
Total number of permits issued	29,541	**36,455**

*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 NAASRA permit system provides for the issue of permits for the movement of vehicles which exceed the mass limits provided for in the Motor Car Act 1958, but which are within the mass limits established by the ERVL Study. The NAASRA permit system has been operating in Victoria pending the introduction of legislation to provide for the increased mass limits established by the Study.

In May 1981, the Motor Car (Mass and Dimension) Limits Act was passed which, inter alia, increases the mass limits for vehicles in accordance with the ERVL Study recommendations. When this Act is proclaimed to come into operation, the NAASRA permit system will become redundant.

There were 218 permits issued for the movement of loads in excess of 100 tonnes during the financial year. These included the movement of items of equipment for the State Electricity Commission's project at Loy Yang, and the cartage of transformers from Melbourne to the Commission's projects at Glenrowan and Bendigo in order to improve power generation in those areas.

It is expected that the movement of heavy items of equipment to the Loy Yang project will continue during the next two years, with the principal items being generators weighing approximately 380 tonnes nett. When the weight of the prime-mover and carrying assembly for these generators is added, the gross weight of the whole unit will be approximately 600 tonnes. To provide for the safe movement of such loads work is proceeding on the strengthening of existing bridges, or the construction of new high strength bridges along the Princes Highway between Melbourne and Latrobe Valley.

Other significant permit loads have been the transport of off-shore drilling components from Melbourne to the Esso-BHP Natural Gas Plant at Longford and Barry Beach.

Weighbridges

With the completion of the Kerang weighbridge during the year, the Board now has eighteen mechanical weighbridges throughout the State which form an integral part of the Board's control of vehicle weight activity. In addition, weighing platforms on the Western Highway at Horsham and on the Hume Highway at Benalla, designed for the recently developed electronic mass weighing units, came into service during the year. The Board also operates an electronic weighbridge located in Lorimer Street, South Melbourne used for the specific purpose of weighing heavy permit load vehicles.

Prosecutions

Policing and enforcement of heavy and overdimensional vehicles is effected by the Board's twenty-two traffic officers, and the six police officers seconded to the Board. The number of offences reported during the year was 6,256, resulting in over $1,116,147 in fines and costs which was paid into the Consolidated Fund.

Emergency services

The Board provides a free emergency telephone service and assistance to drivers of immobilised vehicles on seven 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
- Calder Freeway.

During the year, the emergency telephone service on the Tullamarine and Calder Freeways was extended to include the section of the Tullamarine Freeway from Bulla Road to the Melbourne Airport, and the section of the Calder Freeway from Tullamarine Freeway to east of Keilor township. Sixteen additional telephones were installed on the Tullamarine Freeway between the Bulla Road interchange and Melbourne Airport, and eight additional telephones were installed on the Calder Freeway between Tullamarine Freeway and Erebus Street, Keilor Park. The cost of the additional emergency telephones and replacement units, together with associated equipment, was $383,000.

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 immobilised vehicles can be cleared from the freeway.

The number of calls to the Board's Emergency Service Centre at Head Office increased by 5,622 calls to 26,494 calls during financial year 1980/81.

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 1980/81.

Emergency services – call analysis

Fault	Total	% of all calls
Roadside emergency telephone		
Petrol	3795	14.3
Tyres	1111	4.2
Radiator	1653	6.2
Mechanical	6703	25.3
Hoax	592	2.3
Hazard	353	1.3
Accident	327	1.2
Tows	979	3.7
Other	1098	4.2
Sub total	16,611	62.7
Ordinary telephone		
Hazard	8223	31.0
Traffic lights	239	1.0
Other	1421	5.3
Total	26,494	100.0

Emergency services – road analysis

Road	No. of calls	%
Tullamarine Freeway	4535	27.3
Eastern Freeway	4235	25.5
South Eastern Freeway	2080	12.5
West Gate Freeway	915	5.5
Kings Bridge/Queens Way	196	1.2
Mulgrave Freeway	4432	26.7
Calder Freeway	218	1.3
Total	16,611	100.0

Roadside facilities for disabled persons

The year 1981 has been declared as the International Year of Disabled Persons. The Board is aware that disabled persons have problems in using roadside facilities including toilet blocks on rural freeways and State highways and emergency telephones on urban freeways.

Special provision has been made for disabled persons at toilet blocks being constructed on the Hume Freeway at Avenel. The toilet blocks will have the following special features:

- Barrier free access from the car parking area
- Outward opening door
- Hand basin
- Non slip angled hand rail
- Wall mounted toilet roll dispenser.

During the year, the Board replaced twenty emergency telephones on the Tullamarine Freeway between Flemington Road and Bulla Road with new handsets suitable for use by disabled persons. The new telephones are lower and where necessary closer to the guardrail so that they can be easily reached.

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:

- Snow Driving
- 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).

Snowfalls in the 1980 season were regarded as average by comparison with previous years except for a particularly heavy snowfall in June. Snow clearing was commenced in early June and completed in late September 1980. 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 Service grant in the case of Mt Buffalo.

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

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. In addition a MAN truck snowplough was used in the latter part of the season.

Details of snowfalls recorded during the 1980 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 1980 season
Alpine Road	Mt Hotham	3 June 80	50	$266,008
Mt Buffalo Road	Mt Buffalo	10 June 80	34	$67,024
Mt Buller Road	Mt Buller	10 June 80	49	$65,825
Bogong High Plains Road	Falls Creek	4 June 80	37	$71,065

(a) Costs do not include clearing of car parks for Committees of Management.

(b) Night clearing at Mt Hotham is funded by a Treasury Grant of $33,213 and is included in the cost of $266,008.

(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 is charged to the State Electricity Commission and is included in the cost of $71,065.

Co-ordinated traffic signal system in Melbourne

During the year, the Board continued with the development of the SCRAM (Signal Co-ordination of Regional Areas in Melbourne) traffic signal project.

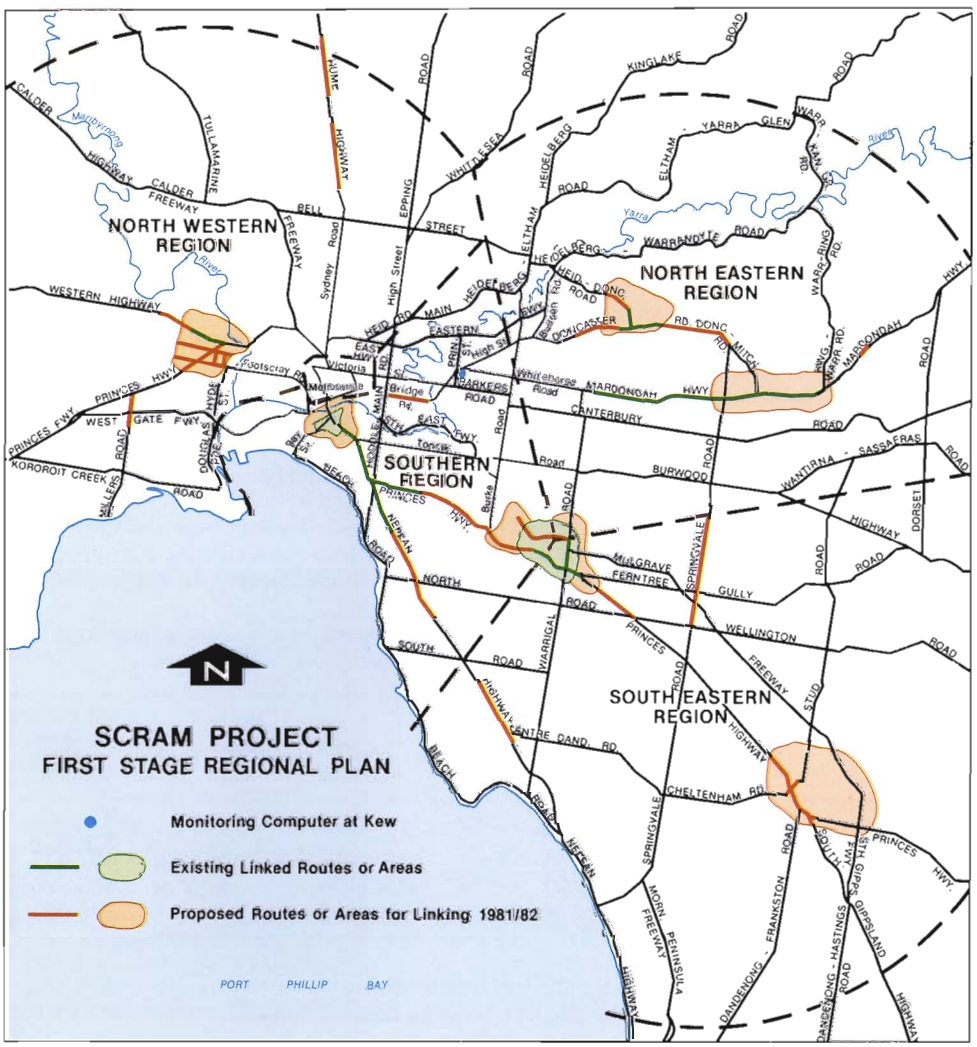
The SCRAM project is designed to improve traffic flow along roads by linking traffic signals to a regional computer. By monitoring changes in traffic flow, the signal phases can be altered through the use of the computer to maintain traffic flow. The system also provides reports to allow rapid detection of any faults that may occur.

During the year, the Board connected the traffic signals at a further 50 intersections on selected routes to the two existing regional computers at Blackburn (North Eastern Region) and St Kilda (Southern Region), bringing the total number of intersections on various routes with linked traffic signals to 58.

Two further regional mini computers were purchased for the north western and south eastern regions and a central computer was installed in the Board's Head Office at Kew for testing, developing and monitoring the SCRAM network.

Traffic signals are linked to the four regional computers, and the monitoring computer at Kew, by the Telecom telephone line network. Fault monitoring terminals which are connected to the monitoring computer are located at the Board's Metropolitan and Dandenong Divisions and in the Emergency Services Centre to provide 24 hour monitoring of the network.

Traffic signals at additional intersections on selected routes or in particular areas, as shown on the plan below, will be connected to the four regional computers in stages during 1981/82, in close consultation with the relevant municipal councils.



Municipal allocations

In May 1981, the Board allocated $96,486,000 to Victoria's 212 municipal councils for road works on main and unclassified roads for 1981/82.
This represented $6,414,000 more than the original allocations made in April 1980 for 1980/81.
The table below shows the allocations of funds to municipal councils for 1980/81 and 1981/82. The table also shows the final allocations for 1979/80 and 1980/81, the percentage increase in final allocations over these two years and the percentage increase in original allocations from 1980/81 to 1981/82.

	1979/80	1980/81			1981/82	
	Final allocations $'000s	Original allocations $'000s	Final allocations $'000s	% increase in final allocations over 1979/80	**Original allocations $'000s**	% increase in original allocations over 1980/81
Main roads	45,826	43,605	46,656	1.8	**47,303**	8.5
Unclassified roads	46,059	46,467	48,805	6.0	**49,183**	5.8
Total	91,885	90,072	95,461	3.9	**96,486**	7.1

Applications for funds for works on main roads and unclassified roads exceeded the level of allocations the Board was able to provide by many millions of dollars.

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 during 1980/81 increasing the total authorised contributions to $1,630,000. The Board's Divisional Engineers, in consultation with the appropriate Forests Commission officers, 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.
The Board conducted a survey during 1980/81, in conjunction with District Officers of the Forests Commission, of works considered to be warranted and eligible for funding from the Municipalities Forest Roads Improvement Fund. It is estimated that an amount of $2,750,000 would be required over a five year period from 1981/82 to 1985/86 to fund these works. The Board allocated a further $200,075 in 1980/81.

37th Conference of Municipal Engineers

The 37th 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 16th and 17th March 1981, concluding with a technical tour of the Underground Rail Loop on 20th March 1981.
The Conference was officially opened by the Honourable Robert Maclellan, MLA, Minister of Transport.
The theme of the conference, "Practical Engineering", was the subject of a keynote address presented by Mr W M Lonie, Study Leader for the Victorian Transport Study. Mr Lonie's comments on the summary of the findings of the Study provided an excellent introduction to a highly informative and successful conference.
Other papers presented were on the general themes of management, planning, research, road and bridge design and construction, road making materials, road construction plant, landscaping, and road finance.
An address was presented at the conference luncheon by the Honourable Sir Esler Barber, a former Judge of the Supreme Court of Victoria, who conducted the enquiries into the failures of King Street Bridge and the West Gate Bridge. Sir Esler spoke on the demands of project planning and contract administration.
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 Mr W M Lonie, and to all engineers participating, particularly those who presented papers, for contributing to the success of the Conference.

Visits to municipalities

Each year the Board members make official visits to a number of municipalities throughout the State. This has been the practice since 1913 when the first Board 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 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 33 municipalities: the Cities of Bendigo, Brighton, Collingwood, Fitzroy, Hawthorn, Kew, Moe, Prahran, Richmond, Shepparton, Swan Hill, Warrnambool and Williamstown; the Town of Kyabram; and the Shires of Eltham, Euroa, Flinders, Huntly, Kaniva, Kowree, Lowan, Maffra, Marong, Narracan, Nathalia, Numurkah, Pakenham, Rodney, Shepparton, Swan Hill, Tallangatta, Warrnambool and Whittlesea.

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 Colac, Moorabbin and Traralgon; the Shires of Benalla, Bulla, Mildura, Newham & Woodend, Omeo and Wangaratta; and the Borough of Wonthaggi. Joint deputations were received from the City and Shire of Shepparton and from the Shires of Diamond Valley and Eltham. Deputations were also received from the Northern Area Commission and the Municipal Association of Victoria.

The main topics raised by the councils were the general inadequacy of road grants to meet the State's road needs, the allocation of road funds to municipal councils by the Board and matters associated with road classifications, traffic management measures and reconstruction and development works.

Flood and storm damage restoration works

During the 1980/81 financial year, grants totalling $157,900 were made by the State Government under a Commonwealth/State agreement for road restoration works following natural disasters. The allocations were made for–

- the restoration of road communications following severe wind storms which occurred in the Shire of Buln Buln during August 1980 and in the Shire of Metcalfe during December 1980;
- increased costs incurred on the replacement of a bridge in the Shire of Maffra which was destroyed during the floods which occurred in the Gippsland area in June 1978;
- repairs to roads damaged by flooding which occurred in the Shires of Gordon, Metcalfe and Pyalong during September and October 1979.

The road restoration works were carried out under the supervision of the relevant municipal councils.

Under the 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 State Treasurer.

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 to schools. A total amount of $59,060 was allocated by the Board in the 1978/79 financial year and a further allocation of $86,050 was made by the Board in 1979/80 for this work.

During the 1980/81 financial year a total allocation of $72,300 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
Ararat City	Blake Street, Ararat
Ararat Shire	Buangor
Ballan Shire	Gordon School Road
Bendigo City	Anderson Street
Bendigo City	Tucker Street
Croydon City	Maroondah High School and West Croydon School Road
Kilmore Shire	Arrowsmith Street, Beveridge
Knox City	Wantirna-Sassafras Road, The Basin
Mornington Shire	Nepean Highway, Mornington
Mortlake Shire	Mortlake High School Road
Mortlake Shire	Scott Street, Mortlake
Mortlake Shire	Hamilton Street, Mortlake
Narracan Shire	School Road, Coalville
Warragul Shire	Old Sale Road, Buln Buln
Wimmera Shire	Grahams Bridge Road

Access roads to Surf Life Saving Clubs

During 1980, following representations from the Surf Life Saving Association of Australia, consideration was given to a proposal that funds be provided to improve access roads to surf life saving club buildings.

Because of the special purpose of these access roads - for emergency situations and the provisioning of club facilities - and the fact that certain of these roads would not be open for vehicular use by the general public it was decided that the need for improvements to the access roads should be individually assessed, with individual grants being made as appropriate from the Transport Fund.

Where it is decided that improvements should be made to a particular access road, the work is carried out by the relevant municipal council which also makes a financial contribution to the work.

It is estimated that an amount of $330,000 will be required over a period of four years to implement improvements considered to be necessary to access roads to surf life saving club buildings.

A programme of improvements to eight access roads has been approved and the following allocations for carrying out these improvements were made by the Board from the Transport Fund in the 1980/81 financial year.

Municipality	Surf Life Saving Club	Allocation
		$
Barrabool	Fairhaven	12,840
	Anglesea	4,200
	Jan Juc	8,350
Belfast	Port Fairy	6,400
Bellarine	Ocean Grove	21,875
Otway	Kennett River	2,400
Queenscliffe	Point Lonsdale	29,200
South Barwon	13th Beach	1,340
		$86,605

Significant works on main and unclassified roads

Main roads

Significant works completed or substantially completed during financial year 1980/81.

Alberton Shire
Yarram–Traralgon Road: Widening and realignment of 2.7 km north of Won Wron.

Alexandra Shire
Yarck Road: Reconstruction of 3.5 km.

Ararat Shire
Ararat–Warrnambool Road: Reconstruction of 2.8 km south of Ararat.

Beechworth Shire
Beechworth–Wodonga Road: Reconstruction of 1.6 km.

Bright Shire
Harrietville Road: Reconstruction and realignment of 2.4 km at Harrietville.

Cobram Shire
Benalla–Tocumwal Road: Construction of a five span reinforced concrete bridge and approaches over Boosey Creek at Katamatite.

Cranbourne Shire
Baxter–Tooradin Road: Reconstruction of 1.8 km.

Croydon City
Canterbury Road: Reconstruction at Colchester Road. Installation of culverts at Bungalook Creek.

Diamond Valley Shire
Heidelberg–Kinglake Road: Reconstruction of 1.2 km.

Doncaster and Templestowe City
Doncaster Road: Reconstruction between Elgar Road and Hender Street.
Heidelberg–Doncaster Road: Reconstruction of 0.6 km between Noelle Street and Derreck Avenue.

Eltham Shire
Eltham–Yarra Glen Road: Reconstruction of 0.9 km.
Whittlesea–Kinglake Road: Reconstruction and realignment of 1.8 km at Kinglake.

Flinders Shire
Mornington–Dromana Road: Reconstruction of 0.5 km near Safety Beach boat ramp.
Mornington–Flinders Road: Reconstruction and realignment of 2.3 km.

Frankston City
Cranbourne–Frankston Road: Duplication of 0.7 km between Beach Road and McMahons Road.

Healesville Shire
Healesville–Kinglake Road: Reconstruction of 0.6 km.

Heidelberg City
Main Heidelberg–Eltham Road: Reconstruction of 0.9 km.

Knox City
Stud Road: Construction of additional lanes between Wellington Road and Lakeview Road.

Korumburra Shire
Poowong–Ranceby Road: Reconstruction and realignment of 2.6 km at Poowong.

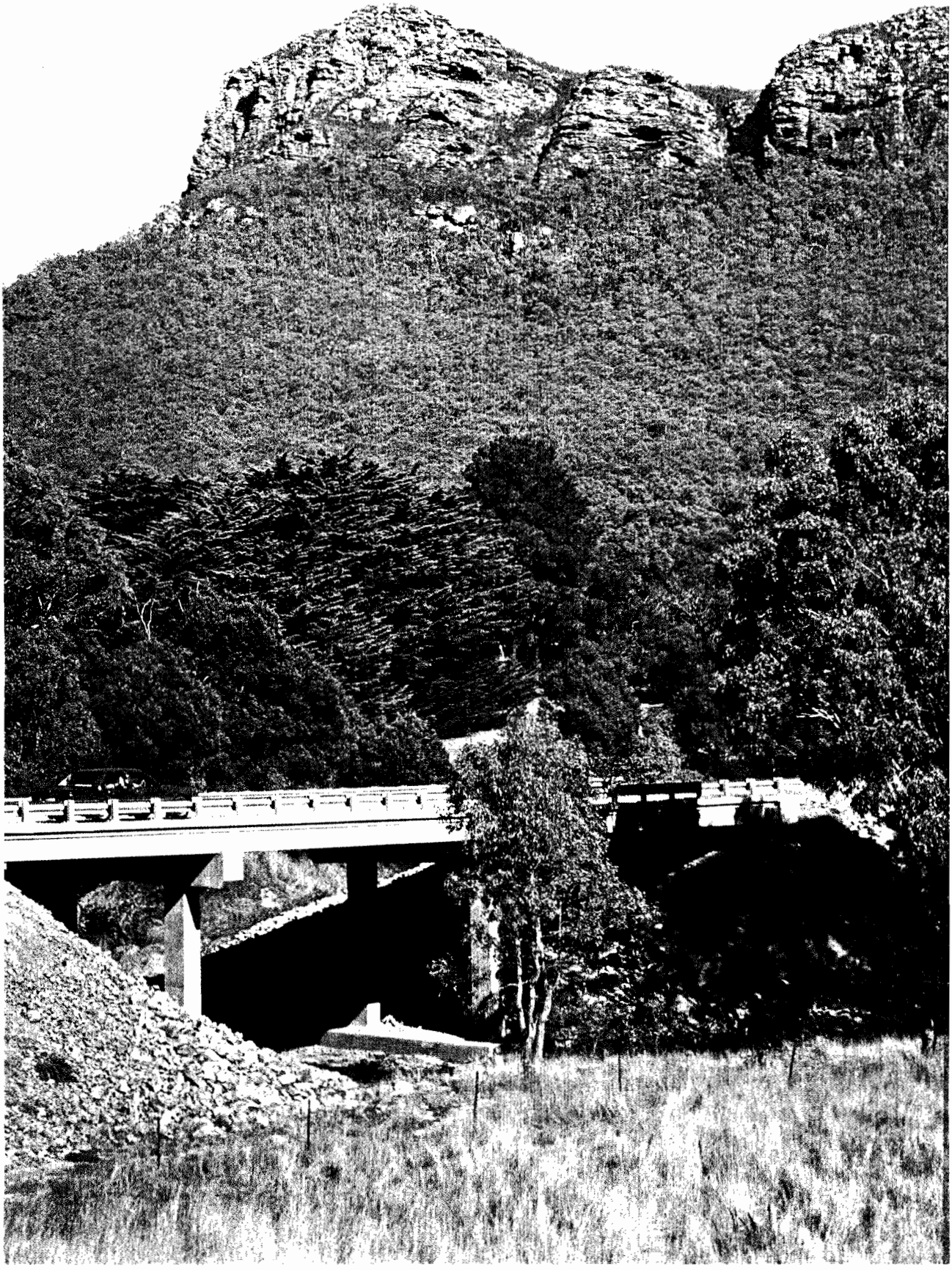
Lilydale Shire
Lilydale–Monbulk Road: Reconstruction of 1.3 km.
Lilydale–Montrose Road: Duplication of 0.5 km.

Minhamite Shire
Hamilton–Port Fairy Road: Construction of a three span bridge 42 metres long over Eumeralla River at Macarthur.

Mirboo Shire
Mardan Road: Reconstruction and realignment of 2.3 km.

