COUNTRY ROADS BOARD

VICTORIA

SIXTY-SECOND ANNUAL REPORT

FOR YEAR ENDED 30th JUNE, 1975

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

(Left to right) Mr W. S. Brake, Member; Mr T. H. Russell, Deputy Chairman; Dr K. G. E. Moody, Engineer in Chief; Mr R. E. V. Donaldson, Chairman; Mr R. G. Cooper, Chief Accountant; Mr N. L. Allanson, Secretary.

COUNTRY ROADS BOARD

Chairman	**R. E. V. Donaldson**
Deputy Chairman	**T. H. Russell**
Member	**W. S. Brake**

PRINCIPAL OFFICERS AS AT 30th JUNE, 1975
HEAD OFFICE

Engineer in Chief	**Dr K. G. E. Moody**
Secretary	**N. L. Allanson**
Chief Accountant	**R. G. Cooper**
Deputy Engineer in Chief	**N. S. Guerin**
Deputy Secretary	**C. C. Liddell**
Deputy Chief Accountant	**R. J. C. Bulman**

REGIONAL DIVISIONAL OFFICES

Division	*Divisional Engineer*
Bairnsdale	**A. N. Jephcott**
Ballarat	**E. T. Oppy**
Benalla	**R. R. Patterson**
Bendigo	**T. M. Glazebrook**
Dandenong	**R. W. Angus**
Geelong	**G. W. Marshallsea**
Horsham	**J. W. Heid**
Metropolitan	**L. M. Jones**
Traralgon	**A. Jacka**
Warrnambool	**F. G. Lodge**

60 Denmark Street
Kew

3rd November, 1975

The Honorable E. R. Meagher, M.B.E., E.D., M.P.

Minister of Transport

100 Exhibition Street

Melbourne 3000

Sir,

In accordance with the requirements of Section 128 of the Country Roads Act 1958 No. 6229, the Board has the honour to submit to you for presentation to Parliament the report of its proceedings for the year ended 30th June, 1975.

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

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

We have the honour to be,

Sir,

your obedient servants

R. E. V. DONALDSON, A.A.S.A. (Senior), A.I.M.A., F.C.I.T., J.P.,
Chairman

T. H. RUSSELL, M.Eng.Sc., B.C.E., Dip.C.E., C.E., F.I.E.Aust.,
Deputy Chairman

W. S. BRAKE, B.C.E., C.E., M.I.E.Aust.,
Member

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

ANNUAL REPORT 1974/75

REVIEW

PROBLEMS OF FINANCE

Unprecedented steep increases in road construction and maintenance costs, without matching increases in revenue, created severe financial problems for the Board during the 1974/75 year.

Material prices soared and overall road construction prices rose by 20.2%. The price of road metal for delivery in the metropolitan urban area increased by 53.9%; hot mix, supply and lay, by 27.1%; bitumen by 84.6%; distillate by 38.3%; cement by 22.9%; steel by 14.1%; reinforced concrete pipes by 50.2% and reinforced concrete box culverts by 99.4%.

Wages increased by 13.4% after the huge 34.1% increase in the previous year. Salaries increased by 11.6% following the 29.7% rise in 1973/74.

In recognition of the Board's need for additional revenue the State Government increased motor registration fees as from 10th February 1975 by 35%. Notwithstanding this increase the Board was forced to institute drastic economies especially in the last quarter of the year. The workforce was retrenched by some 360 men and staff recruitment was severely restricted. Works in progress were retarded and several new projects postponed. Road maintenance work was reduced to a minimum compatible with safety and long term economy.

In the urban areas of Melbourne, Geelong, Ballarat and Bendigo funds were barely adequate for the continuation of current projects, leaving little scope for commencing new projects which are urgently required.

Particular Problems of Rural Roads

The inadequacy of funds provided by the Commonwealth for rural roads is very serious.