Mount Rouse Shire
Victoria Valley Road: Construction of a three span bridge 32 metres long and approaches over Wannon River.

Right: New bridge carrying Victoria Valley Road over the Wannon River, near Dunkeld (Mount Rouse Shire)



Main roads, continued

Myrtleford Shire
Myrtleford-Yackandandah Road: Reconstruction and realignment of 1.3 km north of Myrtleford.

Otway Shire
Colac-Beech Forest Road: Reconstruction and realignment of 2.4 km west of Gellibrand.

Rutherglen Shire
Chiltern-Howlong Road: Construction of the approach roads to new bridges across the Murray Valley Flood Plain.

Sebastopol Borough
Colac-Ballarat Road: Duplication of 0.4 km between Rubicon and Hertford Streets, Sebastopol including the construction of a service road and two roundabouts.

Shepparton Shire
Shepparton-Barmah Road: Reconstruction of 1.8 km.

Springvale City
Cheltenham Road: Widening 0.8 km between Old Dandenong Road and Doncaster-Mordialloc Road.

Tallangatta Shire
Shelley-Jingellic Road: Reconstruction and realignment of 0.9 km.
Talgarno Road: Reconstruction and realignment of 1.4 km.

Tambo Shire
Gelantipy Road: Reconstruction and realignment of 3.2 km north of Buchan.

Traralgon Shire
Tyers Road: Reconstruction of 1.2 km through Tyers Township.

Upper Murray Shire
Tallangatta-Corryong Road: Reconstruction of 3.3 km including the construction of a climbing lane.

Warragul Shire
Bloomfield Road: Reconstruction and realignment of 1.2 km.

Wodonga City
Beechworth-Wodonga Road: Duplication between Pearce Street and Huon Creek Road.

Yackandandah Shire
Dederang Road: Reconstruction of two sections each of 1.5 km.
Kiewa East Road: Reconstruction and realignment of 1.9 km.

Yea Shire
Yarra Glen-Yea Road: Reconstruction and realignment of 1.6 km.

Unclassified roads

Significant works completed or substantially completed during financial year 1980/81.

Ballaarat City
Bridge Street Mall Project: Roadworks and the installation of traffic signals associated with the establishment of the Bridge Street Mall, Ballarat.

Ballarat Shire
Gillies Street: Duplication between Howitt and Norman Streets, Wendouree.

Buln Buln Shire
Fishers Road: Reconstruction and realignment of 1 km north of the Tarago River.
Main Jindivick Road: Reconstruction and realignment of 0.6 km north of Main Neerim Road.

Camberwell City
Toorak Road: Reconstruction of 1.9 km.

Corio Shire
Cox Road: Duplication of 0.2 km between Anakie Road and Gravillie Avenue.
Steiglitz Road: Reconstruction of 1.2 km between Geelong-Ballan Road and Lights Road.
Vines Road: Reconstruction of 0.4 km between Church Street and Carey Street, North Geelong.

Cranbourne Shire
Ballarto Road: Reconstruction of 0.9 km westerly from Dandenong-Hastings Road.

Croydon City
Bayswater Road: Duplication between Canterbury Road and Dandenong Creek.

Diamond Valley Shire
Progress Road: Reconstruction of 1.1 km.

Doncaster and Templestowe City
Blackburn Road: Reconstruction of 1.3 km between Reynolds Road and Heidelberg-Warrandyte Road.

Eltham Shire
Eltham-Greensborough Road: Reconstruction of 0.3 km between Adam Crescent and Stephen Crescent. Reconstruction of 0.5 km between Plenty River and Para Road.

Euroa Shire
Polly McQuinns Road: Construction of a three span reinforced concrete bridge over Seven Creeks.

Flinders Shire
Old Cape Schanck Road: Reconstruction of 2.4 km between Jetty Road and Browns Road.
Sandy Road: Reconstruction of 1.7 km between Rosebud-Flinders Road and Truemans Road.

Healesville Shire
Myers Creek Road: Reconstruction and realignment of 1.1 km.

Knox City
Bayswater-Croydon Road: Widening 0.2 km between Wantirna-Sassafras Road and Dandenong Creek.

Korumburra Shire
North Poowong Road: Reconstruction and realignment of 3.6 km west of Poowong North.

Minhamite Shire
Mt Eccles Road: Reconstruction and realignment of 3.2 km.

Mirboo Shire
Mountain Hut Road: Reconstruction and realignment of 1.2 km.

Mornington Shire
Osborne Drive: Reconstruction of 1.3 km between Bentons Road and Craigie Road.

Mortlake Shire
Chatsworth-Wickliffe Road: Redecking of the bridge over the Hopkins River at Chatsworth.

Nunawading City
Heatherdale Road: Duplication of 0.2 km between Centre Road and Abbey Walk.

Pakenham Shire
Army Road: Reconstruction of 2.1 km southerly from Healesville-Kooweerup Road.
Soldiers Road: Construction of a two span bridge 24 metres long over Cardinia Creek.

Port Fairy Borough
Griffith Street: Redecking the bridge over the Moyne River at Port Fairy.

Rutherglen Shire
Dugays Bridge Road: Construction of a three span reinforced concrete bridge over Black Dog Creek.
Gooramadda Road: Reconstruction and realignment of 6 km.

Unclassified roads, continued

Springvale City
Tootals Road: Reconstruction of 1.6 km between Heatherton Road and Cheltenham Road.

Stawell/Kara Kara Shires
Pilgrim–Banyena Road: Construction of a three span bridge and approaches at Grays Bridge.

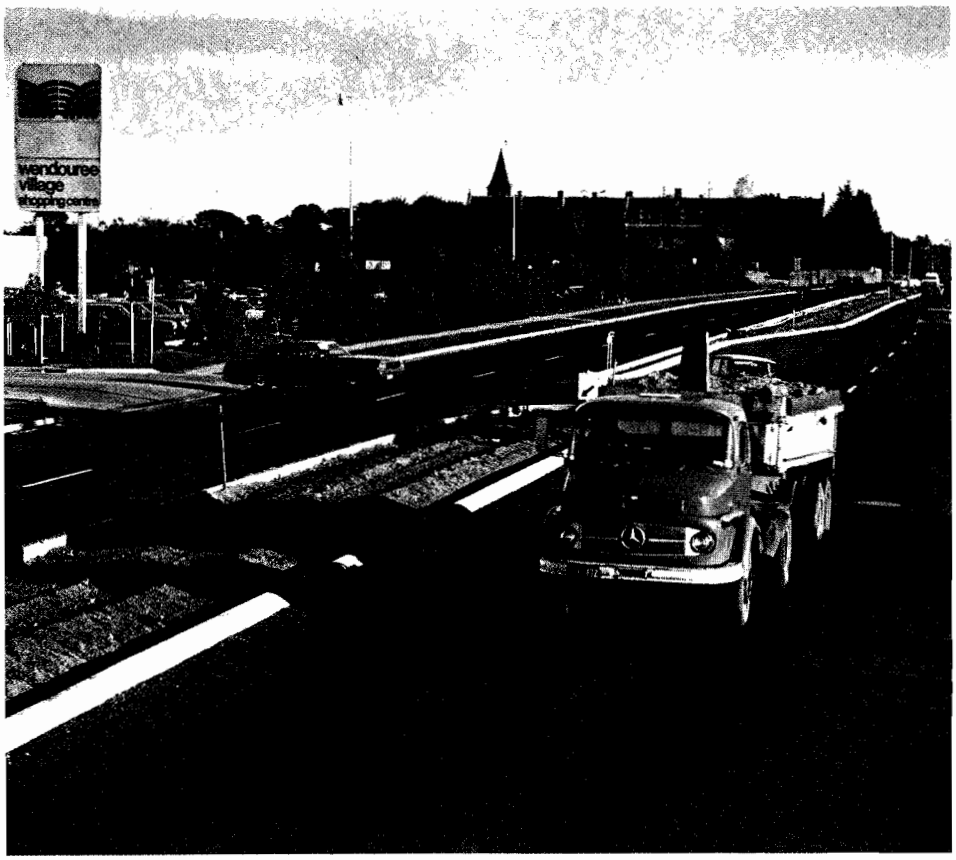
Tambo Shire
Bonang–Gelantipy Road: Reconstruction and realignment of 3.8 km.

Traralgon Shire
Jeeralang North Road: Reconstruction of 2.9 km south of Traralgon.

Wangaratta City
Rowan Street: Reconstruction between Grey Street and Green Street including intersection improvements.

Waverley City
Blackburn Road: Reconstruction of 1.6 km between High Street Road and Waverley Road.

Wodonga City
Osburn–Chapple Street: Duplication between the railway line and Ferrier Street.
Pearce Street: Construction of a connection between Beechworth Road and the Murray Valley Highway.
Smythe Street: Reconstruction and duplication between Elgin Street and Lawrence Street.



Above: Duplication of Gillies Street in Wendouree (Shire of Ballarat)

The following table sets out Board's personnel strength as at 30th June 1980 and 30th June 1981.

	As at 30th June 1980	As at 30th June 1981
Engineers	533	528
Administrative staff	654	637
Technical staff	505	498
Scientists	22	22
Surveyors	37	37
Other technological staff (qualified)	24	28
Printing and other General Division staff	20	19
Depot staff and employees	825	794
Field staff and employees	2618	2262
	5238	4825

During the year, the Board continued its policy of examining carefully all requests for staff recruitment and staff replacements. The recruitment and replacement of staff only proceeded where this was considered to be essential for the Board's operating requirements.
Within the limits of this policy, the Board during the year recruited 13 newly qualified civil engineers, 14 draftsmen/draftswomen and 22 apprentices.
Thirty 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.
The Board was also able to provide 160 school students with work experience under the Work Experience Act 1975, in clerical, technical and field positions. The Act was introduced by the State Government in January 1975 to enable students over thirteen years of age to be provided with work experience for up to twelve days in any one school term. The students are paid an amount of $3 per day by the Board which is subsequently re-imbursed by the State Education Department.

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. Training courses covered a wide range of technical and administrative subjects including road and bridge design and construction, materials testing, traffic engineering, bituminous surfacing and management training.
During the year officers attended the following external training courses:

- Advanced Course - Australian Administrative Staff College.
- Management Development Course - Australian Administrative Staff College.
- Summer/Winter School of Business Administration - University of Melbourne.
- Construction Project Management Course - University of New South Wales.
- Traffic Planning and Control Course - University of New South Wales.
- Government Administrative Course - University of New South Wales.

A Career Development Programme for young engineers was introduced during the year. This programme, extending over a period of approximately eight years, enables young engineers to work in three or four different areas of the Board's operations. By gaining a variety of experience, young engineers will be better prepared for promotion and the Board, in the long term, will benefit from engineers possessing a broader knowledge of its operations.
A CRB Bursary Scheme was also introduced to permit selected applicants to undertake some course of study, training or project which will benefit the Board's operations in terms of efficiency and effectiveness. One bursary was granted during the year to enable an officer to undertake a two months training course in the USA in connection with the construction of Prestressed Concrete Box Girder Bridges with match cast joints similar to the form of construction which is being used for the West Gate Freeway structure.
The Board also conducts a study leave scheme to assist staff development.
The Board provides training attachments for engineers from South East Asia and Africa under aid programmes such as the Colombo Plan, Australia Papua New Guinea Education Plan, South Pacific Assistance Plan and the Special Commonwealth African Plan. These training attachments are part of Australia's aid programme and are organised by the Board following requests received from the Australian Development Assistance Bureau as part of its aid to developing countries.
During the year, the Board provided training attachments for 14 engineers.

Apprenticeships

Twenty-two new apprentices were employed during the year in the trades of motor mechanic (16), carpentry and joinery (1), electrical mechanic (1), structural steel fabrication (1), landscape gardening (1), lithographic printing (1) and automotive electrician (1).
The total number of apprentices in training, at 30th June 1981, was:

Motor Mechanics	69
Structural Steel Fabrication	4
Carpentry and Joinery	6
Painting and Decorating	2
Electrical Mechanics	4
Cooking	1
Automotive Electrics	2
Landscape Gardening	3
Gardening	1
Lithographic Printing	2
Instrument Making and Repairing	-
Fitting and Turning	2
Plumbing and Gas Fitting	1
	97

Industrial relations

Although the Board was involved in a number of proceedings before the Australian Conciliation and Arbitration Commission during the year, the Board's relationships with trade unions and staff associations continued to be generally satisfactory, with no major stoppages of work taking place during the year.
In November 1980, Commissioner Connell made an order varying the Country Roads Board Salaried Staff Award 1973 by including a new classification of Assistant Overseer in place of the previous classification of Ganger. The variation, which was effective as from 30th October 1980, required that as from that date all personnel classified as gangers be reclassified as Assistant Overseers with the result that such personnel became eligible for the entitlements in the Board's Conditions of Employment for Salaried Staff.
During the year, the Association of Professional Engineers, Australia notified a dispute to the Commission concerning the classification of engineers. The hearing of this dispute by Cohen J. was still proceeding at the end of the financial year.
Other proceedings before the Commission which were in progress at the end of the financial year involved the following Awards covering Board's personnel:

- Australian Workers' Union Construction and Maintenance Award
- National Building Trades Construction Award
- Building Construction Employees and Builders Labourers Award
- Metal Trades Award.

Details of the Federal Awards to which the Board is a respondent party and the number of its employees covered by these awards as at 30th June 1981 are as follows:

	No. of Personnel
Australian Workers' Union Construction and Maintenance Award	1470
Building Construction Employees and Builders Labourers Award	113
Carpenters and Joiners Award	12
Engine Drivers and Firemen's Award	3
National Building Trades Construction Award	65
Metal Trades Award	353
Transport Workers' (General) Award	274
Country Roads Board Salaried Staff Award	1871
Municipal Officers (Country Roads Board) Senior Officers Award	18
Professional Engineers (Country Roads Board, Victoria) Agreement	511
Professional Engineers (Country Roads Board, Victoria) Senior Engineers Award	29
Total	4719

Retirements

Personnel who retired after substantial service with the Board:

Name	Position	Location	Length of Service (years)
Turner, W F	Stores Supervisor	Central Stores	42
Handley, R C	Chief Engineer (Special Duties)	Engineer in Chief's Section	34
*Martin, R	Plant Operator	Benalla Division	34
Dawson, J B	Senior Instructor Driver	Mechanical Sub-Branch	33
Hobbs, H W P	Chief Road Design Engineer	Road Design Sub-Branch	32
Gibney, J J	Permit Officer	Traffic Section	32
Shelley, M A	Cleaner	Geelong Division	32
Davies, C A	Patrolman	Ballarat Division	31
Jeziorski, A	Traffic Controller	Bendigo Division	31
McCormack, W P J	Patrolman	Bairnsdale Division	31
McCracken, A L	Articulated Vehicle Driver	Horsham Division	31
Robertson, G P	Construction & Maintenance Worker	Metropolitan Division	31
Arnot, R A	Leading Hand Painter	Mechanical Sub-Branch	30
Hunter, E J A	Ganger	Geelong Division	30
McLeod, T K	Roadmaster	Bairnsdale Division	30
Beavis, A R	Patrolman	Warrnambool Division	29
Bentley, G H	Pay Clerk	Central Stores	29
Kaczynski, S	Plant Cleaner	Traralgon Division	29
Nelsons, Z	Patrol Assistant	Ballarat Division	29
Sterchi, E A	Painter	Mechanical Sub-Branch	29
Zierk, G L	Divisional Engineer's Clerk	Geelong Division	29
Franke, A E	Carpenter	Bairnsdale Division	28
Johnston, J	Overseer	Benalla Division	28
Lohse, J F A	Patrolman	Geelong Division	28
McLeod, A M	Patrol Assistant	Warrnambool Division	28
Stefanovic, D	Patrol Assistant	Traralgon Division	28
Couzens, I K	Cost Clerk	Geelong Division	27
Broadwood, H W	Leading Hand Fitter	Traralgon Division	26
Hanley, M J	Clerk of Works	Bridge Sub-Branch	26
Kalmund, C A	Leading Hand Fitter	Warrnambool Division	25
Lea, A V J	Patrolman	Horsham Division	25
Cecil, R D	Patrol Assistant	Geelong Division	24
Potter, W R	Articulated Vehicle Driver	Horsham Division	24
Rolewski, M	Skilled Builders Labourer	Benalla Division	24
Ross, D J	Engineer	Road Design Division	24
Smith, W	Leading Hand Carpenter	Bridge Sub-Branch	24
Butcher, W E	Survey Officer	Survey Division	23
*Camm, H D	Patrolman	Bairnsdale Division	23
Clarke, L H	Plant Operator	Ballarat Division	23
Vince, A C	Owner Truck Driver	Geelong Division	23
Anderson, I L	Technical Illustrator	Public Relations Section	22
Biggin, C W	Overseer	Ballarat Division	22
O'Donnell, J P	Patrolman	Geelong Division	22
Schwab, N A	Patrolman	Benalla Division	22
Zenkis, J	Truck Driver	Metropolitan Division	22
Crane, N H	Storeman	Geelong Division	21
*Hetherington, A S	Motor Mechanic	Warrnambool Division	21
Hyder, R G	Leading Heater Hand	Benalla Division	21
*Lee, W D	Earnings & Tax Records Officer	Chief Accountant's Branch	21
Brennan, D A	Cost Clerk	Warrnambool Division	20
Burzacott, W R	Skilled Builders Labourer	Ballarat Division	20
Cohen, F J	Patrolman	Traralgon Division	20
Malley, C F	Leading Hand Fitter	Mechanical Sub-Branch	20
Palmer, T M	Tanker Driver	Traralgon Division	20
Robinson, G A	Patrolman	Horsham Division	20
Saunders, A A	Patrolman	Metropolitan Division	20
Stefaniak, G F R	Truck Driver	Benalla Division	20
Vraspir, J	Construction & Maintenance Worker	Mulgrave Freeway Project	20

*Deceased

Workers compensation

An amendment to the Workers Compensation Act, effective from 1st January 1979, gave employers the option of administering all workers compensation claims up to the level of $500 in regard to weekly benefits and associated medical accounts.

The Board did not exercise the option at that time and decided to conduct a review of the experiences of other instrumentalities and major employers which had decided to do so. Following the completion of this review, the Board decided to exercise the option as from 1st July 1980.

During the year, a total of 1171 claims for workers compensation were made on the Board of which 118 were referred to the Board's Insurers and 1053 were handled directly by the Board in the first instance. Of those 1053 claims, 893 were settled for less than $500 and were totally administered by the Board.

Hearing conservation

In accordance with the provisions of the Health (Hearing Conservation) Regulations 1978, the Board continued to arrange for noise level dosage readings to be taken to determine if noise reduction measures were required in specific areas. A programme of audiometric tests was commenced during the year for all personnel working in depot and field locations and 2043 personnel were tested.

Hearing protection devices were provided for employees exposed to excessive noise and symbolic signs were placed on equipment or in areas where it is necessary to wear hearing protection devices.

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:

Beechworth Historical Park	Beechworth Shire
Brisbane Ranges National Park	Bannockburn & Corio Shires
Bulga National Park	Alberton Shire
Cape Schanck National Park	Flinders Shire
Cathedral Range National Park	Alexandra Shire
Chiltern Historical Park	Chiltern Shire
Churchill National Park	Knox City
Coopracambra National Park	Orbost Shire
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 National Park	Rosedale Shire
Kinglake National Park	Eltham & Whittlesea Shires
Lind National Park	Orbost Shire
Little Desert National Park	Dimboola Shire
Lower Glenelg National Park	Portland Shire
Morwell National Park	Morwell Shire
Mount Baw Baw National Park	Narracan 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 & Bulla Shire
Pink Lakes National Park	Walpeup Shire
Port Campbell National Park	Heytesbury Shire
Snowy River National Park	Orbost Shire
Tarra Valley National Park	Alberton Shire
Tingaringy National Park	Orbost Shire
The Lakes National Park	Rosedale Shire
Warby Ranges National Park	Wangaratta Shire
Warrandyte National Park	Doncaster & Templestowe City
Werribee Gorge National Park	Bacchus Marsh & Ballan Shires
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 $1,797,000 available for these purposes since 1st July 1963.

Roads of tourist interest

The State Government provided loan funds totalling $200,000 in 1980/81 for expenditure on roads of a tourist nature other than roads proclaimed as tourists' roads under the provisions of the Country Roads Act. The loan funds are repayable by the Board.
Allocations for particular projects were made by the Board after consultation with the Ministry of Economic Development. The total amount made available by the Government since 1960 is $4,294,000.
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 $1,482,958 was paid during the year. The Tourist Fund is administered by the Ministry of Economic Development.

Public relations

The Board continued to pursue its 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

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

- CRB News Nos 44, 45, 46
- Colouring Book (reprint)
- Bridges
- Roads
- Roadscapes
- Snow Driving
- Princes Freeway, Bypasses of Drouin and Warragul
- Princes Freeway, Bypass of Berwick
- Nepean Highway Widening, Cochrane Street to South Road
- Hume Freeway, Seymour to Euroa
- The Country Roads Board, Victoria
- Financial Facts
- Driver's Guide to Mulgrave Freeway and South Gippsland Freeway (reprint)
- A Guide to Melbourne's Freeways (reprint)
- Pavement Testing, a selection of tests as demonstrated at the 1981 Civil Engineering Exhibition.

Information Bulletins were produced for the following projects:

- Nepean Highway Widening, Elsternwick to Moorabbin
- Eastern Freeway, Bulleen to Ringwood

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

Displays

The Board's exhibit at the Royal Show featured a display on bridge construction techniques, and an exhibit at the CivEnEx Field Display at Werribee in March 1981 featured a display on pavement testing. The Board's Mobile Information Centre was used for displays at rural shows at the following locations:

Bairnsdale	Lardner	Omeo	Traralgon
Foster	Maffra	Sale	Yarram.

The displays centred on work undertaken by the Board's regional divisions appropriate to the location of each show. In addition, a short video presentation called "Roads East" was produced and shown at each rural show visited by the Mobile Information Centre.

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. The 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 capable of 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).

These units form part of 6 Construction Group which is commanded by Col G R Hunt ED, the Board's Specifications and Contracts Engineer.

The 1980 annual camp was held in the Big River Training Area, south of Eildon Weir, and consisted of infantry tasks with an engineering emphasis. Other activities during the year involved the erection of Bailey bridges on the Glenelg Highway at Skipton and on the Pyrenees Highway at Ararat. In addition, a detachment under the command of Maj G A Hose, an engineer in Metropolitan Division, relieved for two weeks a regular Army engineer squadron, which was constructing a road north of Rockhampton in the Shoalwater Bay Training area.

The 22 Construction Regiment was commanded by Lt Col P M Hosking ED, the Board's Assistant Principal Traffic Officer, to May 1981, when he was succeeded by Lt Col W F Hardy, an engineer with the Melton Waterworks Trust. The 107 Plant Squadron (Heavy) is commanded by Maj E G Renton, an engineer in the Board's Works Sub-Branch. As at 30th June 1981, fourteen members of the Board's staff were officers of the Regiment.

Left: Reconstruction of the Bogong High Plains Road, near Bogong
Inset: installation of guard rail posts

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 on national matters are considered by the Australian Transport Advisory Council (ATAC) Road Advisers' Group. This Group comprises the heads of the State Road Authorities and the Department of Housing and Construction and the Commonwealth Department of Transport. The Group advises ATAC, the meeting of Ministers of Transport, which determines national transport policies.

The following NAASRA meetings were held during the year:

- 64th (Annual Meeting) Sydney, 27th and 28th October 1980, attended by Mr T H Russell, Chairman.
- 65th (Intermediate Meeting) Melbourne, 7th May 1981, attended by Mr T H Russell, Chairman, and Mr W S Brake, Deputy Chairman. At this meeting, Mr T H Russell was appointed Acting Chairman of NAASRA following the death of the Chairman, Mr B J Sexton, Commissioner for Main Roads, New South Wales.

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 roads grants legislation
- State roads legislation
- Standards for construction and maintenance of National highways
- Road vehicle limits
- Road studies
- Road statistics
- Road Construction price indices
- Route numbering
- Full scale pavement testing
- Transport Literature Information Systems
- Australian Development Assistance Bureau courses
- Area traffic control systems
- Publications - technical and general information.

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.

Approximately 7% 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 Commonwealth Roads Grants Act 1980.

The objective of the Board is to co-ordinate, encourage and arrange continuing research into problems associated with roads 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 41st Directors' meeting of ARRB at the Department of Main Roads, Sydney on 30th October, 1980 and the 42nd meeting held at the Australian Road Research Centre, Vermont on 5th and 6th May 1981. At the 42nd meeting Mr Russell was reappointed 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 ARRB conference which was the tenth such conference, was held at Sydney in August 1980.
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.

Legislation affecting the Board

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

Country Roads (Road Marking) Act 1980

This Act was passed in the 1980 Spring Session of State Parliament and came into operation on 18th November 1980.
The Act amends Section 113(3) of the Country Roads Act 1958 which provided for the cost of road marking on State highways, main roads, tourists' roads, forest roads and freeways to be paid out of the Country Roads Board Fund. The effect of the amendment introduced by the Country Roads (Road Marking) Act 1980 is to enable such costs to be paid either out of the Country Roads Board Fund or any other money lawfully available to the Board for that purpose.

Motor Car (Mass and Dimension Limits) Act 1981

This Act, which was passed during the 1981 Autumn Session of State Parliament had not been proclaimed to come into operation as at 30th June 1981.
The Act amends the Motor Car Act 1958 and its principal purposes are:

(a) to implement the revised mass and dimension limits for motor cars and trailers recommended by the National Association of Australian State Road Authorities and adopted by the Australian Transport Advisory Council except for the NAASRA recommended height limit of 4.3 metres;
(b) to provide for the separate registration of prime movers and semi-trailers; and
(c) to increase the penalties relating to the overloading of motor cars and trailers.

The Act is significant for the Board as the Board has the responsibility under the Motor Car Act 1958 for issuing permits for the movement of vehicles exceeding the mass, height, length and width limits prescribed by the Motor Car Act:

(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 in the Motor Car Act.

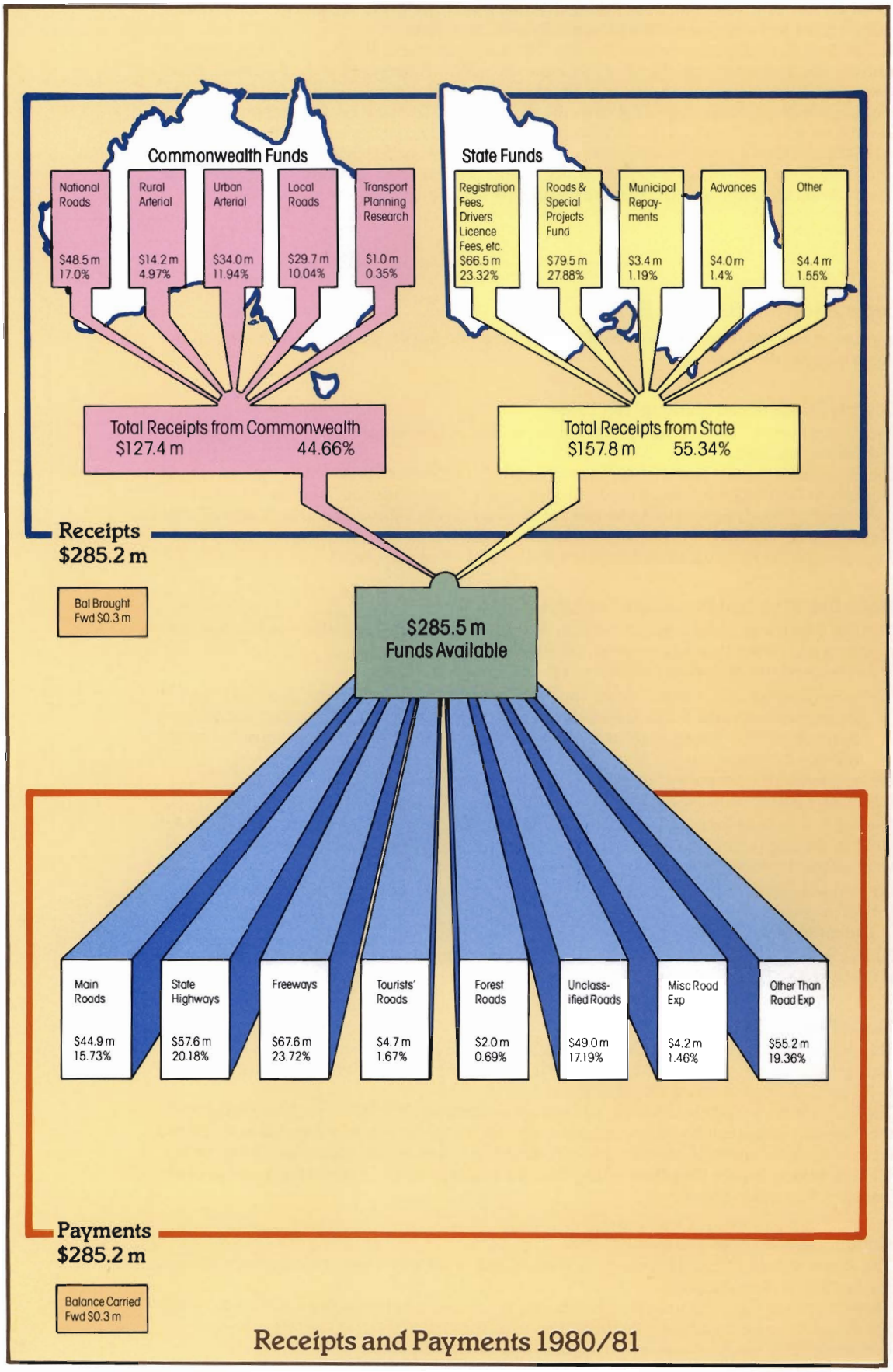
Further details of the Board's activities in controlling overdimensional and overweight vehicles are set out on page 37 of this Report.

Motor Registration Act 1980

This Act was passed during the 1980 Autumn Session of State Parliament. Sections 1, 4, 6 and 7 were proclaimed to come into operation on 9th July 1980 while the remaining sections, 2, 3, 5 and 8–30 came into operation on 29th April 1981.
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 amendment to a number of other Acts including the Country Roads Act 1958.
Mr W S Brake, Deputy Chairman of the Country Roads Board is a part-time member of the Transport Regulation Board.

Commonwealth Roads Grants Act 1981

This Act provides for Commonwealth roads assistance to the States and to the Northern Territory for the 1981/82 financial year.
The Act replaces the Commonwealth Roads Grants Act 1980 which provided for Commonwealth roads assistance for the 1980/81 financial year.
Further details of the Act are set out on pages 12 and 13 of this Report.



Receipts and Payments 1980/81

Receipts

After deducting the cost of collecting revenue received under the Motor Car Act, total funds available to the Board during the year were $285,428,658-57. The funds were derived from:

	$
State sources	157,803,950-36
Commonwealth sources	127,362,123-09
Balance brought forward from year 1979/80	262,585-12
Total	285,428,658-57

The Board's receipts for 1980/81 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 costs of collecting the fees (excluding Metropolitan omnibus registration fees and the specified proportion of registration fees paid first to the Consolidated Fund and after deduction of refunds transferred to the Roads and Special Projects Fund).

2 Registration Number Plate Fees
Fees payable for the provision and/or replacement of number plates (excluding the fees charged for personalised number plates) less the costs of providing the plates and collecting the fees.

3 Examiners' Licence Fees
Fees payable by persons licensed to conduct motor car roadworthiness examinations, less cost of collection of the 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 Permits 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 costs of collection of the fees (one-half, less one-half cost of collection, is paid to the Consolidated Fund; one-quarter, less one-quarter cost of collection, is paid to the Municipalities Assistance Fund).

10 Unregistered Vehicle Permit Fee
A fee for the issue of a permit to use an unregistered motor car or trailer for a period of not more than 7 days, less the costs of collection of the fee.

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

12 Fines imposed under the provisions of the Country Roads Act 1958.

13 Not less than 75% of the amount credited to the Roads and Special Projects Fund from motor registration fees [see (1) above] and from licence fees raised under the Business Franchise (Petroleum Products) Act 1979.

14 Municipal payments on account of main road works.

15 Any special moneys appropriated by Parliament.

16 Loan Money.

Items 1-15 inclusive are paid into the Country Roads Board Fund. An amount equal to two per cent of the total of items 1-11 inclusive is required to be paid by the Board to the Tourist Fund which is administered by the Ministry of Economic Development and an amount equal to one per cent of the total of items 1-11 inclusive is required to be paid by the Board to the Traffic Authority Fund which is administered by the Road Safety and Traffic Authority.

Commonwealth sources

Receipts under the:

- Roads Grants Act 1980
- Transport Planning and Research (Financial Assistance) Act 1977.

The following table shows the funds available to the Board for the construction and maintenance of roads in 1980/81 compared with 1979/80.

Item	1979/80	1980/81
Receipts from State sources	$	$
Fees under the Motor Car Act less cost of collection	74,147,911	66,490,266
Commercial Goods Vehicle Act	1,487,266	
Municipalities contributions	3,111,588	3,395,404
State loan funds	300,000	300,000
Loan funds – Sec 31A Country Roads Act 1958	1,200,000	1,200,000
Redeemed Investments	1,000,000	
Special grant from State treasury	114,000	77,000
General receipts	2,478,111	2,841,280
Allocation from Roads (Special Projects) Fund	36,749,958	
Transfer from Roads and Special Projects Fund	24,800,000	79,500,000
Advances – Sec 31G Country Roads Act 1958		4,000,000
Balance brought forward at 1st July	4,097,352	262,585
	149,486,186	158,066,535
Receipts under Commonwealth grants for roads		
National roads	39,312,000	48,469,000
Urban arterial roads	31,548,000	34,040,000
Local roads	26,041,000	29,668,000
Rural arterial roads	12,759,000	14,182,000
Minor traffic engineering and road safety improvements	2,793,000	
Balance brought forward at 1st July	744,959	
	113,197,959	126,359,000
Traffic engineering and road safety	23,025	
Receipts under Transport Planning & Research (Financial Assistance) Act 1977	1,154,638	1,003,123
Total funds available for expenditure by the Board	263,861,808	285,428,658

Matching Commonwealth Grants for roads

The Commonwealth Roads Grants Act 1980 fixed for 1980/81 a 'quota' of expenditure to be made on roads by each State from its own resources. The achievement of the quota for the year ending 30th June 1981 was necessary for each State to qualify in full for the total amounts of the Commonwealth grants to be made under the Roads Grants Act 1980. Failure to expend an amount at least equal to the overall quota would have required 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 1980/81 was $156,400,000.

Expenditure

Expenditure in the form of cash payments during the financial year amounted to $285,131,694 leaving a balance of $296,965 to be carried forward into financial year 1981/82.

The following table shows expenditure incurred by the Board in the years 1979/80 and 1980/81.

Item	1979/80	1980/81
	$	$
Construction and maintenance of roads and bridges	213,726,248	229,944,923
Capital expenditure (plant, workshops, offices, etc.)	5,553,677	3,840,731
Planning and research	4,839,450	4,965,863
Salaries, operating accounts and other administrative expenditure	33,412,462	40,767,456
Statutory payments to Traffic Authority Fund, Transport Regulation Fund and Tourist Fund etc.	2,931,758	2,313,673
Interest and Sinking Fund payments	3,135,628	3,299,047
Total	263,599,223	285,131,693

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 1980 expenditure on the normal programme, of main roads works in financial year 1979/80 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	23,029,969
Expenditure from Commonwealth funds	10,686,298
Expenditure from proceeds of tonne/kilometre tax (Commercial Goods Vehicles Act)	8,741,225
Total	42,457,492
Amount of Country Roads Board Fund expenditure apportioned to councils	$3,410,925

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 1980/81, compared with 1979/80, was as follows:

	1979/80		1980/81	
	CRB	Council Contribution	CRB	Council Contribution
	$	$	$	$
Patrol maintenance	2,811,458	1,226,808	2,990,037	1,310,517
Construction, reconstruction and other maintenance	41,494,242	10,399,146	43,243,989	9,988,766
Total	44,305,700	11,625,954	46,234,026	11,299,283

Municipal councils were not required to contribute towards the cost of works involving an expenditure during the year of $131,896,644 on State highways, freeways, tourists' roads and forest roads.

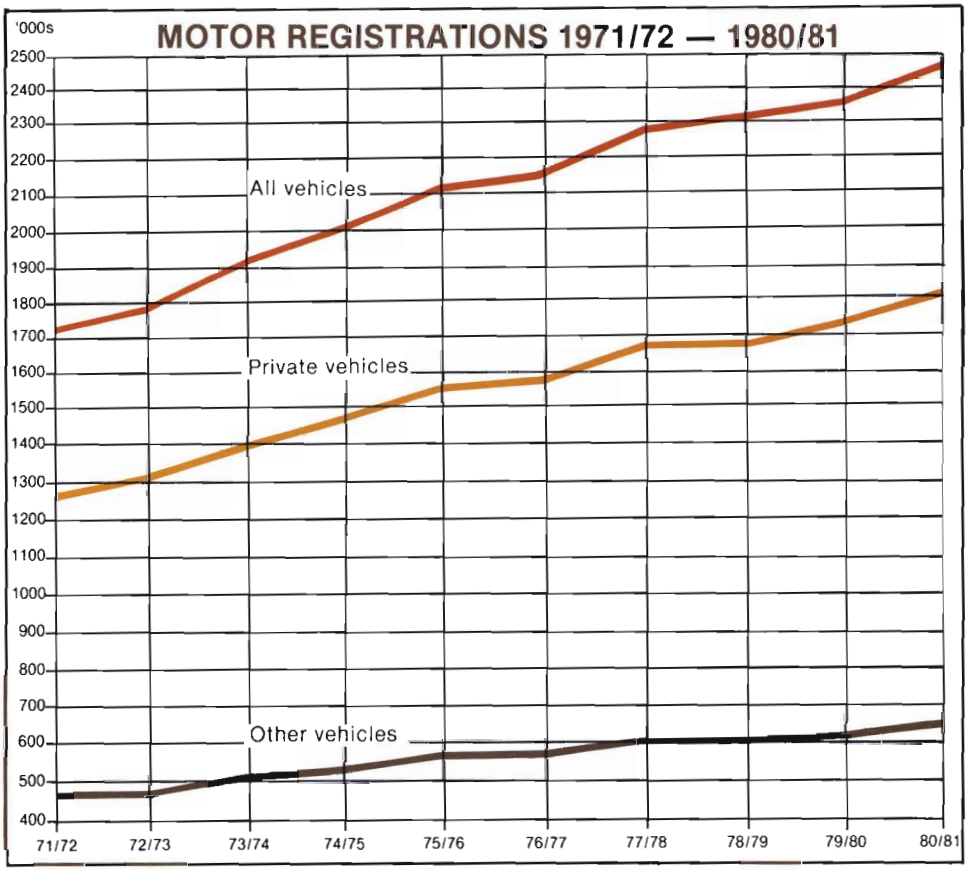
APPENDIX 1

Motor registrations

Registrations under the Motor Car Act during 1980/81 totalled 2,464,230, an increase of 4.6% over the total for the previous year.

Vehicle	Financial Year 1979/80		1980/81		Increase
Private					
New	118,678		120,256		
Secondhand:					
Re-registered	57,896		58,040		
Renewed	1,556,504	1,733,078	1,631,348	1,809,644	76,566
Commercial and Hire					
New	14,949		15,549		
Secondhand:					
Re-registered	5,704		5,262		
Renewed	137,153	157,806	147,664	168,475	10,669
Primary Producers' Trucks and Tractors					
New	5,166		5,071		
Secondhand:					
Re-registered	3,394		4,514		
Renewed	80,170	88,730*	82,526	92,111+	3,381
Trailers		319,649		327,439	7,790
Motor Cycles		55,873		65,636	9,763
Licences under the Motor Omnibus Act		851		925	74
TOTALS		2,355,987		2,464,230	108,243

* Includes 44,702 no-fee tractors + Includes 42,626 no-fee tractors



Lengths of State highways, freeways, tourists' roads and forest roads

State highways - declared as at 30.6.81

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	175.4
Kiewa Valley	Bandiana-Mt Beauty	78.5
Loddon Valley	Bendigo-Kerang	123.7
Maroondah	Melbourne-Mansfield	184.6
McIvor	Heathcote-Bendigo	44.7
Midland*	Geelong-Mansfield	414.7
	Morwell-Port Welshpool	78.9
Murray Valley	Corryong-Hattah	737.0
Nepean	Melbourne-Portsea	90.5
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	484.6
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 Highway	340.0
Warburton	Lilydale-Warburton	34.6
Western*	Melbourne-Serviceton	371.8
Wimmera	Apsley-St Arnaud	222.2

*Lengths quoted do not include freeway sections

Freeways — as at 30.6.81

Name	Section	Length (kilometres)
Calder	Keilor	2.8
	Elphinstone	2.8
Eastern	Hoddle Street to Bulleen Road	9.0
Frankston	Armstrongs Road to Beach Street	5.8
Hume	Craigieburn to Kalkallo	8.3
	Beveridge to Tallarook	52.1
	Avenel	14.4
	Violet Town-Baddaginnie	20.7
	Chiltern	21.3
Midland	Yinnar	9.6
Mornington Peninsula	Springvale Road to Armstrongs Road	8.1
	Dromana to Rosebud	8.4
Princes	Mulgrave	19.5
	Drouin, Moe and Haunted Hills	24.2
	Orbost	5.9
	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

Freeways, continued

West Gate	Bertie Street to Graham Street	.3
	Williamstown Road to Princes Freeway	5.1
Western	Deer Park to Melton	13.3
	Bacchus Marsh to Gordon	41.9

Tourists' roads - declared as at 30.6.81

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 30.6.81

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	20.4
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

APPENDIX 3

Works executed on behalf of Commonwealth and State Government Authorities

for the year ended 30 June 1981 (adjusted to nearest dollar)

Departments	Description of Works	Expenditure	
		$	$
Commonwealth			
Department of Housing and Construction	Access roads to various Commonwealth establishments		7,610
Victoria			
Ministry of Tourism	Additional snow clearing on the Alpine Road to Mt Hotham	33,897	
Port of Melbourne Authority	Repairs to upgrade the structure of Centenary Bridge, Port Melbourne	142,081	
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	88,690	
State Electricity Commission	Roadworks to enable the movement of heavy loads to Loy Yang power station	1,616,129	
Victorian Railways Board	Construction of a crossing loop at Deep Lead	59,028	1,940,125
State Treasury	Improvements to various roads adjacent to State Forests to facilitate the extraction of timber and charged to Municipalities Forest Roads Improvement Fund	85,769	
State Treasury	Restoration works on roads and bridges damaged by floods	153,957	239,726
			2,187,461

Statement of receipts and payments

For the year ended 30 June 1981 (adjusted to nearest dollar)

		Country Roads Board Fund	State Loan Funds	Roads Grants Act 1980	Transport Plan. & Res. (Fin. Asstnce.) Act 1977		Total $
Receipts							
Balance as at 1 July 1980		262,585					262,585
Motor Car Act 1958							
Motor Car Registration Fees	76,521,090						
Drivers Licence Fees	2,885,820						
Drivers Licence Testing Fees	525,024						
Trailer Registration Fees	2,209,992						
Learner Drivers Permit Fees	581,060						
Examiners License Fees	10,010						
Sale of Log Books	21,740						
Motor Driving Instructors Licence – Appointment and Testing Fees	1,463						
Motor Driving Instructors Licence Fees	12,025						
	82,768,224						
Less: Cost of Collection	16,277,958	66,490,266				66,490,266	
Municipalities Contributions							
Permanent Works – Main Roads	120,209						
Maintenance Works – Main Roads	3,275,195	3,395,404				3,395,404	
Transfer from Roads and Special Projects Fund		79,500,000				79,500,000	
Transport Works and Services Act No. 9448		77,000				77,000	
Fines – Country Roads Act 1958		8,651				8,651	
General Receipts		2,832,629				2,832,629	
State Loan Funds – Act No. 9448			300,000			300,000	
Loans – Country Roads Act 1958 Sec. 31A		1,200,000				1,200,000	
Advances – Country Roads Act 1958 Sec. 31G		4,000,000				4,000,000	157,803,950
Commonwealth Grants							
Roads Grants Act 1980				126,359,000		126,359,000	
Transport Plan. & Res. (Fin. Asstce.) Act 1977					1,003,123	1,003,123	127,362,123
		$157,766,535	300,000	126,359,000	1,003,123		285,428,658

Payments							
Road Expenditure							
Main Roads	– Construction and Reconstruction		14,971,878		11,586,540	26,558,418	
	Maintenance		18,285,215			18,285,215	44,843,633
State Highways	– Construction and Reconstruction		12,040,421	300,000	25,419,260	37,759,681	
	Maintenance		16,855,450		2,934,991	19,790,441	57,550,122
Freeways	– Construction and Reconstruction		28,410,596		35,473,865	63,884,461	
	Maintenance		2,591,650		1,160,225	3,751,875	67,636,336
Tourists' Roads	– Construction and Reconstruction		2,214,803			2,214,803	
	Maintenance		2,534,620			2,534,620	4,749,423
Forest Roads	– Construction and Reconstruction		550,167			550,167	
	Maintenance		1,410,596			1,410,596	1,960,763
Unclassified Roads	– Construction and Reconstruction		15,620,987		23,351,059	38,972,046	
	Maintenance		1,263,422		8,286,621	9,550,043	
Contribution to Melbourne & Metropolitan Tramways Board Tram Tracks Reconstruction			500,000			500,000	49,022,089
Rail/Road Bridges Protection			728,433				728,433
Murray River Bridges & Punts			738,165				738,165
Metropolitan Bridges			478				478
Traffic Line Marking			2,299,512		415,969		2,715,481
							229,944,923
Statutory Payments							
Interest and Sinking Fund – State Loans		3,002,520					
Interest and Loan Repayments – Board's Loans		289,027					
Sinking Fund Contribution – Country Roads Act 1958 Sec. 31C		7,500					
Traffic Authority Fund		741,479					
Tourist Fund		1,482,958					
Transport Regulation Fund		89,236	5,612,720				5,612,720
Planning & Research			3,962,740			1,003,123	4,965,863
Capital Expenditure							
Plant Replacement and Additions		2,550,656					
Buildings, Workshops, etc.		1,290,075	3,840,731				3,840,731
Management & Operating Expenditure			23,036,986		17,730,470		40,767,456
			$157,469,570	300,000	126,359,000	1,003,123	285,131,693
Balance available to the Board as at 30 June 1981			$296,965				$296,965