The Commonwealth Aid Roads Act 1969 placed emphasis on urban roads, thereby directing a concentration of effort on these roads. The current Commonwealth Roads Grants Act and National Roads Act further reduce the support for rural roads other than national highways.

The funds provided by the Commonwealth for expenditure on national highways have resulted in a serious reduction in the amount of funds provided by the Commonwealth for rural arterial roads and rural local roads.

While the Commonwealth Government has stated that it intends to finance in full all work on national highways, Victoria in 1974/75 was forced to expend $2,339,000 from its own funds on the Hume Highway and Western Highway to meet the cost of works in progress.

During the final three years, 1971/72–1973/74, of the Commonwealth Aid Roads Act 1969, Commonwealth grants to Victoria for rural roads totalled $60.76 million. Under current Commonwealth legislation an amount of $92.46 million, which includes the supplementary grants made in 1974/75, is provided for rural roads in the three year period from 1st July 1974 to 30th June 1977. However, $59.55 million of this sum is required to be spent on national highways, i.e. the Hume Highway and the Western Highway, leaving only $32.91 million for all other rural roads.

The Roads Grants Act 1974 provides $3.7 million in 1974/75, reducing to $2.8 million in 1976/77, for the construction of rural arterial and developmental roads. No Commonwealth funds are provided for the maintenance of these roads. The length of rural arterial roads under this current legislation is 15,380 km (9,560 miles) compared with a length of only 4,040 km (2,510 miles) under the Commonwealth Aid Roads Act 1969. Finance for the construction and maintenance of rural local roads is also most inadequate.

The Victorian system of rural State highways and other declared roads is approximately 21,700 km (13,500 miles) in extent and about 90% of this length has a sealed surface. It is necessary each year to carry out a programme of pavement reconstruction and resealing work of sufficient size to prevent deterioration of the existing asset. A deficiency of about 260 km (160 miles) of reconstruction and 450 km (280 miles) of reseal annually cannot be carried out because of lack of funds. Such deficiencies are cumulative and in a relatively few years will build up to a massive rehabilitation problem similar in size to that which faced the State in the late 40s and early 50s.

Already, during the wet winter of 1974, there were increased pavement failures on the rural roads. This condition will accelerate and unless adequate amounts of money are made available the danger exists that large parts of the rural road system will

deteriorate to such an extent that many additional lengths of pavement will fail. This financial situation developed during the period of the Commonwealth Aid Roads Act 1969 and is accelerating more rapidly under the current Acts. No amount of additional expenditure on national highways will provide a solution. Money must be made available to enable the State to apply the appropriate remedies on the ordinary rural roads.

Section of the Calder Highway reconstructed near Kurting, between Bendigo and Charlton.

Undesirable Features of Commonwealth Legislation

A detailed account of the funds made available to Victoria from 1st July 1974 to 30th June 1977 under the Commonwealth National Roads Act and the Commonwealth Roads Grants Act in on Page 22 of this Annual Report.

The most undesirable feature of the Commonwealth legislation is the fact that the amounts provided under the Act are much less than those recommended by the Commonwealth Bureau of Roads following a comprehensive road needs survey. The Bureau has recommended $61 million more than granted under the Act during the three year period — a difference which is all the more marked by the fact that the Bureau's recommended level of grants allowed for an inflationary factor of only 6% per annum which is considerably less than the present inflation rate of over 20% being experienced in the Board's work.

After allowing for inflation the Commonwealth funds to be made available to Victoria as contained in the National Roads Act and the Roads Grants Act will be 18.6% less than those received over the preceding three years in terms of real financial capacity to perform works.

Other undesirable features of the legislation concern the intrusion of the Commonwealth into the development of Victoria's road system in accordance with the priorities and standards determined by Victoria.

These features include:

National Roads Act

1. The Commonwealth Minister for Transport may request the State to submit for his approval a programme of proposed projects to be carried out on national roads, i.e. national highways, export roads and major commercial roads.
2. The Commonwealth Minister for Transport may modify the State's programme of proposed projects.
3. The Commonwealth Minister for Transport may
   (a) notify a State of the standards to be observed in connection with the construction and maintenance of national roads,
   (b) notify a State of the order in which work in connection with national roads should be carried out,

(c) after consultation with the State, notify the State of the works on national roads that the Commonwealth Government considers necessary to be carried out.

Roads Grants Act

1. The Commonwealth Minister for Transport may require a State to submit programmes of work of a specific kind for his approval.
2. The Commonwealth Minister for Transport may require a State to submit programmes of work on the construction of roads designated as "urban arterial roads" to include all projects whether they are to be financed from Commonwealth, State or local authority funds.
3. If the Commonwealth Minister for Transport notifies a State that he is satisfied that the State or a local authority has expended any money on the carrying out of projects on roads designated as "urban arterial roads" that were not in the programme of projects approved by the Minister, the State will be required to repay the amount received under the Act or such lesser amount as the Commonwealth Minister for Transport determines.

FUTURE MAJOR ROAD PROPOSALS IN THE METROPOLITAN AREA

During the year much progress was made by the Board in the development of a plan of its intentions for future major road projects in the Melbourne metropolitan area. The plan was being formulated as part of a review of metropolitan Melbourne's roading requirements following the tranfer to the Board of the roading responsibilities of the Melbourne and Metropolitan Board of Works on 1st July 1974.

The projects considered for inclusion in the plan would greatly improve conditions for motorists and give an improved degree of service and safety. Particular emphasis was given to projects which could be integrated with the pattern of development envisaged in Melbourne's regional planning scheme and those projects which would service the proposed growth corridors.

The proposed routes of many of the projects to be included in the plan have been known for some years. Other projects are being investigated in depth by the Board in close consultation with other relevant authorities, local municipal councils, and representatives of local communities.

Some of the major projects being considered for inclusion in the plan of intentions are:

- **Outer Ring Road**

  The route of the proposed outer ring road swings in a wide arc around Melbourne from Frankston north through Noble Park to Ringwood (the Scoresby Freeway route), thence north-west towards Greensborough (section now under investigation) where it follows the proposed F5 freeway reservation west across the northern suburbs through Broadmeadows to Keilor. The route south-west from Keilor to join the Princes Freeway West (Geelong Road) in the vicinity of Altona North has yet to be finally determined.

- **Lower Yarra Freeway — F9 Extension**

  The extension of the Lower Yarra Freeway (F9) from Graham Street, Port Melbourne to Kingsway near Grant Street would provide for three lanes of traffic in each direction. Sections of the extension would be on an elevated structure to pass over the railway lines and some local roads. Connections with St. Kilda Road via Grant Street and with appropriate arterial streets would be provided.

- **South Melbourne Arterial Routes**

  Major arterial routes in the Port Melbourne – South Melbourne – St. Kilda area would be improved to help keep through traffic out of residential areas. Routes under consideration include Graham Street – Beaconsfield Parade – The Esplanade; Kingsway – Queens Road – St. Kilda Road; Ferrars Street – Canterbury Road to connect with St. Kilda Road; and Kerferd Road – Albert Road, between Beaconsfield Parade and Kingsway.

- **Mulgrave Freeway**

  The Mulgrave Freeway would be extended westerly to Warrigal Road, Chadstone. Arterial roads in the vicinity would be improved and the need for a road connection between the Mulgrave Freeway at Warrigal Road and the South Eastern Freeway at Tooronga investigated.

- **Dandenong Road, Malvern**

  The narrow section of Dandenong Road between Glenferrie Road, Malvern and the Caulfield shopping centre would be widened to provide three lanes in each direction.

- **Bridge Road, Richmond**

  The narrow section of Bridge Road between Punt Road and Church Street would be widened to provide for three lanes of traffic each way with twin tram tracks in the centre of the road. The widened road would be similar to Bridge Road east of Church Street.