Auditor General's Certificate

The accounts of the Country Roads Board for the year ended 30th June 1981 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 30 September 1981

R. G. Cooper, Chief Accountant 11 September 1981

APPENDIX 5

Loan Liability to the Government of Victoria

as at 30 June 1981

	Main Roads etc.	Developmental Roads	Total
Permanent Works	$	$	$
Main Roads	16,730,322-16		16,730,322-16
State Highways	20,204,304-20		20,204,304-20
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	775,893-76	587,917-51	1,363,811-27
Total Amount Borrowed	40,940,004-45	13,439,432-60	54,379,437-05
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	3,825,608-67		3,825,608-67
National Debt Sinking Fund	11,214,585-89	10,047,085-71	21,261,671-60
Consolidated Fund	96,545-55		96,545-55
	15,878,554-98	11,450,024-46	27,328,579-44
Loan Liability at 30 June 1981	**$25,061,449-47**	**$1,989,408-14**	**$27,050,857-61**

APPENDIX 6

Loans raised by the Country Roads Board

under authority of Country Roads Act 1958 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	" "	10.8%	31 January 1980	31 January 1990	500,000
5.	The National Bank Savings Bank Limited	" "	9.3%	15 June 1979	15 June 1994	500,000
6.	The National Bank Savings Bank Limited	" "	12.6%	13 June 1980	13 June 1990	700,000
7.	State Insurance Office	" "	13%	28 February 1981	28 February 1988	500,000
8.	The National Bank of Australasia Limited	" "	13.9%	30 April 1981	30 April 1991	700,000

Sinking Fund Contribution – Country Roads Act 1958 Sec 31C

Invested with	Type of Investment	Interest Rate	Date Invested	Maturity Date	Amount $
State Electricity Commission of Victoria	Inscribed Stock	10.5%	1 December 1979	1 December 1989	5,000
State Electricity Commission of Victoria	" "	10.9%	1 March 1980	1 March 1990	2,500
The National Bank of Australasia Limited	Term Deposit	12%	26 June 1981	26 September 1981	7,500

Country Roads Board

Report of the Engineer in Chief

1980-1981

Engineer in Chief's Report

Country Roads Board
Melbourne

The Chairman

I submit herewith my report for 1980/81. 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

Urban and rural road inventory maps

As an aid in road planning studies sets of maps showing all trafficked roads in Victoria, except for minor unclassified roads in rural towns, have been prepared as listed hereunder:

	Scale	
• Melbourne Statistical Division	1:25,000	set of 64 maps
• Geelong Statistical District	1:25,000	set of 4 maps
• Ballarat Statistical District	1:25,000	set of 9 maps
• Bendigo Statistical District	1:25,000	set of 6 maps
• Rural Victoria	1:100,000 with rural towns enlarged to 1:25,000	set of 109 maps

The maps are drawn on an Australian Map Grid base and identify individual roads by number. They may, therefore, be used as a general reference or as a reference to a particular road or group of roads about which information is required.

Cross-section, alignment, structure, intersection and other data is collected and maintained for all roads declared or proclaimed under the Country Roads Act and all unclassified arterial roads (i.e. roads classed as arterials in the NAASRA functional classification but which have not been declared by the Board).

The data currently held in the inventory for these roads is in most respects correct as at 1977. It is currently being revised and by early 1982 will be correct as at 1981 except for roads in the inner urban areas of Melbourne, Geelong, Ballarat and Bendigo.

Data from the 1972 Australian Road Survey is held for all other unclassified roads in rural and outer urban areas. Although this material was collected ten years ago, many items of data have not changed and are still useful.

Each road has a reference number which, for declared roads, is unique within Victoria and for unclassified roads is unique within each municipality. Thus the road number for a declared road identifies it completely and uniquely, but the road number for an unclassified road must be linked with the name (or number) of the municipality concerned. The maps show road number, road name, direction of inventory, major structures, and railway crossings. Topographical features are not shown. Samples of the road inventory maps for the Melbourne Statistical Division and rural Victoria are shown in Figures 1 and 2.

The current series of maps show the trafficked road network existing at a nominal date of November 1979. It is intended that the maps will be revised at intervals of about two years.

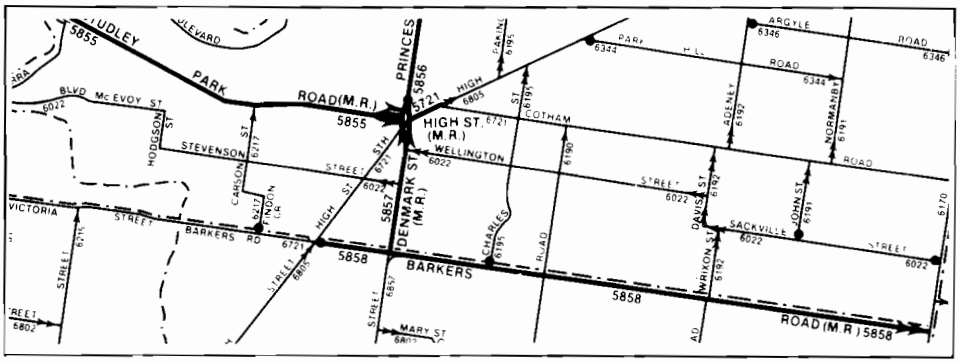
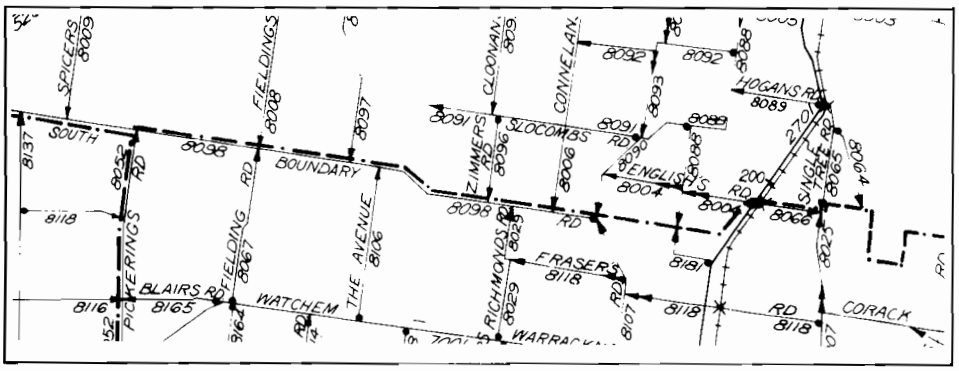


Figure 1

Figure 2



Rehabilitation of Barwon Heads Bridge

The 34 span timber bridge over the Barwon River was constructed at Barwon Heads in 1927 and widened in 1961. It is 308 m long by 7.3 m between kerbs, with a footway 1.5 m wide. The bridge was designed for a 10 ton load, i.e. approximately half the current legal road limit.

Because of deterioration of the timber piles, beams and decking, and recent increases in the speed and mass of vehicles, some of the main beams or stringers failed. Load and speed limits were therefore imposed on the bridge.

Following detailed inspections and testing of the bridge members above and below water, it was found that if repairs were effected to some timber piles, four lines of steel girders could be added to the existing superstructure of the bridge, and after repair of cross beams and decking, the load and speed limits could be removed.

The inspections also revealed that the substructure had been constructed from 'A' class timber species, with turpentine piles resistant to teredo, and with the repairs the substructure could be expected to serve for a further 15 to 20 years.

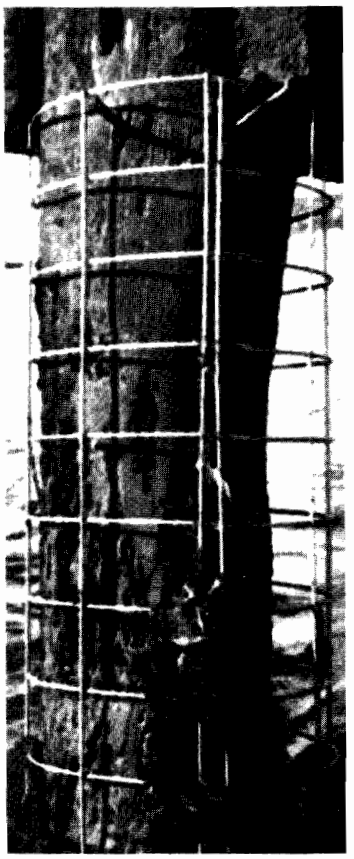
Because of the high cost of replacing the bridge, it was decided to strengthen the superstructure to carry the current legal load, and to use repair methods providing a good quality riding surface requiring limited maintenance.

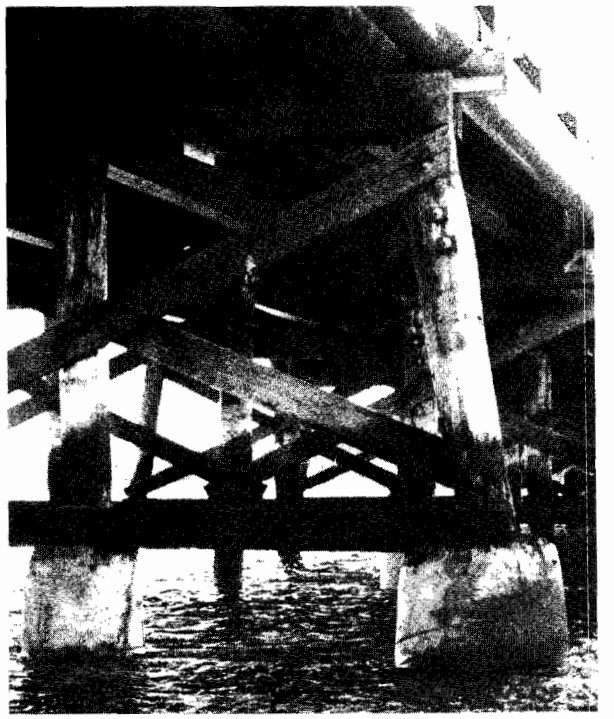
Strengthening of timber piles

The divers' inspections showed that 38 timber piles (of 175 in the bridge) had been so reduced in cross-section by the abrasion of sand carried by the swift tidal flow during the past 50 years that strengthening of the piles up to two metres below water level would be required to safely support the increased loads.

The 'Fabriform' method, using a water permeable weather resistant nylon sacrificial form, was adopted to place reinforced concrete jackets ranging in diameter from 650 mm to 1 m around the weakened pile sections from waling level to hard clay below the bed level.

After divers had cleaned the pile and placed a galvanized steel reinforcing cage, the fabric form was wrapped around the outside of PVC tube spacers fixed to the cage, stapled to the bottom of the pile and sealed there with a draw string tie. After joining the vertical edges of the wrapped form with a nylon zipper, sulphate resistant concrete was pumped from the deck above to the bottom of the form using a standard tremie method to displace the water and fill the form.





Above: Completed concrete pile jackets

Left: One of the bridge piles following excavation to solid base and the placement of galvanised mesh reinforcement

Reinforced concrete overlay of the timber deck

To achieve a satisfactory riding surface requiring only limited maintenance, several alternative methods of redecking the bridge were considered. Steel trough decking filled with asphalt was not adopted because of the potential corrosion problems, and the difficulty of adapting it to the existing uneven timber deck.

Reinforced concrete is not susceptible to these problems. Although heavier than filled steel troughing, calculations showed that the repaired substructure, with four additional lines of steel girders would support a reinforced concrete overlay of 100 mm to 150 mm thickness together with the current legal loading.

A similar process had been used successfully by the Main Roads Department of Western Australia for a number of years, and with savings estimated at approximately $90,000 compared with use of the steel troughing, the reinforced concrete overlay was adopted.

To provide a firm and enduring base for the concrete, approximately 30 per cent of the timber crossbeams and 13 per cent of the deck planks were renewed. The casting procedure involved placing concrete half width over four spans while traffic was confined to the adjoining half width.

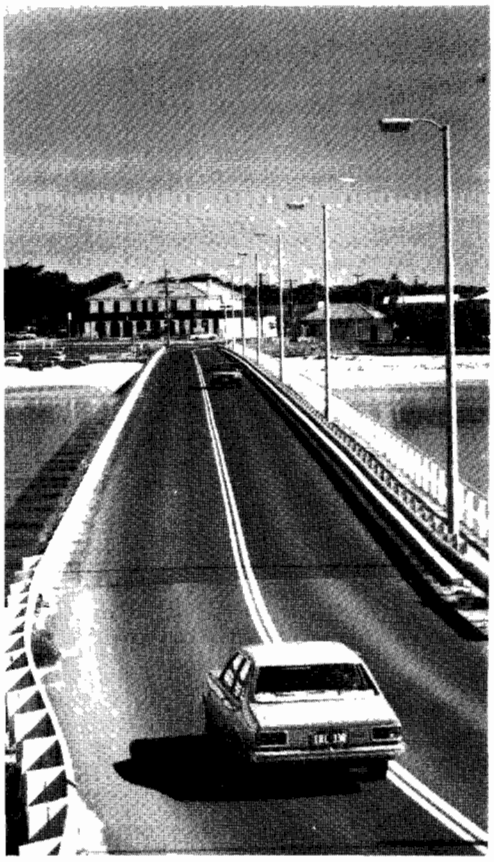
Before casting concrete, gaps between the deck planks were sealed with timber strips or galvanized iron. F1218 reinforcing mesh was then placed with a 30 mm clearance to the deck, and the concrete cast with a minimum thickness of 90 mm at the kerb and 150 mm on the centre line to provide crowning for drainage. The overlay thickness varied to provide an even riding surface allowing for sag of the existing spans and other unevenness in the timber deck surface.

After curing for about 3 days to a concrete cylinder strength of approximately 22 MPa, traffic was diverted onto the newly cast section while the adjoining half width was concreted. Expansion joints were provided at every fourth span with break joints over all other piers, while a tongue and groove joint was provided along the centre line. Reinforced concrete kerbs were cast subsequently, with W beam galvanized steel guardrail bolted to galvanized steel posts attached to the outer faces of the kerbs.

On completion of the concreting, the deck was primed and sealed with 10 mm aggregate.

The cost of the rehabilitation of the Barwon River Bridge was $260 per square metre. The cost of replacement of the structure would have been of the order of $1000 per square metre.

Below, right: The bridge after completion of the rehabilitation work
Below, left: Typical section of timber deck prior to laying the reinforced concrete overlay



West Gate Freeway, South Melbourne Section

Installation of deep cylinder piles

The Stage I and II contracts for the installation of deep cylinder piles on the West Gate Freeway comprise the construction of 88 1.1 m diameter, 134 1.3 m diameter and 94 1.5 m diameter piles. These contracts cover about 75% of the total foundation requirements for the West Gate Freeway. The Stage I contract covers construction of all piles west of Normanby Road and the piles between the Port Melbourne Railway and Haig Street and the Stage II contract covers construction of all piles east of Clarendon Street. The Stage III contract to be awarded late in 1981 will comprise the construction of the remaining piles for the Project.

The total contract cost for Stages I and II is $10.1 million.

Each pile is of reinforced concrete construction founded and socketed in silurian mudstone and consists of an outer steel liner which is used to case off the overlying material above the top of mudstone. The steel casings are installed to a minimum of 1.0 m into mudstone and are fabricated from 12 mm thick plate. In some instances, 16 mm thick plate is used for the leading section of casing. The toe or cutting edge of the casing is stiffened with an additional 25 mm thick plate for a length of one metre to resist the high driving forces required to seal the casing into mudstone.

Installation of casings is achieved by either vibration, percussion, or oscillatory methods.

Excavation of soils within the steel casings and socket regions is by rotary drilling and/or chopping and grabbing techniques.

Piles vary in length from 36 m to 62.7 m with socket lengths ranging from 2.5 m to 22.5 m.

Two methods of socket construction have been used as follows:

Classification 1 method

This method applies to piles in the socket region where the bore information identifies sound material, and there is no evidence of instability in the socket walls.

After drilling out the socket under water, the socket is dewatered and the pile base cleaned of debris. The socket is inspected to confirm the socket dimensions and geological formation.

After socket inspection, the pile is re-filled with water, and the base cleaned again by airlifting. The pile socket is cast by placing 175 mm slump concrete through a water-tight tremie tube keeping the base of the tremie tube beneath the level of the concrete at all times. The water is then pumped out of the casing and the top surface of the concrete is broken back to sound concrete. The reinforcement cage is then placed and the remainder of the pile is cast using 80 mm slump concrete with internal vibration.

The socket design for piles in this classification assumes applied loads to be carried by both end bearing and side resistance.

Classification 3 method

This method applies to piles where the bore information indicates that the walls of the socket are likely to be unstable and it would therefore be dangerous to dewater the piles to inspect the sockets. For piles of this classification, the socket is excavated with the pile filled with water or bentonite to natural surface level. After completion of the excavation of the socket the water or bentonite is re-circulated and airlifted to remove rock fragments and fines within the pile. The concrete is then cast in two stages in the same manner as for Classification 1 piles.

Since the bases of piles of this classification cannot be physically inspected to ensure that they are clean, the socket design ignores end bearing resistance and relies solely on side resistance.

Progress has been made in modifying and developing construction equipment and methods to clean socket bases under water or bentonite which, when used in conjunction with the Socket Inspection Device described in the 1979/80 Report, enables account to be made of end bearing resistance. A number of piles have been successfully completed with shorter socket lengths resulting from the contribution of end bearing resistance.

A third method of construction, designated the Classification 2 method, has also been specified. The method involves the progressive mining and lining of the socket with concrete in lengths up to 1.5 m. It has not been necessary to implement this method of construction.

Test pile programme

The construction of the elevated section of the West Gate Freeway South Melbourne Section requires the construction of 420 piles socketed into silurian mudstone or basalt. An extensive test loading programme has been underway since mid-1980 to validate the load-settlement behaviour of piles founded in both mudstone and basalt.

To date, five tests have been performed on piles in mudstone. In one test on Pile 5014/2, the 17 m-long socket was instrumented to determine settlements at the top and base of the socket and the distribution of load within the socket. A maximum test load of 10.3 MN was applied, resulting in the load settlement behaviour shown in Figure 3. Figure 3 also indicates the predicted behaviour using the socket design procedure adopted for the mudstone piles.

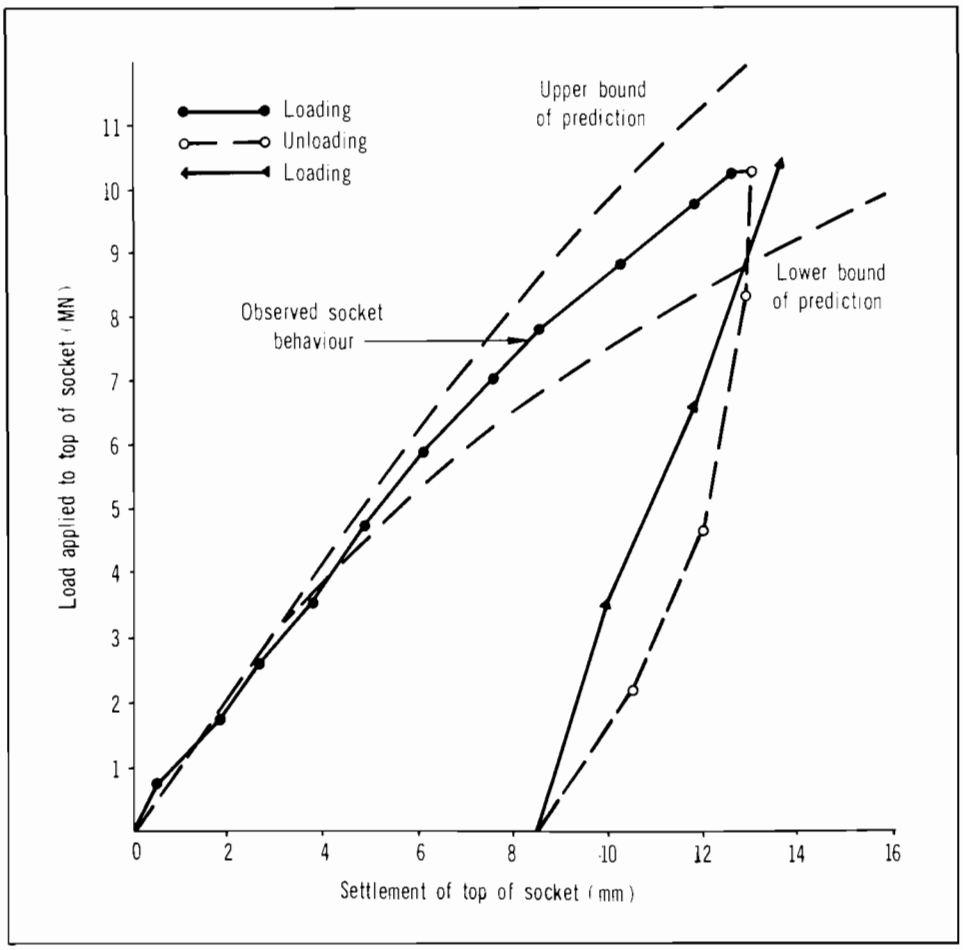


Figure 3
Load settlement behaviour for pile socket

Test loading of basalt-founded piles was carried out to establish a design method for sockets in variably weathered basalt, with underlying sands and clays. This work is for the design of approximately 80 piles in basalt, thus avoiding the very significant cost of excavating the basalt and founding in the mudstone below. A total of three tests have been performed including a model pile which was loaded to failure. Strain gauging of the sockets has enabled, among other things, determination of the allowable stresses for side and base resistance for various degrees of rock weathering. Other aspects of the tests have centred on estimation of the likely long-term settlements resulting from consolidation of the clays below the basalt layer.

Where required, some test piles have been constructed to allow the applied load to be transferred fully to the socket region such that no load losses are incurred in the overlying layers above the mudstone or basalt. This has been achieved by constructing the pile above the socket region within a smaller diameter casing. The resultant 100 mm thick annulus was grouted after the testing to complete the in-service pile.