- **Eastern Freeway**

  The Eastern Freeway would be extended easterly from Bulleen Road, with high priority being given to investigation of a connection to Doncaster Road, North Balwyn as the first stage.

- **Greensborough Freeway**

  The Greensborough Freeway would be constructed north of the intersection of Greensborough Road – Watsonia Road to connect with Diamond Creek Road by-passing the Greensborough shopping centre. Construction of the Watsonia section would be co-ordinated with the duplication of the railway line between Macleod and Greensborough.

- **Hume Freeway**

  The construction of some sections of the proposed Hume Freeway from Collingwood to Craigieburn would proceed to relieve the severe congestion on roads in the Brunswick, Coburg, Reservoir and Thomastown areas.

- **Calder Freeway**

  The Calder Freeway would be constructed to by-pass the township of Keilor to serve the developing Melton and Sunbury corridors and provide a route through the suburbs for traffic to Bendigo and north-western Victoria.

- **Tullamarine Freeway**

  Lancefield Road alongside the Essendon Airport would be constructed to freeway standard to provide freeway conditions from Mt. Alexander Road, Flemington to Melbourne Airport, Tullamarine. An interchange would provide access to the Essendon Airport at English Street.

- **Western Highway, Braybrook**

  Improvements to the narrow section of the Western Highway between Geelong Road (Princes Highway West), Footscray and Ashley Street, Braybrook.

- **Mornington Peninsula Freeway**

  The section of the Mornington Peninsula Freeway from north of the Frankston Freeway terminal at Seaford to Springvale Road, Edithvale would be constructed to relieve traffic congestion on the Nepean Highway south of Mordialloc and on Wells Road, particularly in holiday periods.

- **Nepean Highway**

  The Nepean Highway between Cochrane Street, Elsternwick and South Road, Moorabbin would be widened to provide four lanes of traffic in each direction.

CONSTRUCTION OF FREEWAYS AND DUAL CARRIAGEWAY ROADS

Once again the Board's construction programme was severely hampered because of limited finance. Notwithstanding this the Board was able to complete the construction of 32 km (20 miles) of additional dual carriageways on freeways and State highways during the year. This increased the total length of dual carriageways on freeways, State highways and main roads to 603 km (375 miles).

The more important dual carriageway projects completed or in progress during the year are briefly described below:

Calder Freeway, Keilor East

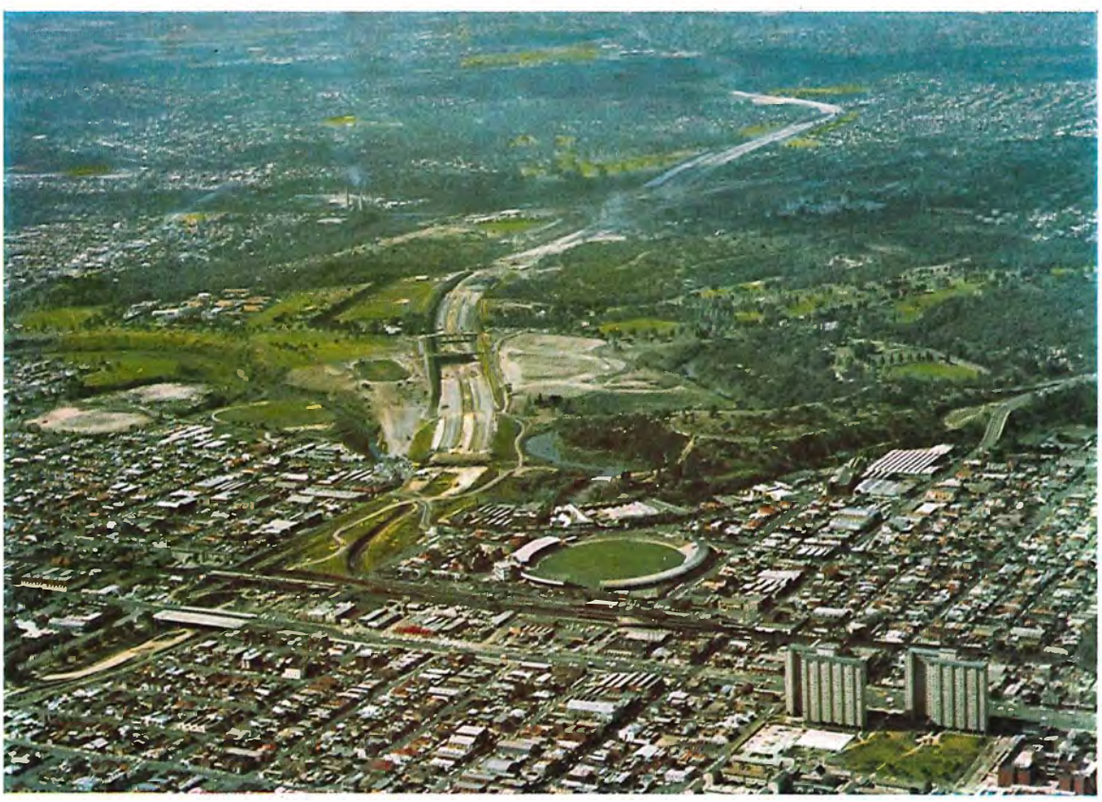
The Calder Freeway, between The Avenue and Erebus Street, Keilor East, was opened to traffic in December 1974.