Above: Test loading a pile on the West Gate Freeway (South Melbourne Section) project

All piles tested have been loaded by jacking against rock anchors grouted into mudstone. Anchors range from 65 m to 99 m below natural surface, with grouted lengths ranging from 25 m to 35 m. All anchors have been fabricated from stressing wire or strand to form the anchor tendon. Groups of two and four anchors have been used depending on the required load capacity which has varied from 10.3 MN to 20 MN. Rock anchors are stressed by means of hydraulic jacks transferring the load to the pile via a steel reaction beam seated on top of the test pile.

Koonung Creek conduit

The treatment adopted to relocate Koonung Creek, which is severed in many places by the construction of the arterial road extension of the Eastern Freeway between Bulleen Road and Doncaster Road, was the construction of an underground conduit capable of carrying flood flows with 100 year return period.

The conduit consists of precast reinforced concrete half arch units placed on a cast-in-place reinforced concrete base slab. The half arch units, which are 3.5 m long and weigh 13.5 tonnes, form a three pinned parabolic arch with pin joints at the crown and the base. The 2.4 km long structure is scheduled for completion in July 1982.

The project requires the production of 1398 half arch units, which are cast in steel moulds at an off site precasting yard at a maximum rate of five per day.
The 7.60 m wide x 460 mm thick continuously reinforced concrete base slab was cast in lengths of approximately 40 metres. To do this, the contractor fixed steel rails supported on short pipe posts accurately to line and level and parallel to the outer edges of the base slab. The rails served as the runway for a travelling profiled vibrating screed and trowelling platform. Steel pans, formed to a semi-circular cross-section, were connected to the underside of the rails to form the underside of the lower hinges of the arch section.
The lower edges of the half arch units were formed with semi-circular protrusions to match the formed recesses in the base slab. The upper edges have semi-circular recesses within which the crown hinge is formed.

Above: Placing a precast reinforced concrete half arch unit for the Koonung Creek conduit

The precast half arch units are placed by slewing crane. The units are self supporting during erection, as the half arch units on one side of the conduit are offset by half a unit length relative to units on the other side of the conduit.
When the units are erected, the crown hinge is formed with a rubber tube 5 mm thick x 115 mm O.D. located in semi-circular recesses in the half units. Grout is injected into the tube and pressurised to 0.07 MPa and the exposed part of the tube is then protected with a poured bituminous filler.
The structure is being progressively backfilled until ultimately Koonung Creek will be underground over a length of 2.4 km.

Factors in stage development of rural freeways

An objective of the Board's rural programme is to convert to freeway standard those sections of the State highway system which carry very high traffic volumes. The principal characteristics of freeway standard road facilities are:

- separation of traffic in opposing directions
- separation of cross traffic via overpasses or underpasses
- full access control so that no abutting development has direct access to the freeway, and access is available only at interchanges.

Where planning provides for ultimate upgrading to freeway standard, a lesser standard may be initially acceptable provided traffic, economic, environmental or other considerations indicate that this is reasonable and desirable. This may be regarded as 'staged freeway development'.
Staging is normally achieved by progressively converting suitable sections of an existing highway to freeway standard. Appropriate stages are:

- initial duplication, which may precede or coincide with improvements to the existing carriageway as required,
- provision of grade separations and interchanges,
- full control of access, and
- construction of additional lanes.

However where abutting development, topography or alignment render sections of an existing road unsuitable for upgrading, deviations may be constructed to freeway or partial freeway standard, to bypass the specific sections.
Successive stages are usually upgraded in response to existing and predicted traffic volumes. These factors are the basis for ensuring adequate capacity on freeways, access roads and intersections, and enable road user savings to be determined. Together with savings from reduced accidents, these may be compared with capital cost expenditure to determine the overall benefit to the community.

Specific considerations in which traffic volumes, capital costs and community savings influence stage development, are:

Number of lanes

Any stage development should allow for the ultimate cross-sectional elements to be provided with the minimum loss of earlier construction, and minimum general disruption. Thus medians are provided at the four-lane stage which are wider than necessary so that the later internal addition of extra lanes will not disturb structures, ramps and other peripherals.

Provision of grade separations and interchanges

If cross road volumes are particularly low, and full access control is not initially provided, at-grade intersections may be acceptable during the early stages. Construction of some grade separations and interchanges may therefore be deferred. Any structures included at the initial stage must include provision for ultimate freeway development.

Provision of access control

When full access control is implemented, existing roads may be truncated, properties may be severed, and existing private access will be denied. Alternative access must then be provided. Under some circumstances, full control of access may be deferred during the early stages, and direct access permitted at specified points. Alternative access is then provided at a later stage.

Upgrading the existing carriageway

Because of either substandard horizontal or vertical geometry, inadequate bridge widths, design loading or water way area, absence of sealed shoulders, susceptibility to flooding, or a combination of these or other factors, sections of some existing highways will be below freeway standard. Where these sections are proposed to be upgraded, initial duplication may provide sufficient extra capacity that improvement to the existing carriageway can be deferred.

Presplitting of freeway rock batter

The major cut on the Sunday Creek to Goulburn River section of the Hume Freeway at Seymour is through a series of siltstones which vary from highly weathered in the upper zone to low grade hornfels at pavement level.

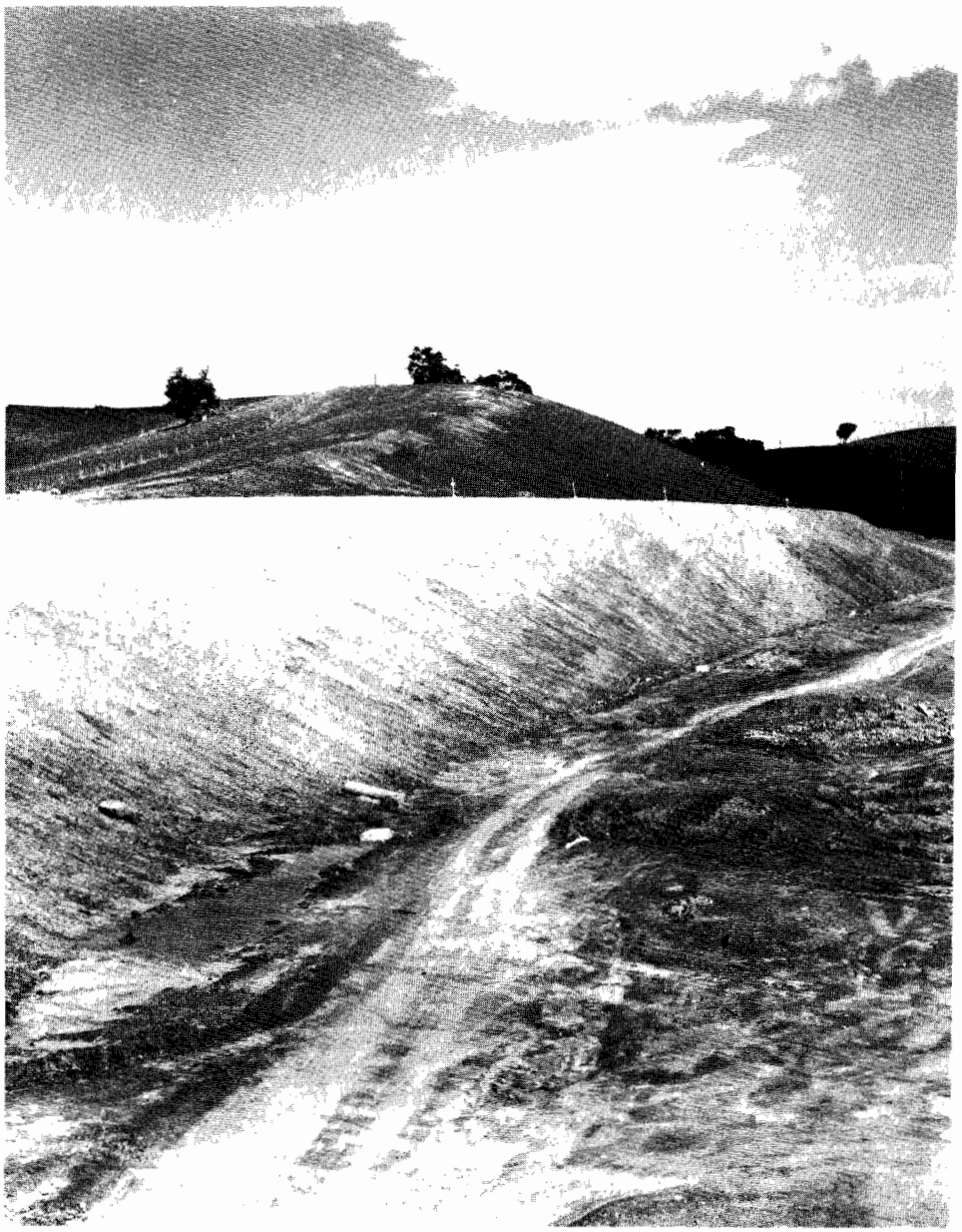
The cut is 44 m deep and has a 5 m wide bench 15m above subgrade level. The batter slope above the bench is 2:1 and below the bench 1:1.

Site investigations, including extensive coring, seismic testing and shaft sinking established that the lower (1:1) batter would be in harder rock types which dipped in a direction perpendicular to the batter face. Accordingly it was decided to establish the lower batter using a rock presplitting technique. Holes were drilled at 675 mm centres along the length of the batter and the batter split by blasting with string charges of 165 g of gelignite at 675 mm spacings down each hole. Drill holes varied from 22 to 27 m long at slopes between 1:1 and 1.4:1.

The 1:1 batter was designed with a slight vertical crest on a horizontal curve of 1625 m radius and was warped to match a 2:1 batter slope at either end.

The direction of the presplit holes was established by survey with the objective of achieving the designed batter face within a tolerance of ± 300 mm.

Below: A view along the presplit batter on the Hume Freeway - Seymour Section



Maintenance study, Metropolitan Division

The improvement of the road system, and the changing requirements of road users, has resulted in an increasing proportion of the funds available for roads being directed to road maintenance and road operation. This study, which was completed in 1980, was undertaken to examine organisation resources, distribution, supervision, cost effectiveness and standards related to road maintenance practices in the Board's Metropolitan Division. The specific objectives were to identify the maintenance standards currently achieved, and to ascertain the cost and consequences of change in current standards.

Metropolitan Division has approximately 150 men employed in maintenance and operating activities. The study highlighted that pavement, drainage, median and roadside maintenance accounted for 46 per cent of maintenance expenditure. Public lighting charges represent 20 per cent of freeway maintenance costs, with traffic signals on urban highways and shoulders on rural highways being about 20 per cent of their respective costs. Overall maintenance costs in Metropolitan Division ranged from $30,000-$40,000 per kilometre for urban freeways, $14,000-$20,000 for urban highways and $5,000-$8,000 for rural highways. The labour component of maintenance activities ranged from 52 per cent to 77 per cent of maintenance expenditure excluding public lighting, with an average of 63 per cent. This resource was distributed as shown in Table 1 (in man hours per kilometre per year).

Table 1

Activity Man hours/km/year	Freeways	Urban Highways	Rural Highways
Routine patrolling	90	70	20
Pavement and drainage	140	155	50
Shoulders	-	-	90
Signs, lines and guard rail	85	100	-
Sweeping	50	50	-
Traffic signals	50	50	-
Grass cutting and plantations	620	350	140
Litter	60	50	65

Difficulty was experienced in establishing quantitative measures of maintenance standards and a subjective ranking of standards was adopted for each type of road, using descriptive terms ranging from excellent to poor.

The most surprising conclusion was the large effort involved in roadside maintenance for all types of roads. The data provided a basis for resource levelling by highlighting activities with high standards and high resources, and poor standards and limited resources.

The highest maintenance expenditure was incurred on activities where standards are not easily quantified in contrast to the more readily defined activities such as pavement and drainage maintenance.

As an outcome of the study, supervisory activities within the Division were rearranged and the number of supervisors reduced. Resources were redistributed and a set of trial maintenance standards established. These relate mainly to frequency of attention, although quantitative standards have been given for pavement maintenance. The determination of the cost and consequences of change in maintenance standards is an ongoing operation.

Provision for bicycles

In June 1980, an experimental length of two-lane two-way bicycle path along the western side of the Nepean Highway between Bay Street and North Road, Brighton was opened for use. To date this short length of the proposed 6.5 km total length has proved to be acceptable to cyclists and other road users.

Other projects where provision is being made for bicycles are:

- The bridges over the Murray River at Mildura and Echuca where a width of 1.4 m of the pavement will be linemarked for use by cyclists.
- Bridges over the Western Freeway at Station Road and Coburns Road, Melton, where provision will be made for bicycle lanes 2 m wide as part of the plan for a future bicycle network in Melton.

Data on volumes of bicycle traffic is currently not readily available. To overcome this deficiency and provide data for planning, bicycle traffic was counted at all traffic census stations during March 1981, and counts were also taken at a number of other specific locations during the year.

Technical guidelines for bicycle facilities on declared roads have been prepared by the Board's Bicycle Planning Committee and the document is currently being reviewed.

Treatment of expansive clays

The structural performance of heavy duty flexible pavements constructed in the past 15 years on the basaltic clay plains to the north and west of Melbourne has generally been satisfactory. However, riding qualities have deteriorated badly due to differential volume changes in the expansive clay subgrades, and remedial treatment by the application of asphalt overlays has provided short term relief rather than correction of the fault.

Because of this experience, it was decided as part of the planning of a further section of freeway construction to investigate methods of improving strength and reducing volumetric changes of the clay subgrades which exist in the area. A set of strength tests of a typical basaltic clay are shown in Figure 4 in the form of a contour plot of 4 day soaked Californian Bearing Ratio (CBR) and measured swell for particular combinations of dry density and moulding moisture content. It shows that if the clay is compacted close to the laboratory optimum moisture content and to a density of at least 95 per cent of the Modified Compaction maximum dry density, the soaked CBR will be approximately 1.5-2.5 per cent and the swell will be 6-8 per cent.

If 2 per cent by mass of lime is added to the clay then significant strength improvements are obtained. A soaked CBR of 5 per cent or better could be achieved with the same compaction conditions (moisture close to OMC and 95 per cent of the modified maximum dry density). The swell of the material is also reduced to between 4 and 5 per cent. The testing also shows that compacting the stabilised clay at low moisture contents will also result in much lower soaked strengths. If 4 per cent lime is added to the clay, then the soaked CBR values shown in Figure 5 are obtained. The stabilised material will have significant strength and could be considered as a pavement sub-base. The sensitivity of the clay to compaction moisture content which is evident in Figure 4 has now virtually disappeared, as a material with CBR > 20 is obtained from a wide range of moisture conditions. The swell potential of the material is virtually eliminated with all swell measurement being less than 1 per cent.

Material	LL	PL	PI	LS	Appt. particle density t/m³	Specimen treatment after compaction	
						cure days	soak days
Unstabilised clay	74	22	52	20	2.72	0	4
Stabilised with 4% hydrated lime	53	26	27	10	2.72	5	7

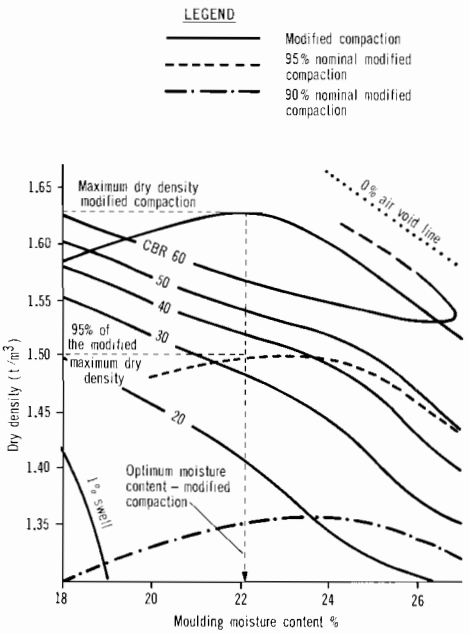


Figure 5
Strength and swell characteristics:
clay stabilised with four per cent hydrated lime

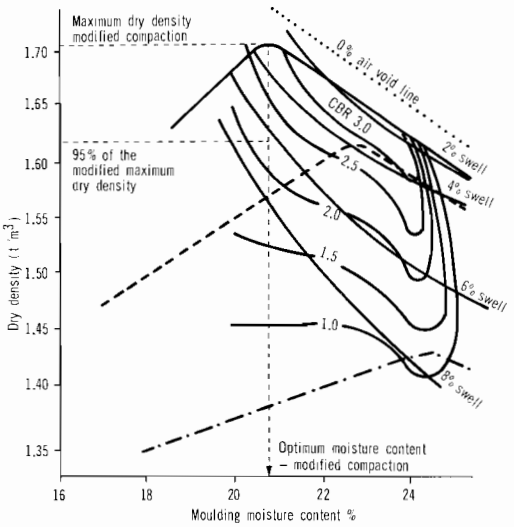


Figure 4
Strength and swell characteristics:
unstabilised clay

To minimise the swell potential of the general clay earthworks, it will be necessary to carry out compaction with the material in a wet condition using heavy tamping rollers to produce a dispersed structure in the clay. While this gives a very low strength material (in the case of this soil, a CBR of approximately 1 to 2), a very impermeable structure results which minimise change in moisture content and hence volumetric change.

Special attention to construction procedures are required to prevent loss of moisture from the clays during construction from both cut and fill areas. Stabilisation of the upper portion of the subgrade with lime to provide a pavement sub-base will enable the earthworks to be quickly insulated from moisture change. Construction of the earthworks in a period other than mid-summer to minimise moisture-loss would be an advantage.

In addition to the above procedures, a number of other matters to consider in the reduction of volumetric change on this work will include:

- testing and selection of clays with least potential for volumetric change for placing in the upper sections of fills
- selection of verge materials that will provide adequate insulation of the clays from moisture change. This may include the use of bituminous or plastic membranes
- placing of the pavement layers and selected verge materials as soon as practical after completion of earthworks.

Use of unbound pavement bases

Since its early days, the Board has used naturally occurring materials or crushed rock to build pavements. These pavements with so-called unbound base materials and surface seals have performed well in situations where road traffic has been relatively light and where there has been a gradual increase in the weight and volume of road traffic with time, but in most overseas countries pavement design methods for heavily trafficked roads require substantial thicknesses of bound materials in the base. While the economies that can be derived from the use of unbound bases in heavily trafficked roads are obvious, experience has shown that they have little margin for error in their use, and without care and attention to detail, they can become severely distressed very early in their working life. The cost savings which can be achieved are so significant however that the Board is continuing to use unbound base materials wherever possible.

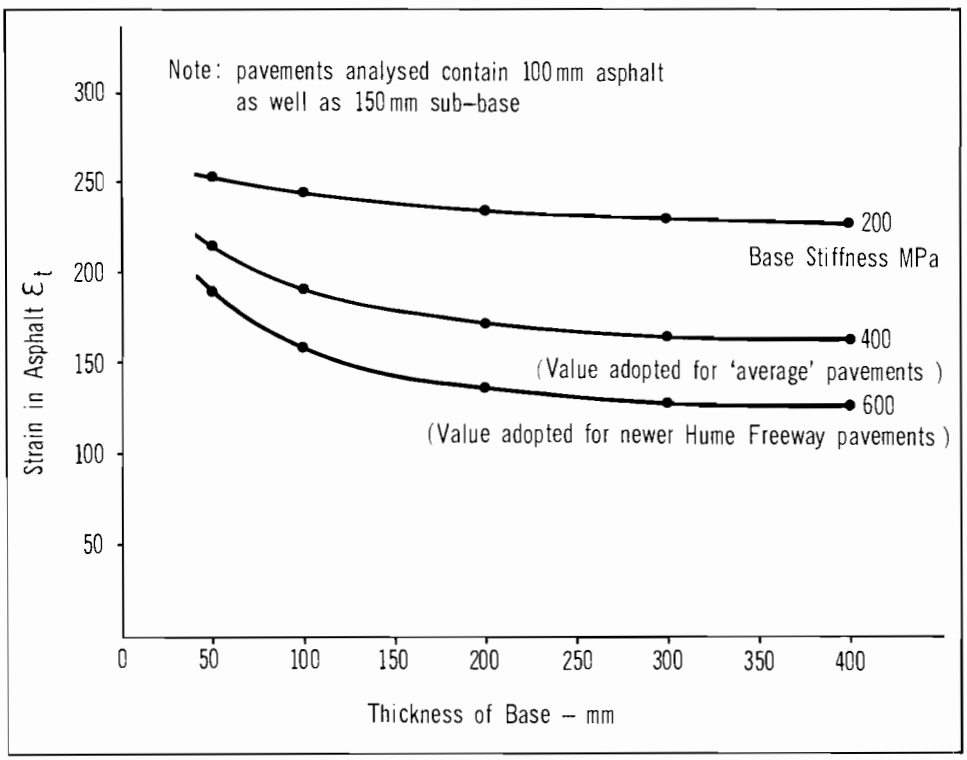


Figure 6
The effect of thickness of unbound base on asphalt tensile strain

Some studies have been carried out to determine whether there are any theoretical reasons why unbound base materials should not be satisfactory in heavy duty pavements. Figures 6 and 7 show the effect of increasing thickness of unbound base on horizontal tensile strain in asphalt surfacing (related to cracking of asphalt surfacing by fatigue) and on vertical subgrade strain (related to rutting of pavements).

It can be seen that increasing the thickness of unbound base beyond say 200 mm results in limited reduction in asphalt strain and diminishing reduction in subgrade strain. Greater benefit is obtained by increasing the stiffness of the unbound base material rather than the thickness, and this justifies the much higher standards of compaction now sought in major pavement construction.

The advent of high capacity pavement construction equipment has emphasised the importance of having sufficient quantities of uniform quality material produced to tight tolerances, which can be compacted very uniformly to high standards with high output equipment without reworking or trafficking and which is not unduly sensitive to wet weather.

The properties required of a material to meet these criteria are not well defined and are to a great degree related to the type of material. Particle shape, particle surface characteristics and the nature and composition of the fines (less than 0.075 mm) are all important factors governing the compactability, workability and capacity of the material to "set up". Components may be combined from a number of sources to provide a product having the required properties. Relatively sophisticated plant is required to carry out the blending and mixing and hence material of this quality is available only where the demand is sufficiently high.

At the present time, laboratory tests do not define adequately all of the properties needed, and materials conforming to the Board's specifications may not necessarily possess all of the required attributes. With any new materials, it may be necessary to perform field trials to prove that adequate standards of compactability, cohesion and stability can be achieved.

Recent trials of this type have been conducted to determine suitability of material and specification requirements for river gravel/sand mixes proposed as an alternative to crushed rock for pavements on the Seymour section of the Hume Freeway.

Here trials were undertaken to overcome construction difficulties experienced with a trial pavement of uncrushed river gravel/granitic sand mix. The aim was to produce a more stable material with greater internal friction and interlock by the inclusion of sufficient crushed particles.

The crushed river gravel/granitic sand mix provided no handling problems and produced a strong dense/pavement layer which could be prepared for sealing employing standard procedures.

As a result of the field trial, a requirement that at least 80 per cent of the particles have two or more crushed faces was included in the specification.

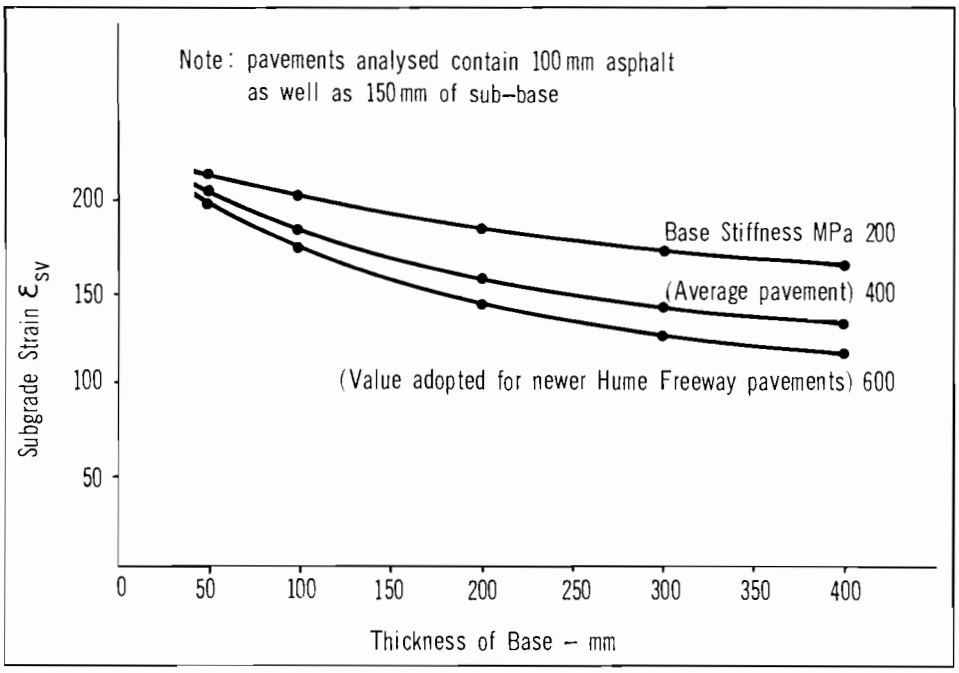


Figure 7
The effect of thickness of unbound base on subgrade strain

Hume Freeway – Seymour

Mechanically stabilised gravels

Mechanically stabilised materials have been used extensively in the past in constructing road pavements in rural areas. They have not been used extensively in constructing freeway pavements because of doubts as to their adequacy.

In constructing pavements on the Seymour and Avenel Sections of the Hume Freeway, river gravel extracted from the bed of the Goulburn River, tertiary gravel (locally known as Mangalore gravel) extracted from freeway cuttings and granitic sand extracted from pits in the district have been mixed in various proportions to provide base and sub-base pavement laying. The cost savings compared with quarried products are substantial.

Typical test properties on these raw materials are shown in Table 2.

Table 2 Properties of Raw Materials

Material	Particle Shape	Sieve Analysis (mm)											
		75	53	37.0	26.5	19.0	13.2	9.5	4.75	2.36	0.425	0.075	LL	PI
River gravel	Rounded		100	99	91	79	63	51	37	29	9	1		NP
Mangalore gravel	Rounded	100	98	93	83	75	65	58	50	44	28	15	29	14
Granitic sand	Angular						100	98	94	83	40	20	23	7

River gravel consists of approximately 65% quartz particles, 10% hornfels and quartzite particles and 25% sand particles. Mangalore gravel consists of approximately 50% quartz particles, 10% hornfels and quartzite particles and 40% sand, silt and clay particles. Laboratory testing on a 2:1 river gravel/Mangalore gravel mixture and a 5:1 river gravel/granitic mixture is summarised in Tables 3 and 4.

Table 3 Grading and Atterberg tests on laboratory mixed gravels

Material	Sieve Analysis (mm)											
	53	37.5	26.5	19.0	13.2	9.5	4.75	2.36	0.425	0.075	LL	PI
RG/MG (2:1)	100	98	91	82	63	51	38	32	16	7	22	9
RG/GS (5:1)		100	95	82	64	52	39	30	12	4	19	3

Table 4 CBR and permeability of laboratory mixed gravels

Material	CBR* (%)		Permeability* (cm/sec)	
	95% MDD	100% MDD	97% MDD	100% MDD
RG/MG (2:1)	60	150	1×10^{-4}	4.0×10^{-6}
RG/GS (5:1)	50	155	6×10^{-5}	4.7×10^{-6}

*Materials compacted at Modified Optimum Moisture Content to modified dry densities as shown

The river gravel/Mangalore gravel mixture was used in lower sub-base layers while the river gravel/granitic sand mixture was used in upper sub-base layers and in some areas as a base pavement material. Based on field experience, the ratio of the river gravel/granitic sand mixture was amended to 4:1. Both materials were mixed on the roadbed utilising Bomag stabilisers.

The main concern with these materials is the effect of particle shape on their stability under traffic. The performance of a trial river gravel/granitic sand mixture as a base pavement material carrying heavy traffic (approximately 1500 equivalent standard axles per day, one way) is currently being monitored. After nine months of trafficking, no signs of distress have been recorded. Deflection testing carried out on the trial pavement after four months of trafficking recorded values in the range 0.20-0.40 mm. However difficulties have been experienced using these materials during the winter-spring months. Once the wet season commences, instability occurs and construction progress is significantly impeded. In most situations, replacement of unstable material with crushed products has been necessary.

More recently, some limited trials have been undertaken using crushed river gravel stabilised with granitic sand. These trials were aimed, in part, at overcoming the construction difficulties mentioned above by generation of greater internal friction in the compacted material through particle to particle friction and interlock. This can be achieved by ensuring that sufficient crushed particles of dimension greater than 4.75 mm are contained in the mixture. A mixture containing greater than 90 per cent of crushed particles demonstrated good handling and compaction characteristics whilst a mixture containing approximately 50 per cent of crushed particles was difficult to handle and compact. These requirements have been incorporated into specifications for pavement base for major projects.

Evaluation of structural performance of pavements

A Lacroix Deflectograph was purchased by the Board in 1974 to monitor the structural response of pavements by measuring the road surface deflection under a standard load. The machine has been in constant use on the road network throughout the State since that time.

As originally supplied, the machine provided a semi-continuous recording of pavement deflection under a standard wheel load. After each 3.4 m of travel, the pavement deflection at the point on the pavement under each wheel was measured by the travelling beams, and the deflections plotted onto a strip chart. Records were subsequently analysed in the office to determine average deflection over specified intervals and site information added to the charts by hand for final reporting. The time spent on the analysis was a considerable portion of the road testing time and represented wasted utilisation of the machine.

To reduce data processing effort, a new recording system compatible with the Board's IBM computer was designed and built. At the same time, steps were taken to incorporate improvements to the mechanical system of measurement to reduce maintenance.

The redesigned deflectograph incorporates new deflection measuring beam assemblies with up to 10 mm range and a microprocessor based recording and control system. Information is stored on cassette magnetic tape and transferred to the IBM computer for analysis and plotting.

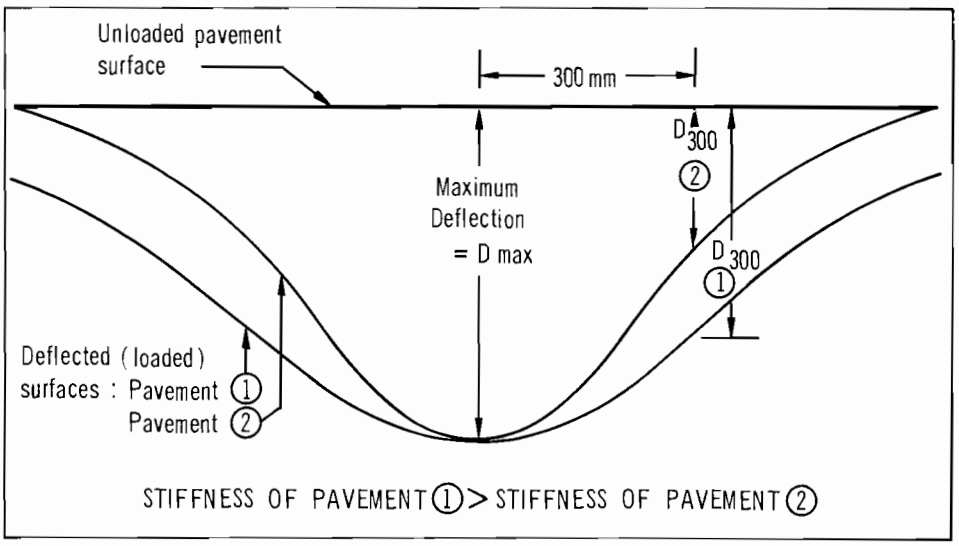
The new system not only reduces initial reporting time but enables future statistical analysis and comparisons of deflection data to be readily achieved–a factor which was difficult with the previous system. The advantage of the new recording system is that all data is stored on permanent computer file and is therefore readily recalled for analysis.

Surface deflection measurements have been used since the 1950s to assess the strength of pavements. Until recently, the maximum elastic deflection of the pavement surface alone has generally been used as an indicator of total pavement response to load and a predictor of all forms of load associated distress. The two major observed forms of such distress are permanent deformation of the pavement (wheel rutting or isolated depression) which is sometimes associated with cracking of the seal, and fatigue cracking of asphalt surfacing which in the initial stages at least is not accompanied by permanent deformation.

The maximum deflection level has been found to be closely correlated to permanent deformation of a pavement, but in some instances it is not a good indication of the potential for fatigue cracking, possibly because there is no simple relationship between maximum deflection and asphalt tensile strain, which is related to fatigue cracking.

Figure 8 shows, in idealised form, two pavement surfaces superimposed, each of which deflects by the same amount under a given load but in one case the deflection is developed over a shorter distance than in the other.

Figure 8
Idealised deflection bowls for two pavements having different stiffness but giving the same maximum deflection



The tensile strain at the underside of the asphalt in the pavement showing the sharpest "curvature" will, in most cases, be greater than that in the other pavement. The information summarised in Figure 9 supports the theory that a measure of the radius of curvature of the deflection "bowl" gives a better indication of asphalt strain than does maximum deflection alone.

The measure of curvature plotted in Figure 9 is the arithmetic difference between the maximum deflection (D max) and the deflection measured a set distance (in this case 300 mm) from the point of maximum deflection (D300).

By studying and analysing deflected surface shapes it should be possible to obtain estimates of significant stresses and strains in pavements and in so doing to model the properties of pavement layers.

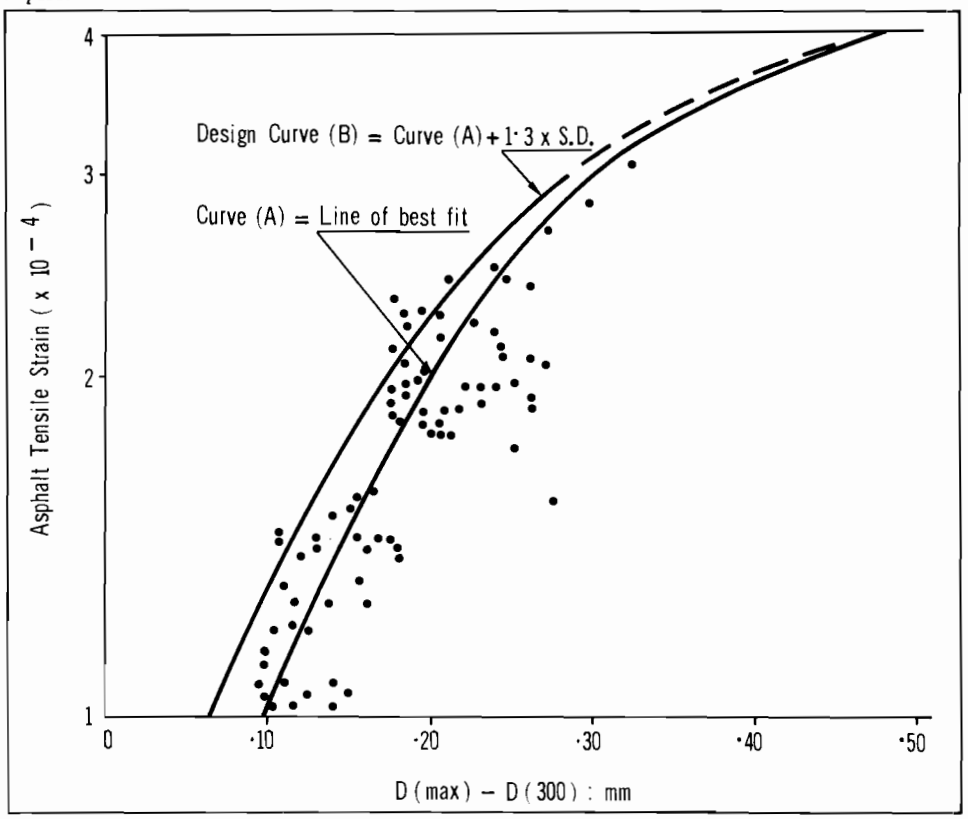
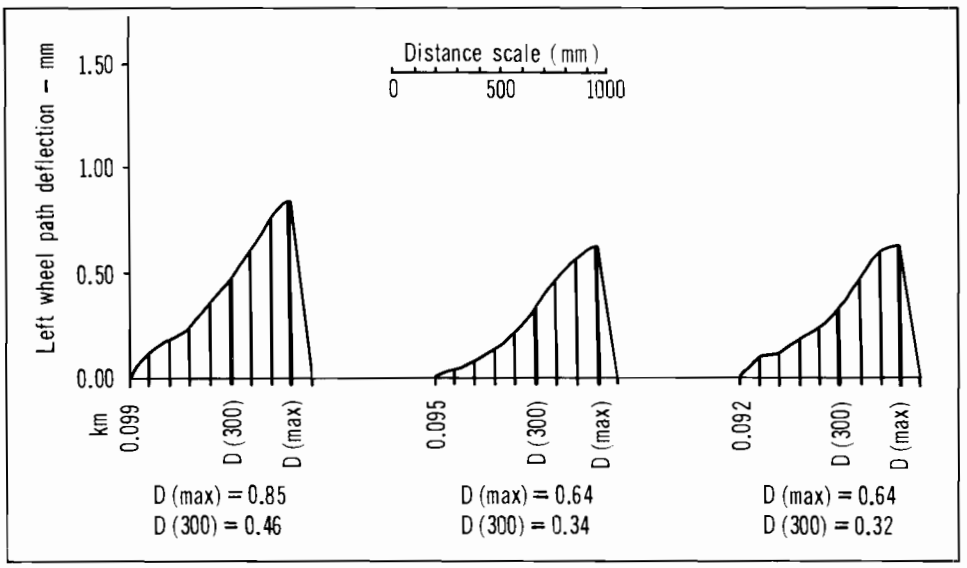


Figure 9 Curvature function vs asphalt strain

Figure 10 Field determination of shape of deflection bowls



The new deflectograph system automatically records the response of the pavement at a point as the loaded wheel moves toward and passes it, by measuring the deflection at each 100 mm of travel of the wheel (see Figure 10). Work is in progress in Materials Division to use this data and the techniques outlined to develop a pavement analysis and overlay design procedure which will more satisfactorily account for fatigue cracking of asphalt surfaces.

Monitoring of freeway pavements

In November 1980, a programme of monitoring the performance of freeway pavements throughout the State was implemented. The object of the monitoring programme is to evaluate the accuracy of the various design assumptions, and to allow engineers to predict well in advance, when works to upgrade the pavements may be required. The present programme is planned to extend over a 10 year period (i.e. until 1990).

The thickness and quality of materials adopted for construction of a road pavement depend on predictions of the future strength of the pavement and underlying subgrade materials, and on the traffic which will use the road. In order to predict the future material strengths (in terms of the California Bearing Ratio) consideration must be given to:

- material type
- construction methods
- moisture conditions during construction
- environmental effects
- drainage, and
- maintenance during the pavement's service life.

In all, 21 sections of freeway carriageway, with a total length of 220 km, throughout Victoria will be monitored at intervals of two years. As part of the programme, assessments have been made of the expected life of existing pavements, using data available for current conditions, predictions of traffic growth, and information available from various sources on the properties and contribution to structural performance of the materials used in these pavements. Elastic analyses have been carried out to determine vertical subgrade strain and, where applicable, the horizontal tensile strain in asphalt surfacing. There is evidence that vertical subgrade strain and number of repetitions of that strain is related to overall pavement serviceability, and that cracking of asphalt surfacing is related to horizontal tensile strain and the number of repetitions of that strain in the asphalt.

Relationships between subgrade strain and pavement life have been developed by analysing pavements designed in accordance with the methods described in the Board's Technical Bulletin 31 (see Figure 11). For asphalt fatigue life, the relationship developed by Heukelom & Klomp (Shell Oil Company Ltd.) between asphalt tensile strain and repetitions of load was adopted (Figure 11).

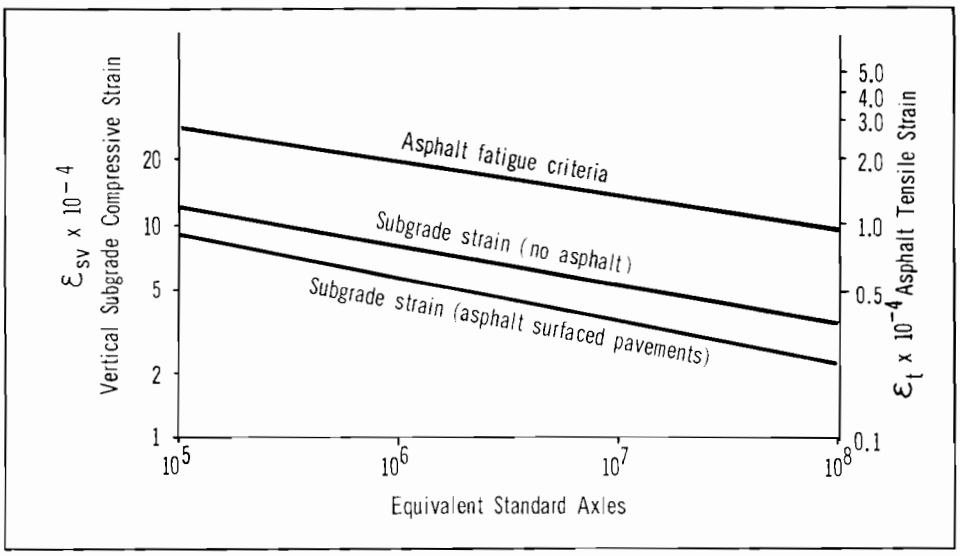


Figure 11
Relationships between design criteria and number of equivalent standard axles

These calculations indicate that the majority of the pavements under observation should have "lives" in excess of 20 years, i.e. with normal maintenance, before significant strengthening is required. Several of the pavement sections where much shorter "lives" are indicated may need strengthening by application of asphalt overlays.

As noted above, the main purpose of the monitoring programme will be to evaluate the adequacy of the methods of pavement design, particularly with regard to the properties of the materials, the methods of construction adopted and the standards achieved during construction.

The programme comprises:

- deflection testing using the Board's Lacroix Deflectograph
- roughness testing
- visual inspection by maintenance personnel and engineers.

Results of successive test runs will be compared by computer to enable performance trends to be identified, and these comparisons will be supplemented by further analyses of pavement and subgrade strains using elastic layer theory.
Monitoring will be carried out between late August and October which is the period in which subgrades in Victoria are considered to be at the wettest.
An important part of the evaluation procedure will involve the collection of data regarding vehicle numbers and axle loads. Although there are very few reliable load data available at present, consideration is being given to the use of special electronic equipment which is capable of collecting the required information without disruption to traffic.
Observations to date indicate that performance of the pavements is generally satisfactory although isolated weak areas are evident in some sections. Some minor cracking noted in several sections appears to be related to environmental factors rather than traffic related factors.

Durability of basaltic source rock

Since 1978, an investigation has been proceeding to identify the factors which affect the durability of rock used in pavement construction and ancillary works. An examination has been made of the mineralogical and petrological factors having a significant effect on rock durability for the main rock types quarried in Victoria. The test procedures currently used to characterise rock durability have been evaluated, and several new test procedures have been introduced.
It has been found that of the rock types commonly used in Victoria, basic volcanic rocks (e.g. basalt) constitute the rock group most susceptible to deterioration in service. A test, described in the 1979/80 Report, has been developed which can induce rapid degradation in basaltic aggregates which contain within their fabric significant quantities of deleterious alteration minerals of the smectite group (highly expansible clays). A study of the service records for non-durable altered basaltic rock types indicates that the laboratory induced degradation for significantly altered rock simulates the inservice degradation of rocks with similar physico-chemical and mineralogical properties. The test procedure developed thus appears to provide a valuable method to enable non-durable basaltic rock types to be excluded by appropriate specification from use in pavement construction.
Rock durability tests examined or developed during the investigation will now allow a continuing assessment to be made of the durability of weathered or otherwise altered rock types. This is particularly so for the altered basaltic rock types for which it is now possible to compare the properties of a single aggregate piece sampled from the road pavement with the properties of the different rock types present within the source quarry. Having determined the properties of aggregate pieces which are showing obvious deterioration in the pavement due to traffic stress and other environmental factors, it is then possible to eliminate by specification those material types in the source that have similar properties and hence a similar potential to deteriorate.
For basaltic source rocks, the following test procedures have been found to be most useful in the characterisation and identification of those altered basalt types which are susceptible to rapid deterioration in service.

• Total Surface Area (Test Method CRB 355.01)

This method, which relies on the molecular adsorption of ethylene glycol monoethyl ether, gives a measure of the hydratable surface area of the minerals present in the altered rock which is in turn related to the quantity and activity of the clay minerals present. The test does not permit any judgment on activity or clay quantity alone nor does it examine distribution of the clay through the aggregate fabric or the availability of the clay to take up moisture. It is performed on a ground rock powder.

• Water loss at 200°C and 900°C

The amount of water lost, and the temperature at which this occurs, gives an estimate of the type and quantity of clay present as an alteration product in a powdered rock sample. Water loss between 100° and 250°C is a measure of the quantity of smectite (montmorillinitic) clay types present and losses at higher temperatures a measure of the chlorite and kaolinitic clays. The test when carried out in conjunction with the test for Total Surface Area is helpful in establishing both the quantity and type of clay present.
The total moisture loss between 200°C and 900°C for a rock type in a particular deposit bears a relationship to the Total Surface Area as shown in Figure 12.