The project, costing $2.5 million, is a 2 km extension of the existing Calder Freeway, which connects to the Tullamarine Freeway at Lancefield Road, Essendon.

The Calder Freeway at Keilor East.

Eastern Freeway

The construction of the Eastern Freeway between Hoddle Street, Collingwood and Bulleen Road, Bulleen, a distance of 9 km, commenced in 1971 under the supervision of the Melbourne and Metropolitan Board of Works and was taken over by the Country Roads Board on 1st July 1974.



The Eastern Freeway under construction.

This section of the freeway will be generally of eight-lane capacity with a ten-lane capacity between the Merri Creek and the Chandler Highway interchange. The central reservation is designed to cater for a fixed rail public transport system in the median to serve East Doncaster area.

Hoddle Street, Belford Road and Burke Road overpasses over the freeway were opened to traffic during the year and work on the freeway carriageways progressed satisfactorily. The freeway is expected to be operational in 1977.

The total cost of this first section of the Eastern Freeway, including provision of the central reservation for public transport, is estimated to exceed $80 million.

Frankston Freeway

Construction continued on 2.5 km of the Frankston Freeway between Eel Race Road and Armstrongs Road, Seaford.

This section is expected to be completed by mid-1977 at an estimated cost of $0.65 million.

Hume Freeway, Wallan to Broadford

Construction continued over the whole length of the 34.1 km of four-lane freeway from south of Wallan to north of Broadford.

In March 1975 traffic using the Hume Highway was transferred to completed sections of the Wallan and Broadford interchanges to allow connections between the highway and the new freeway carriageways to be constructed.

Bridge structures were completed at the Wandong, Glenelgin and Strath Creek Road interchanges, the North Eastern railway, the Kilmore East-Wandong Road, McDonalds Road and Mia Mia Road.

Construction of the freeway commenced in January 1972 and is expected to be completed in early 1976, at an estimated cost of $33.8 million.

Hume Highway, Wodonga

Work on widening the Lincoln Causeway between Wodonga and the State border at the Murray River proceeded satisfactorily and should be completed late in 1975. Two lanes in each direction will be provided for traffic.

The works include the widening of five bridges. The estimated cost of the project is $2 million.

Providing for dual carriageways on the Lincoln Causeway (Hume Highway) between Wodonga and the Murray River

Mornington Peninsula Freeway

The section of Mornington Peninsula Freeway between the Nepean Highway, Dromana and Jetty Road, Rosebud was completed with the opening of the Kangerong

Avenue overpass, Dromana in July 1975. This 8 km section of freeway cost more than $7 million.

When completed the Mornington Peninsula Freeway will extend from the Frankston Freeway, north of Frankston to Canterbury Jetty Road, Blairgowrie.

Mulgrave Freeway

Work advanced satisfactorily on the construction of 3.5 km of the Mulgrave Freeway between Springvale Road, Mulgrave and Forsters Road, Mount Waverley and on the earthworks along the adjoining section to Stanley Avenue, East Oakleigh. The section of freeway between Springvale Road and Forster Road is expected to be completed early in 1977.

Stephensons Road overpass across Scotchmans Creek and the Mulgrave Freeway was opened to traffic in June 1975. Construction proceeded on the bridge structures at Ferntree Gully Road, Blackburn Road, Forster Road and Stanley Avenue.

Princes Freeway West (Geelong Road)

Work progressed on the widening of the Princes Freeway to three lanes in each direction from the Lower Yarra Freeway to the Maltby By-pass Road near Werribee, a distance of 12 km. The project is estimated to cost $4.1 million. The first section from the Lower Yarra Freeway to Point Cook Road is scheduled for completion in December 1975.

The Princes Highway is also being widened to three lanes in each direction between McDonalds Road and the Old Geelong Road, Brooklyn. This work is scheduled for completion in early 1976 and is estimated to cost $0.55 million.

South Gippsland Freeway

Construction works continued on the southerly extension of the South Gippsland Freeway from the Princes Highway East to the South Gippsland Highway at Hampton Park.

Bridges across the Gippsland railway line and the Hallam Main Drain were completed during the year.

This section of freeway is expected to be completed early in 1977.

South Gippsland Highway

Construction of dual carriageways of the South Gippsland Highway, between Cranbourne and the South Gippsland Freeway construction works at Hampton Park, a distance of 17 km, was completed.

A new overpass at the Y-junction of the South Gippsland Highway and the Bass Highway was almost completed at the end of the year. The estimated cost of the intersection improvements is $1 million.

Dual carriageways constructed on the South Gippsland Highway.

Western Freeway, Myrniong

The construction of 5.8 km of freeway to by-pass the township of Myrniong is expected to be opened to traffic in October 1975 at an estimated cost of $3 million.

The project will connect the Pentland Hills and the Pykes Creek sections of the Western Freeway.

Work in progress on the Western Freeway (Myrniong Section).

Nepean Highway, Mentone

Work progressed on the widening of the Nepean Highway to three lanes in each direction between Centre Dandenong Road, Cheltenham and Lower Dandenong Road, Mentone.

The widening of the highway is estimated to cost $1.3 million and is scheduled for completion in September 1975.

High Street, St. Kilda

During the year the major works involved in the reconstruction and widening of High Street, St. Kilda between Carlisle Street and the St. Kilda Junction were substantially completed and opened to traffic.

Widened and reconstructed section of High Street, St Kilda.

The project included the construction of approximately 1.9 km of dual carriageways, each of four traffic lanes, and the relocation of the tram tracks. The estimated cost of the project is $11.2 million. The work was commenced under the supervision of the Melbourne and Metropolitan Board of Works in 1973.

The new dual carriageways replace the old narrow bottleneck section of High Street, providing continuous dual carriageways between the St. Kilda Junction and Carlisle Street. In conjunction with this work the section of Punt Road northerly from St Kilda Junction to Raleigh Street was also reconstructed with dual carriageways.

Hoddle Street

The widening of Hoddle Street, Collingwood between Victoria Parade and Alexandra Parade was completed during the year to provide dual carriageways each of four traffic lanes. The work included the construction of an eight-lane overpass to carry Hoddle Street over the Eastern Freeway.

The Hoddle Street-Punt Road route between Clifton Hill and St. Kilda is one of Melbourne's major arterial routes by-passing the central Melbourne area and will become one of the major feeder routes to the Eastern Freeway.