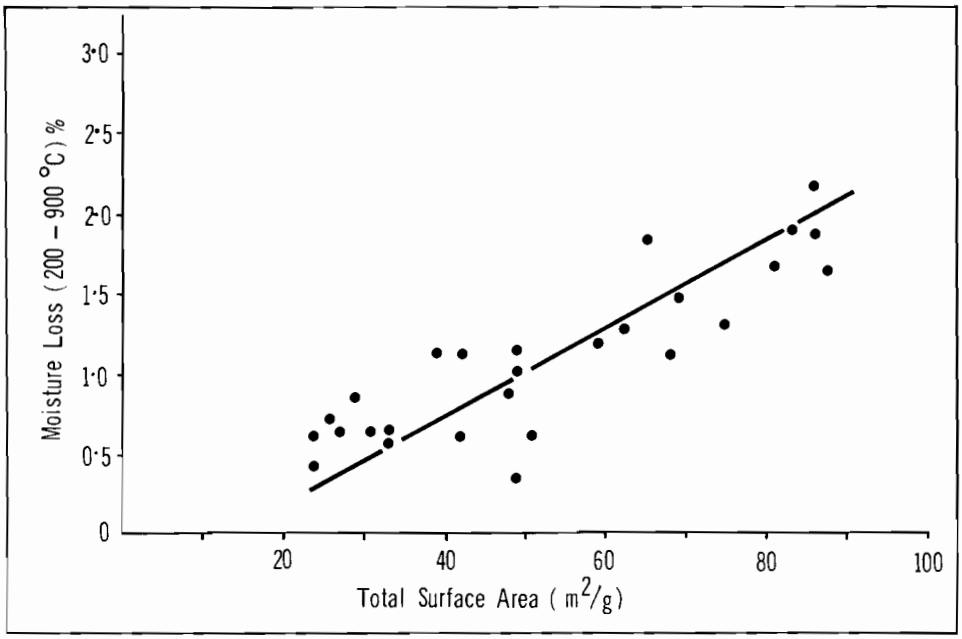


Figure 12
Relationship between total surface area and moisture loss for 27 samples of basalt from a single source

• Accelerated Soundness Test

When basaltic aggregates containing significant quantities of expansive clays are treated with an aqueous solution of ethylene glycol at elevated temperatures and pressure, rapid disintegration of the aggregate occur. The amount of disintegration produced gives a measure of the potential durability of the aggregate and this is dependent on:

- amount of clay minerals, their activity and their availability to ingress of water through the rock fabric
- size of aggregate tested - coarse aggregates exhibit less disintegration than fine aggregates produced from the same sample
- liquid composition - complete absence of water in the pressure vessel produced no disintegration of the aggregate
- test pressure - higher pressures produced more disintegration
- test time duration - longer test times produce more disintegration.

The currently adopted test method uses:

- aggregates passing 13.2 mm, retained 11.2 mm
- 80 per cent ethylene glycol, 20 per cent water
- 1300 kPa gauge obtained by heating pressure vessel to 240°C
- 4 hour test time.

The product resulting after test is dried and sieved over a 6.7 mm aperture.
The mass of material retained on the sieve is expressed as a percentage of the total test sample and is termed the Accelerated Soundness Index.
From the Accelerated Soundness Test rock quality or durability can be inferred. The relationship shown in Figure 13 also allows total surface area limits to be set for sound rock from a particular source.

The methods discussed above provide rapid techniques for assessing the potential durability of aggregates. Of the three procedures the Aggregate Soundness Index provides the best assessment of durability in that it accounts for the clay type present, its availability and quantity and the strength of the rock fabric. The test procedures require only a small sample size (1 g in some cases) and it is possible to determine the properties of single aggregate pieces and compare them with the properties of rock spall samples obtained from the aggregate source and for which a wider range of test properties are known. The testing of an aggregate sample removed from the road surface for example can be carried out and results compared with the properties of the different rock types present in the source quarry. Having determined the properties of aggregate pieces which are showing obvious deterioration in the road surface due to environmental and traffic stress, it is thus possible to eliminate by appropriate specification those material types in the source that have a similar potential to degrade.

Physico-chemical tests provide a fundamental understanding of the components of degradation of basaltic rocks and the Accelerated Soundness Index test provides a good model of the degradation process. The tests have been valuable in checking the appropriateness of specification limits for durability which are expressed in terms of the Degradation Factor which is based on the Washington Degradation Test and Secondary Mineral Count. They will be used in future to examine the durability of materials which have anomalous Degradation Factor or Secondary Mineral Counts relationships and also to provide durability tests on small samples recovered from existing roads to check the suitability of specification limits.

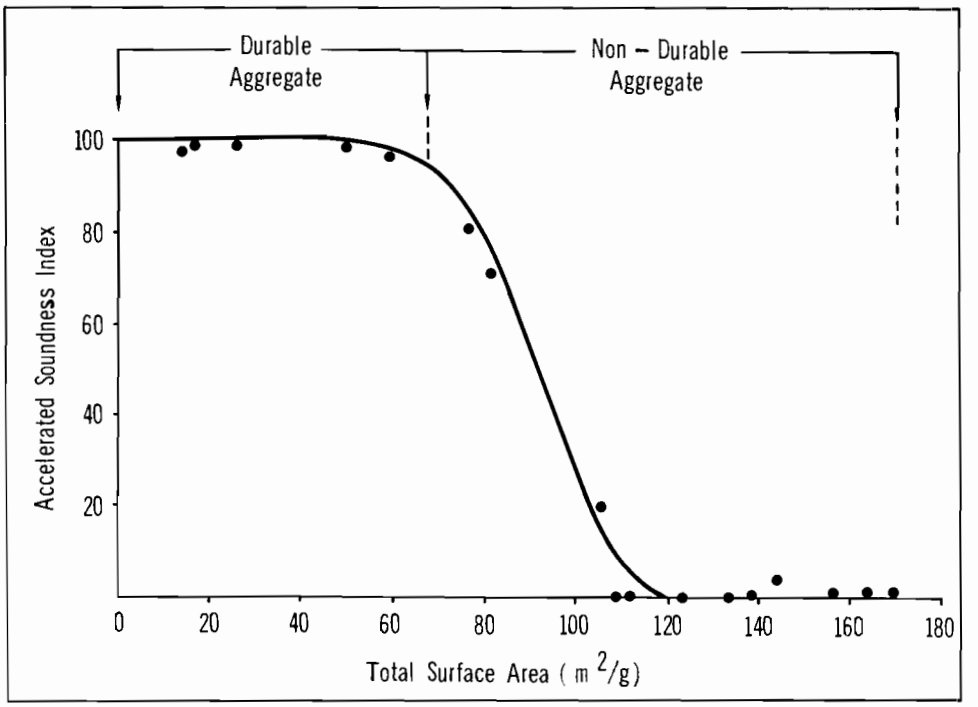


Figure 13
Relationship between total surface area and the accelerated soundness index for 17 samples of basalt from a single source

Specification of durability of source rocks

Since 1977, and concurrently with the investigation of the durability of source rocks, an intensive programme of quarry inspection and sampling was instituted. As a result, a greater appreciation has been gained of the field occurrence within a quarry source of the occurrence of the various rock types. Sufficient data has now been obtained to permit a reassessment of the Board's source rock specification requirements. Amendments to the specification limits for igneous and metamorphic source rock durability and hardness requirements have been approved and introduced in all source rock specifications as from 1 July, 1981.

The source rock specifications as amended are a simplification and rationalisation of the previous specifications and are more closely related to the inherent durability properties of the rock types used and the occurrence of such rocks in the field.

Under the terms of the new specifications, source rock is divided into sound, marginal or unsound according to the requirements set out in Table 5, unsound rock being any material which fails to meet the minimum requirements of marginal rock. Unsound and marginal rock in the portion of a mixture retained on a 4.75 mm A.S. sieve are not permitted to exceed the amounts listed in Table 6.

Table 6

Class	Total of Marginal and Unsound Rock % (max)	Unsound Rock % (max)
1	8	3
2	10	5
2A	10	5

These evaluations still rely on the visual classification of rock fragments in a representative sample of the material by an inspector, whose judgement is aided by samples of rock from the same source which have been classified by test into one of the three classes.

In many circumstances, it is not possible to obtain sufficient crushed rock fines from the same source as the coarse component and hence additional fines must be imported from other sources. The durability of the fine component is of extreme importance, and to enable it to be evaluated a modified degradation factor test procedure has been devised. After suitable correlation tests a value of not less than 60 has been specified for the Degradation Factor – Crusher Fines.

Table 5

Rock Type	Test Value			
	Sound Rock		Marginal Rock	
	Degradation Factor Source Rock (min)	Secondary Mineral Content % (max)	Degradation Factor Source Rock (min)	Secondary Mineral Content % (max)
Acid Igneous				
Granite	50	–	35	–
Adamellite	50	–	35	–
Granodiorite	50	–	35	–
Granophyre	45	–	35	–
Rhyolite	45	–	35	–
Rhyodacite	45	–	35	–
Intermediate Igneous				
Diorite	45	–	35	–
Porphyry	45	–	35	–
Trachyte	50	–	30	–
Basic Igneous				
Basaltic Rocks (Basalt, Dolerite, Limburgite)	50	25	30	30
Metamorphic				
Hornfels	40	–	20	–
Quartzite	45	–	30	–
Schist	45	–	30	–
Phyllite	45	–	30	–
Gneiss	45	–	30	–
Greenstone	45	–	30	–

SURFACING

Extent of work

Table 7 shows that 4718 km of all types of bituminous surfacing work was completed in 1980/81 compared with 5027 km in 1979/80. The length of roadway treated decreased by 309 km and the area treated has decreased by approximately 2,426,000 m^2.

In 1980/81 the length of sealed road on the Board's declared system was increased by 46 km and the Board contributed to increasing the length on unclassified roads by 426 km, as shown in Table 8. Reconstruction of previously sealed pavements and the restoration of the seal coat amount to 261 km of the declared system, 1.1 per cent of the sealed length, compared with 1.6 per cent in 1979/80.

Retreatments on declared roads amount to 1702 km (7.8 per cent of the sealed road length), compared to 1803 km (8.3 per cent) in 1979/80.

The trends in the rate of reconstruction and restoration of seal coats and rate of retreatments on declared roads are shown in Figure 14.

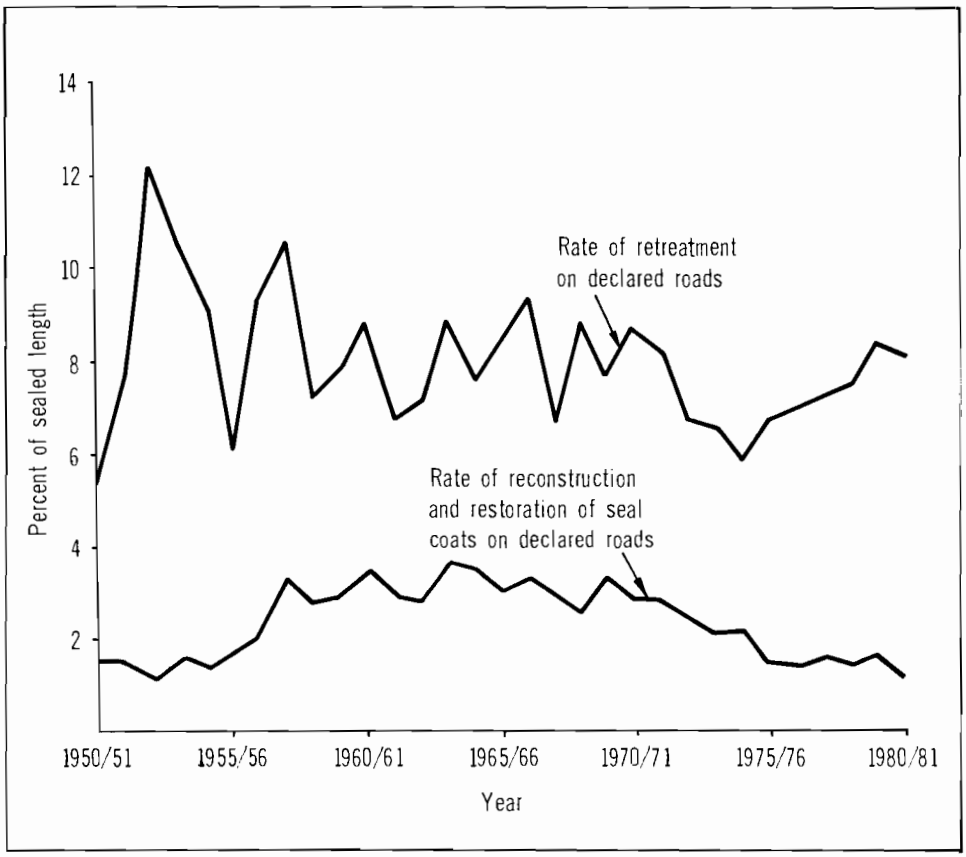


Figure 14
The trends in the rate of reconstruction and restoration of seal coats and the rate of retreatments on declared roads

Types of work

Sprayed work (initial treatments and retreatments) was again the principal type of work, amounting to 96.5 per cent of the total length of the work.

The plant mix work completed in 1980/81 was 151 km, i.e. 3.5 per cent of the total length and 5.2 per cent of the total area. The 1980/81 expenditure on plant mix works was equivalent to 30 per cent of the total expenditure on bituminous surfacing. For the plant mix work a total of 276,800 tonnes was supplied and spread by contractors.

Table 7 Bituminous surfacing work completed

Category of road and plant used	1979/80			1980/81		
		km			km	
Work on roads to which the Board contributed funds						
CRB declared roads						
Board's plant	2352			**2242**		
Municipal plant	101			**39**		
Contractor's plant	220			**157**		
		2673			**2438**	
Unclassified roads						
Board's plant	1659			**1581**		
Municipal plant	173			**200**		
Contractor's plant	205			**158**		
		2037			1939	
Sub-totals			4710			**4377**
Work done for other Authorities by the Board's plant (No Board contributions for these works)						
Municipalities		311			**331**	
State Instrumentalities		6			**10**	
Commonwealth works		–			–	
			317			**341**
Totals			5027			**4718**

Table 8 Bituminous surfacing work on various road categories (on roads to which the Board contributed funds during 1980/81)

	State highways	Freeways	Tourists' and Forest roads	Total Board's Main roads	Declared System	Unclassified roads	Totals
	km	km	km	km	km	km	km
Initial treatments							
Extensions to sealed system							
Sprayed work	1.20	14.52	9.02	19.22	43.96	423.32	467.28
Plant mix work	–	1.80	–	–	1.80	2.25	4.05
Reconstruction of lengths of previously sealed pavements							
Sprayed work	67.65	.90	7.64	169.04	245.23	219.87	465.10
Plant mix work	3.09	–	.03	13.12	16.24	30.88	47.12
Widening of existing sealed pavements							
Sprayed work	74.13	19.47	2.24	49.23	145.07	61.82	206.89
Plant mix work	4.27	2.01	–	3.24	9.52	4.90	14.42
Duplication of existing sealed pavements							
Sprayed work	4.89	–	–	1.98	6.87	3.21	10.08
Plant mix work	2.54	–	–	7.70	10.24	.90	11.14
Final seal							
Sprayed work	122.84	3.55	14.75	109.60	250.74	213.36	464.10
Plant mix work	.19	1.00	–	5.36	6.55	8.70	15.25
Retreatment							
Sprayed work	653.90	48.85	118.83	850.43	1672.01	941.13	2613.14
Plant mix work	5.04	5.22	–	19.49	29.75	28.80	58.55
Totals	939.74	97.32	152.51	1248.41	2437.98	1939.14	4377.12

Cost of work

The average unit costs for sprayed work done by the Board's 18 bituminous surfacing units are shown in Table 9. The average overall cost of all types of sprayed work was 103 cents per square metre compared with 89 cents in 1979/80, an increase of 16 per cent.

The average cost per tonne for asphalt supplied and laid was approximately $39.25 per tonne in the Melbourne and Geelong areas, and approximately $45.80 per tonne in other areas of the State. The average cost per tonne was $39.88, compared with $34.80 in 1979/80.

Table 9 Average costs of sprayed bituminous surfacing done by CRB plant (on roads to which the Board contributed funds during 1980/81) (Costs in cents per m^2)

	Nature of Work												
Item	ITP&S Size 13 & over	ITP&S Size 10	ITP&S Size 7	ITP&S 2 Appln Seal	IT Primerseal	ITSO&ITFS & Reseal Size 13 & over	ITSO&ITFS & Reseal Size 10	ITSO&ITFS & Reseal Size 7	ITSO&ITFS & Reseal Size 5	BSRS Reseal Size 13	BSRS Reseal Size 10	ITSO&ITFS & Reseal 2 Appln	Surface Enrichment
Square metres costed	1,014,375	1,213,435	79,867	35,599	1,867,467	3,697,149	9,174,005	5,802,368	822,097	303,215	360,026	101,190	300,041
Material													
Cents	95.4	91.6	72.3	189.4	61.4	73.3	60.7	51.0	49.7	100.9	86.0	152.5	19.5
%	59.6	62.8	62.1	66.3	63.4	61.3	62.2	61.9	66.9	58.6	57.7	67.5	69.9
Stores													
Cents	7.9	4.5	3.6	7.7	3.0	4.4	3.5	3.0	2.1	6.5	7.2	5.1	0.8
%	4.9	3.1	3.1	2.7	3.1	3.7	3.6	3.6	2.8	3.8	4.8	2.3	2.9
Plant													
Cents	24.3	21.2	17.7	37.3	13.8	16.7	13.2	11.5	9.1	21.9	22.3	26.7	3.3
%	15.2	14.5	15.2	13.1	14.2	14.0	13.5	14.0	12.2	12.7	15.0	11.8	11.8
Labour													
Cents	32.6	28.6	22.8	51.0	18.7	25.1	20.2	16.9	13.5	42.8	33.5	41.6	4.3
%	20.3	19.6	19.6	17.9	19.3	21.0	20.7	20.5	18.1	24.9	22.5	18.4	15.4
Totals													
Cents	160.2	145.9	116.4	285.4	96.9	119.5	97.6	82.4	74.4	172.1	149.0	225.9	27.9
%	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

- **Aggregate**

The total quantity of covering aggregate was approximately 259,400 cubic metres on sprayed work undertaken by the Board, and 29,600 cubic metres on sprayed work undertaken by municipalities and contractors. Table 10 details the average prices of aggregates over the last five years and illustrates that the average price in 1980/81 was $2.11 per cubic metre higher than the average price in 1979/80.

Table 10 Average price of aggregate for bituminous surfacing (in roadside stacks)

Material Prices/cubic metre	76/77	77/78	78/79	79/80	**80/81**
	$	$	$	$	**$**
Screenings	12-66	13-00	14-11	15-73	**17-83**
Gravel	12-55	11-97	12-09	14-72	**16-92**
Sand	4-89	6-40	7-07	8-95	**8-86**
Scoria	6-41	21-38	7-80	8-55	**9-70**
Average price all aggregate	12-42	12-92	13-69	15-43	**17-54**

- **Bitumen**

The Board purchased 35,550 tonnes of bitumen by contract with four suppliers at a cost of $8,792,000.

Bitumen prices increased by 13 per cent between July 1980 and June 1981 compared with 56 per cent between July 1979 and June 1980.

Efficiency of work

Since 1969/70, the number of the Board's bituminous surfacing units has reduced from 23 to 18. Part of the reduction in numbers is due to an increase in work done by Municipal and Contractor's plant, and part through improvement in efficiency of operation of the Board's plant. A measure of efficiency is the quantity of binder sprayed by each unit per day. Information for the past 12 years is summarised in Table 11.

Table 11 Output of CRB bituminous surfacing units 1969/70 to 1980/81.

Year	Total number of Board units	Total length of work by Board's plant	Average output of Board sealing units
		km	litres/day
1969/70	23	4521	12400
1970/71	20	4431	12840
1971/72	19	4347	13650
1972/73	17	4142	13600
1973/74	17	3669	13920
1974/75	17	3509	13890
1975/76	17	3405	13920
1976/77	17	3544	14460
1977/78	17	4220	15400
1978/79	17	4165	15570
1979/80	18	4328	16720
1980/81	**18**	**4163**	**16030**

TRAFFIC MANAGEMENT

SCRAM Project (Signal Co-ordination of Regional Areas in Melbourne)

Development of the SCRAM system

In 1979, the Board adopted the SCAT System for linking signals in the Melbourne metropolitan area. The installation of SCATS (i.e. the Sydney Co-ordinated Adaptive Traffic System) is being carried out as part of the Board's major effort in signal linking under the project name of SCRAM (i.e. Signal Co-ordination of Regional Areas in Melbourne).

During the 1980/81 financial year, a further 50 intersections were connected to the existing regional computers at Blackburn and St Kilda, bringing to 58 the total number of intersections on various routes connected to the SCRAM system. The central computer (PDP11/44) was installed in the head office complex at Kew to allow operators to communicate with the regional computers and local controllers. The central computer:

- reports faults in signal equipment at any intersection in the system. These faults and reports are automatically transmitted to terminals installed at the two metropolitan area CRB divisional offices at East Kew and Nunawading, and the Emergency Services office located at CRB head office
- allows an operator to check the operation and, if required, to log the operation of any intersection or system continuously via any of the terminals
- allows operators to modify and improve controller operations at any intersection in the system from the control room, allowing programme adjustments to satisfy changing traffic conditions
- maintains back-up files of each regional computer for reloading if regional computer files have been contaminated or lost due to either power blackout or any other causes
- allows testing of traffic signal operations for all controllers installed as part of the SCRAM project
- assists in the development of further ancillary equipment and software such as the interface device for traffic signal controllers and tram priority options
- enables traffic flow information to be collected.

Two additional PDP11.34 mini-computers have been purchased for the Western and South-eastern Regions. When these two regional computers have been installed in Footscray and Springvale (scheduled for the second half of 1981), the SCRAM system will be capable of linking almost any signals in metropolitan Melbourne. One of the advantages of the SCAT System is that all communication between the central computer, the regional computers, and the local controllers is via rented Telecom lines. Many other linking systems require expensive new cables between the computers and local controllers.

Because all communications within the SCAT System are via existing Telecom lines, changes to the system are far easier and cheaper than for a "hard-wired" system. For example, changing a signalised intersection from one region to another in the SCAT System is as simple as changing a telephone number, whereas for a "hard-wired" system, expensive changes to cabling would be required.

The programme of traffic signal works for the next five years provide for the installation of the two further regional computers mentioned above and the connection of a further 170 signalised sites including signalised pedestrian crossings to the regional computers at Blackburn, St Kilda, Footscray and Springvale, bringing the total number of SCRAM co-ordinated signals on various routes to 230.

Development of the interface device

Because of the random installation of traffic signals in Melbourne over a long period of time, there are many varieties of controllers. Many of these controllers are not compatible with the SCAT System as they are not operated by micro-processors. About one third of this group are Eagle CT250 controllers and an interface device has been developed to allow these controllers to be linked into the SCRAM system after successful performance of the prototype. A production model has been designed to fit in a standard extension housing placed on the top of the existing controller cabinet.

The interface device will permit the local controller to operate as a standard isolated traffic signal controller in the event of failure in the interface device or communications with the SCATS' regional master. This was achieved by incorporating hardware and software "watchdog" timers in the interface device and by minimizing the modifications required to the CT250 controller.

This device will be further developed to allow other types of controllers to be interfaced with the SCAT System.

The interface device is a self-contained micro-computer with the following specification:

- Power supply - 240 V a.c. input
- Central Processor Unit (C.P.U.) - 8085A
- PROM Programme storage - 4K bytes, expandable to 16K bytes PROM/RAM
- RAM storage - 256 bytes
- Inputs - 24 optically isolated inputs
- Outputs - 8 relay controlled outputs
- Serial interface - 300 Baud, 20mA current loop for field terminal connection
- Telecom interface - 300 Baud for communication with regional SCATS master via standard RX/TX card contained within the interface device
- Expansion interface - all internal bus signals are available on an expansion connector to allow the use of additional modules to expand the capabilities beyond those outlined above.

Traffic management studies

Investigations aimed at the identification of low cost traffic management on arterial roads in the metropolitan network, to maximise the available capacity, reduce delays and improve safety, continued to be a major activity. These improvements also assist in attracting traffic to the arterial routes and away from local and collector roads which are currently used by through traffic to bypass points of congestion and delay in the arterial road network, thereby improving the amenity of the areas served by the local street network.

The studies result in the definition of a range of treatments including intersection flaring, parking control, lane definition, improved pedestrian facilities, etc., many of which can be undertaken at a very low cost which, when implemented, provide significant improvements with respect to traffic flow and safety.

These studies involved:

(i) collection of extensive field data including traffic counts, some travel time information, phasing of signalised intersections, intersection layouts and accident histories at all intersection and mid-block locations;
(ii) extensive site observations throughout the study areas during both peak and off-peak periods to assess existing traffic performance;
(iii) defining a road hierarchy for the study area to identify those roads along which traffic should be encouraged and those roads which should be protected from through traffic;
(iv) identifying sites with safety problems or problems of delay and congestion;
(v) developing solutions to the problems identified;
(vi) estimating the effects on safety and capacity of the solutions developed;
(vii) estimating approximate costs for the proposed solutions.

Typical examples of the results achieved by these studies are:

Northern suburbs study

(a) High Street/Keon Parade/Mahoneys Road intersection and rail crossing

- provision of an extra through lane on each of the south, north and east approaches by alterations to the linemarking and minor road widening within the existing road reserve
- amendment of the traffic signal phasing to allow two vehicle phases to run during the train phase
- introduction of signal phases to control the right turns from south to east and from north to west to reduce the number of accidents involving right turning traffic.

This particular improvement has been completed at a cost of approximately $55,000 with an improvement in capacity of about 20 per cent in the peak periods and an expected reduction in accidents involving right turning vehicles.

(b) Keon Parade/Dalton Road intersection

At this roundabout during the p.m. peak hour about 80 vehicles make the left turn from west to north by doing a "loop turn" (270°) around the roundabout from the right hand lane because the queue in the left lane is so long.

Widening the northbound departure from the roundabout to allow two lanes of traffic to make this left turn simultaneously has increased the p.m. peak capacity of the critical western approach by about 40 per cent and increased the capacity of every entry to the roundabout by about 6 per cent.

(c) Grimshaw Street/Watsonia Road intersection

By implementing amendments to the present linemarking at this intersection to provide a five lane treatment and slight amendments to the traffic signal system at a minimal cost, an increase in capacity of about 7 per cent in the a.m. peak and 32 per cent in the p.m. peak, can be achieved.

(d) Minor improvement projects of a similar nature to the above have been proposed at over 50 other sites.

Heidelberg study

The aim of the study was to investigate traffic problems and to recommend a set of traffic management measures which could be readily implemented to improve the safety and general operation of the arterial road network within the study area.

The most significant proposals were:

(a) Bell Street – Burgundy Street

- installation of pedestrian operated signals in Bell Street opposite The Mall
- five lane treatment in Upper Heidelberg Road at the intersection with Bell Street and Burgundy Street
- climbing lane in Burgundy Street opposite Austin Hospital
- intersection/pedestrian signal linking through Heidelberg shopping centre
- five lane treatment in Burgundy Street at Rosanna Road intersection (see Figure 15).

These measures would result in capacity increases of approximately 17 per cent in the a.m. peak and 11 per cent in the p.m. peak at the Bell Street/Upper Heidelberg Road and 26 per cent and 19 per cent during the a.m. peak and p.m. peak respectively at the Burgundy Street/Rosanna Road intersection. Other proposals would yield significant benefits in terms of safety and delays.

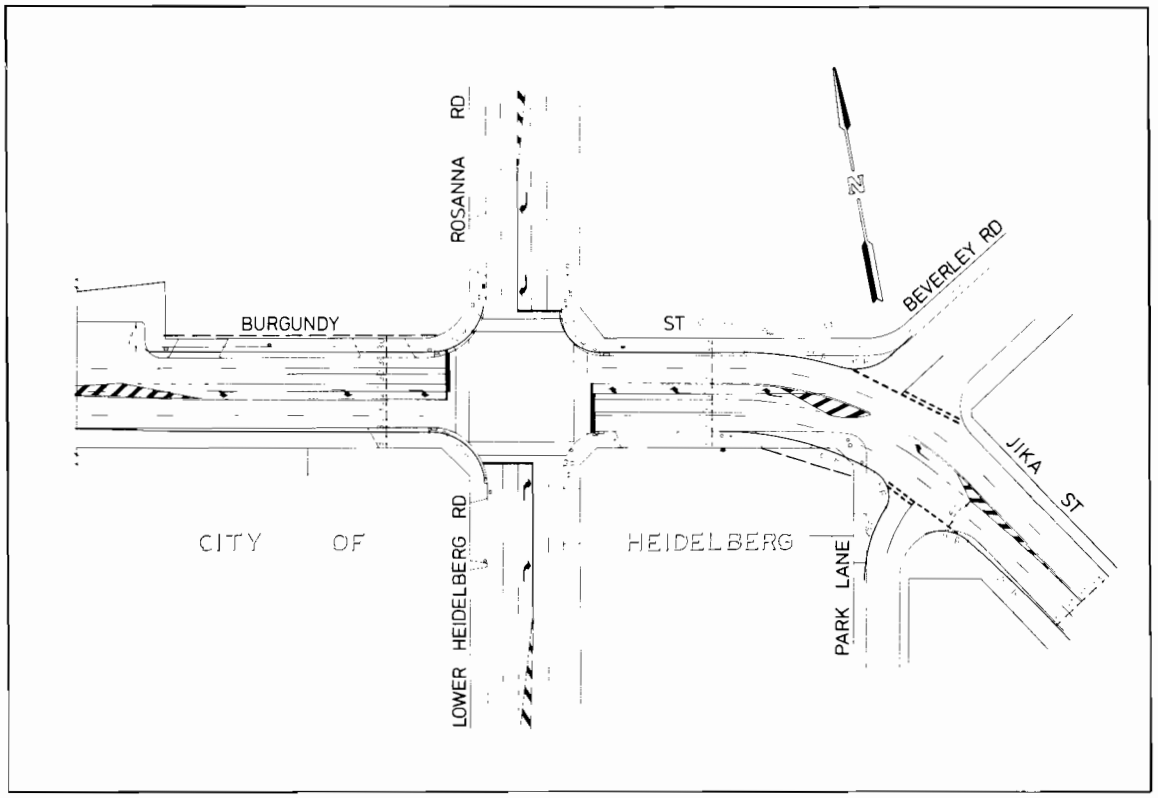


Figure 15
The improvements proposed (shown in black) at the Burgundy Street/Rosanna Road/Lower Heidelberg Road intersection.

(b) Banksia Street – Manningham Road

- minor linemarking and traffic signal modifications at a number of locations
- half closure of Mount Street south of Banksia Street to disallow egress
- signalisation of the intersection of Manningham Road with Bridge Street and linking of signals with those at the Manningham Road/Bulleen Road intersection
- widening of the east bound carriageway of Manningham Road to three lanes between Bridge Street and Bulleen Road
- capacity improvement at the Manningham Road/Bulleen Road intersection by signal and linemarking modification and flaring.

At the intersection of Manningham Road and Bulleen Road capacity increases of approximately 8 per cent in the a.m. peak and 20 per cent in the p.m. peak would be expected while at other locations significant improvements to safety and general traffic operation would be forthcoming.

(c) Burke Road North – Lower Heidelberg Road – Rosanna Road

- construct permanent roundabout at the intersection of Burke Road North/Lower Heidelberg Road with improved design features
- link traffic signals at Banksia Street and Burgundy Street
- re-linemark Rosanna Road to provide four lanes between Burgundy Street and Lower Plenty Road
- introduce a painted island treatment near Banyule Road and Douglas Street to provide sheltered right turn lanes.

The capacity of the Burke Road North/Lower Heidelberg Road roundabout could be improved by up to 25 per cent during the a.m. peak and to a small degree during the p.m. peak. General improvements to safety and delays along Lower Heidelberg Road and Rosanna Road would result from the above measures in conjunction with the five lane treatment at the Burgundy Street/Rosanna Road intersection mentioned earlier.

Northern corridor study

Deficiencies in operational efficiency and safety in the north-south arterials of St Georges Road and Epping Road between Northcote and Epping have been identified and it is evident that the following works would improve conditions for traffic.

- Provision of five lane treatments in Westgarth Street at High Street plus rephasing the traffic signals to provide a right turn phase from west to south.
- Upgrading of signal hardware on High Street by providing mast arms and new lanterns.
- Conversion of St Georges Road/Merri Parade intersection to roundabout operation.
- Signal linking along St Georges Road.
- Improvements to signing and linemarking at various locations.
- Roundabout treatment for High Street/Spring Street intersection at Reservoir.

Earlier similar studies were undertaken on Punt Road (Bridge Road to St Kilda Junction), Warrigal Road and Princes Highway East in the Malvern/Caulfield area. Many of the low cost improvements in these corridors have now been completed with the observed effect of improved traffic efficiency and safety. There is a need for continued monitoring of traffic operation on all roads to ensure that optimum operational standards are maintained under changing conditions.

Safe working practices

For the 1980/81 year, safety statistics have been derived from Work Injury Reports submitted by Board's personnel. These forms are required to be completed for **all** on the job accidents.
The forms are received daily from the various work areas and the information is categorised into 'Cause of injury' and 'Part of body'. The number of journey accidents are now significant and these will have a separate category in future.
From the information submitted with the Work Injury Reports, it is ascertained whether the reported accident is statistically significant in accordance with the appropriate Australian Standard. A statistical accident is a work injury in which the person is absent for at least one day after the day of the accident.

Table 12

	Cause of injury	Total number 1979/80	1980/81
1.	Arising out of or use of plant/vehicle/machinery	393	419*
2.	Exposure to or contact with harmful substances, e.g. Epoxy	56	40
3.	Using powered or other hand tools/equipment, e.g. chain saws	372	390
4.	Persons falling, knocking, slipping, jumping, etc.	369	360
5.	While manual handling	422	323
6.	Arising out of a housekeeping problem	47	24
7.	Working environment/weather, e.g. allergies, sunburn	61	78
8.	Electrical discharge	2	2
9.	Other (including misadventure)	104	156
	Totals	1826	1792

(* includes 43 journey accidents)

Table 13

	Part of body	Total number 1979/80	1980/81
1.	Head or neck	138	152
2.	Limbs	508	524
3.	Spine	336	352
4.	Eyes	231	191
5.	Hands or fingers	372	363
6.	Feet or toes	113	68
7.	Cardiovascular	8	2
8.	Skin/burns	17	20
9.	Hernia	8	7
10.	Loss of hearing	1	5
11.	Respiratory	8	20
12.	Others	156	229
13.	Fatalities	Nil	3*
	Totals	1896	1936

Note: As some injured personnel have suffered multiple injuries, the total for Table 13 is greater than Table 12.

*Details of fatalities

L F Hawkes Roller driver Traralgon Division	9/7/80	Roller overturned
R Johns Truck driver Ballarat Division	22/9/80	Journey accident - motor car collision
P J Truman Compensation Investigating Officer Estates Section	18/11/80	Driving Board vehicle which left road and struck a tree

At the end of each month, the manhour figures are obtained and the Disabling Injury Frequency Rate (DIFR) is calculated according to the following formula:

$$\frac{\text{Number of lost time injuries x 1,000,000}}{\text{Manhours exposure}}$$

A CRB Work Injury Reports Analysis form is produced each month from the data supplied in the Work Injury Reports, and distributed to work areas to:

- help identify cause of injuries in the different work areas to enable the Regional Safety Committees and the Safety Officer to take appropriate action
- create an awareness and promote interest in the Board's accident prevention programme.

The 'Cause of injury' and 'Part of body' accident statistics for 1979/80 and 1980/81 are given in Tables 12 and 13. 'Safety statistics' are given in Table 14.

Table 14
Safety statistics

	Statistical Accidents	Non-Statistical Accidents	Total Statistical and Non-Statistical	Total Manhours Worked (million)	Disabling Injury Frequency Rate (DIFR)
1979/80	538	1,288	1,826	8.995	59.81
1980/81	**491**	**1,301**	**1,792**	**8.833**	**55.58**

Staff

As at 30 June 1981, personnel in the Engineer in Chief's Branch numbered:

Engineers	528
Scientists	22
Surveyors	37
Other Professional Officers	28
Technical Staff	497
Administrative Staff	294
Printing & other General Division Staff	18
Field Staff & Employees	2262
Depot Staff & Employees	743
	4429

There were also 15 staff on secondment to various other areas, 14 on extended leave and one student engineer.

Publications

The following papers by officers in the Engineer in Chief's Branch were presented or published in the 1980/81 year:

Bitumen Scrap Rubber Seals: R G Allen, Asphalt Engineer
Presented at the Eighteenth Australian Road Research Board Regional Symposium, Traralgon, May 1981

Street Lighting: E V Barton, Traffic Engineer
Presented at Monash University, Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1981

Improved Quality Control Procedures: J D Bethune, Assistant Principal Construction Engineer
Presented at the Australian Road Research Board Second Workshop on Quality Control, Sydney, July 1981

The Interpretation of Static Penetration Tests in Sand: G A Chapman, Engineer, Materials Division, CRB and I B Donald, Associate Professor, Department of Civil Engineering, Monash University
Presented at the Eleventh International Conference on Soil Mechanics and Foundation Engineering, Stockholm, 1980

Determining Serviceability Deflection in Plastically Designed Structures: G J Clarke, Design Engineer, Bridge Design Division, CRB and R E Melchers, Senior Lecturer, Department of Civil Engineering, Monash University
Published in **Transactions of the Institution of Engineers Australia, Civil Eng.** Vol CE23 No 1, January 1981

Traffic Signals – Design and Operation: P R Cornwell, Traffic Systems Officer, Traffic Engineering Division
Presented at Monash University, Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1981

Road Pavement Materials in Gippsland: D T Currie, Divisional Engineer, Traralgon
Presented at the Eighteenth Australian Road Research Board Regional Symposium, Traralgon, May 1981

Participatory Road Studies – A Review of Techniques: R G Evans, Leader, Joint Road Planning Group and K Bush, Economist, Joint Road Planning Group
Presented at the Tenth Australian Road Research Board Conference, Sydney, August 1980

An Analysis Method of Secondary Toppling Rock Failures – The Stress Redistribution Method: R S Evans, Scientific Officer, Materials Division
Published in **Quarterly Journal of Engineering Geology**, Vol 14 No 2, 1981

A Test to Assess the Durability of Crusher Fines: B J Fielding, Scientific Officer, Materials Division
Presented at the Tenth Australian Road Research Board Conference, Sydney, August 1980

The Washington Degradation Test – Mechanism and Use: B J Fielding, Scientific Officer, Materials Division
Presented at the Tenth Australian Road Research Board Conference, Sydney, August 1980

Air Quality in the Vicinity of Roads: D Ford, Scientific Officer, Materials Division
Presented at the Tenth Australian Road Research Board Conference, Sydney, August 1980

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 1981

Prediction of Casualty Accident Rates on Urban Arterials in Melbourne: B W Grayling, Engineer, Road Planning Division
Presented at the Tenth Australian Road Research Board Conference, Sydney, August 1980

The Movement of Superloads to Loy Yang: N C Haylock, Assistant Chief Bridge Engineer, CRB and J Jones, Senior Construction Engineer, State Electricity Commission of Victoria
Presented at the General Meeting of the Gippsland Group, Victorian Division, Institution of Engineers, Australia, Churchill, August 1980

Development of a Socket Inspection Device: J C Holden, Research Engineer, Materials Division
Published in **Proceedings of the International Conference on Structural Foundations on Rock**, Vol 2, 1981 and published in **Australian Geomechanics News**, No 1, December 1980

Review of the NAASRA Study of Road Maintenance Standards, Costing and Management: J R Jordon, Study Team Leader, NAASRA Road Maintenance Study, G Logue, Study Team Member, and G M Anderson, Study Team Member (on secondment from CRB)
Presented at the Tenth Australian Road Research Board Conference, Sydney, August 1980

Systematic Monitoring of Road Surface Deflection: P W Lowe, Materials Engineer
Presented at the Eighteenth Australian Road Research Board Regional Symposium, Traralgon, May 1981

Traffic Surveys: I L Mackintosh, Engineer, Traffic Engineering Division
Presented at Monash University, Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1981

The Performance and Design of Intersections: T C Miller, Engineer, Traffic Engineering Division
Presented at Monash University, Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1981

Roundabouts – Application and Design: T C Miller, Engineer, Traffic Engineering Division and C Fox, Engineer, Traffic Engineering Division
Presented at Monash University, Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1981

Traffic Design – Roadway Elements: T C Miller, Engineer, Traffic Engineering Division and C Fox, Engineer, Traffic Engineering Division
Presented at Monash University, Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1981

Road Roughness as an Objective Measure of the Need for Road Reconditioning:
P Mulholland, Engineer, West Gate Freeway Project
Presented at the Tenth Australian Road Research Board Conference, Sydney, August 1980

Traffic Signal Linking and Area Control: B J Negus, Senior Traffic Design Engineer, Traffic Engineering Division
Presented to the Institution of Engineers, Australia, Transportation Branch, Victoria Division, Melbourne, October 1980

Traffic Signal Linking and Area Control: B J Negus, Assistant Traffic Engineer (Signals) and C K Mottram, Engineer, Metropolitan Division
Presented at Monash University, Department of Civil Engineering Traffic Engineering Practice Workshop, Melbourne, April 1981

Creating a Multiple Use Linear Park: R Niran, Landscape Architect, Road Design Division
Presented at the Royal Australian Institute of Parks and Recreation Conference, Sydney, September 1980

Planting Cribwalls: R Niran, Landscape Architect, Road Design Division
Published in **Landscape Australia**, February 1981

The Use of Cement Works Flue Dust in Fines Deficient Crushed Base Material:
A Ratnarajah, Scientific Officer, Materials Division
Presented at the Tenth Australian Road Research Board Conference, Sydney, August 1980

Epoxy Asphalt Surfacing of West Gate Bridge: J J Rebbechi, Assistant Asphalt Engineer
Presented at the Tenth Australian Road Research Board Conference, Sydney, August 1980

Pavement Laying Conditions: J J Rebbechi, Assistant Asphalt Engineer
Presented at the Australian Asphalt Pavement Association Training Course for Asphalt Supervisors, Melbourne, August 1980

Traffic Noise and Road Design: R E Saunders, Leader, Environmental Studies Section
Presented at the Society of Automotive Engineers, Australia Seminar on Noise and Vibration Control, Melbourne, April 1981

A Computer Based Materials Data Bank: S G C Servais, Scientific Officer, Materials Division
Presented at the Tenth Australian Road Research Board Conference, Sydney, August 1980

Temperature Effects on Bridge Structures: J D Thomas, Senior Design Engineer, Bridge Design Division
Presented at the Short Course on Concrete Bridges, Buildings and Other Structures, University of Melbourne, October, 1980.

Cyclic Movement – Curvature Characteristics of Mild Steel: F Tin Loy, Design Engineer, Bridge Design Division
Published in **Materials and Structures**, Vol 13 No 77, October 1980

Deformation Analysis Under Variable Loading: F Tin Loy, Design Engineer, Bridge Design Division
Published in **Engineering Structures**, Vol 3 No 1, January 1981

An Approach to Road Planning Investigations: R T Underwood, Chief Planning Engineer
Presented at the Tenth Australian Road Research Board Conference, Sydney, August 1980

Planning Implications of an Outer Ring Road: R T Underwood, Chief Planning Engineer
Published in **American Society of Civil Engineers' Journal of the Urban Planning and Development Division**, Vol 106 No UP1, November 1980

Urban Roads – Concerns of the 1980s: R T Underwood, Chief Planning Engineer
Presented at the Institution of Engineers, Australia Annual Conference, Canberra, March 1981

Transportation Fuel Conservation in Urban Areas: R T Underwood, Chief Planning Engineer
Presented at the Third Conference, Road Engineering Association of Asia and Australasia, Taipei, April 1981

West Gate Freeway (South Melbourne Section) Design and Construction: R Valentine, Project Engineer, West Gate Freeway
Presented to the Concrete Institute of Australia, Victorian Branch, Melbourne, August 1980, and to the Institution of Engineers Australia, Victorian Division, Civil Branch, May 1981

Hourly Traffic Volume Patterns Throughout the Day in Melbourne: B E Van Every, Engineer, Road Planning Division and A L George, Engineer, Road Planning Division
Published in **Australian Road Research**, Vol 11, No 1, March 1981

Rock Socketed Piles – Design and Construction Aspects: A F Williams, Engineer, Materials Division, CRB and G Smith, Engineer, Frankipile (Aust) Pty Ltd
Presented at the Australian Geomechanics Society, Queensland Group, Symposium on Socketed Foundations on Weak Rocks, Brisbane, May 1981

The following papers were presented in 1979/80, but were not recorded in last year's report:

Subgrade Evaluation: P W Lowe, Materials Engineer
Presented at the National Concrete Pavement Course, Monash University, Melbourne, May 1980

Some Experience with Heavily Trafficked Rural Freeway Pavements in Victoria: P W Lowe, Materials Engineer
Presented at the Australian Road Research Board Seminar on Heavily Trafficked Flexible Pavements, Melbourne, June 1980

Deflection Bounding at Shakedown: F Tin Loy, Design Engineer, Bridge Design Division
Published in **American Society of Civil Engineers Journal of the Structural Division,** Vol 106 No ST5, May 1980

Also published in 1980/81 were:

Research Memorandum No. 25, **Testing of Match Cast Concrete Box Girder Bridge Segments:** B J Weinberg, Research Engineer, Materials Division and S B Bromham, Scientific Officer, Materials Division

Technical Bulletin No 31, **The Design of Flexible Pavements**

Technical Report No 68, **Hilf Rapid Compaction Test:** K I York, Scientific Officer, Materials Division.