In the past, with traffic restricted to two lanes in each direction, an average of 22,500 vehicles used Hoddle Street between 7.00 a.m. and 7.00 p.m. each week day. Traffic volumes are expected to further increase on the opening of the Eastern Freeway.

Traffic signals at the various intersections with Hoddle Street will be synchronized to improve traffic flow.

The total cost of widening this section of Hoddle Street, including land acquisition, is estimated to be $8.7 million.

The work was commenced by the Melbourne and Metropolitan Board of Works in 1973 and taken over by the Board on 1st July 1974.

Dual carriageways provided on Hoddle Street, Collingwood.

Johnson Street Bridge — South Melbourne City

Work on the construction of the Johnson Street bridge and its approach roads commenced under contract in January 1975.

This new crossing of the Yarra River is located approximately 0.7 km downstream of the Spencer Street bridge and will consist of dual four-lane structures. The approaches will connect the bridge to Footscray Road at Mountain Street on the north side of the river, and Lorimer, Montague and Brady Streets on the south side of the river.

The works are designed to be compatible with the proposed freeway F9 connecting West Gate Bridge approaches with Kingsway and St. Kilda Road.

The construction of the new bridge will prevent shipping access to wharves and dry dock facilities upstream. Replacement wharves have therefore been constructed in Victoria Dock, and the Duke's and Orr's dry dock will be replaced by a floating dry dock purchased in Germany and located downstream of the new bridge at a mooring facility in the Interstate Swinging Basin.

The bridgeworks and the necessary road approaches are expected to be complete by late 1977 at an estimated total cost of approximately $30 million.

USAGE OF ROADS

In August 1974 the Commonwealth Bureau of Statistics conducted a survey throughout Australia to obtain among other things, information about the means by which persons travel to work and students travel to school, university, or other type of educational institution.

The findings of the study indicated a large increase in the percentage of persons travelling by car to work and to educational institutions since 1970. The findings of the survey are consistent with the results of the Board's traffic counts. The convenience of motor car travel and the need for most people in the community to have access to a motor car for recreational, shopping and emergency purposes as part of the community's desire for an improving standard of living are no doubt reflected in the findings of the survey.

Works to improve the intersection of Power Street, Riversdale Road, and Wallen Road were carried out by the City of Hawthorn with financial assistance from the Board.

The main features of the survey relating to Victoria as published by the Bureau were:

(a) persons who travel to work:

- in August 1974, of the 1,295,000 persons who travelled to work, more than two out of every three (890,000) travelled by car and only one in five (259,000) used public transport.
- between May 1970 and August 1974, the percentage of persons travelling to work by car increased from 58.0 to 65.7 in Melbourne and from 71.8 to 80.0 in other areas.
- in the same period the proportion of persons using public transport in Melbourne fell from 30.9% to 24.4% and in other areas from 6.7% to 3.4%.

(b) students who travel to school, university, etc:

- In August 1974, 821,000 students travelled to school, university, etc., 197,000 using public transport and 186,000 travelling by car.
- public transport was used by 20.4% of students in Melbourne and 32.3% of students in other areas.
- between May 1970 and August 1974, the percentage of students travelling by car increased from 15.7 to 23.1 in Melbourne and from 16.5 to 21.4 in other areas.

ROAD PLANNING STUDIES

The need to undertake road planning studies in which community attitudes have every opportunity of being considered is recognised by the Board as an essential factor in investigating requirements for particular road improvements, especially in urban areas. The social and environmental impacts of road proposals are receiving more detailed consideration than at any period in the Board's history.

Ringwood Roads Impact Study

The Ringwood Roads Impact Study was commenced in September 1974 with the objective of investigating the effects of four alternative road proposals on the environment, the community structure and aesthetic enjoyment of the Ringwood-Donvale-Mitcham area. Three of the alternatives involved the construction of a freeway or major road and the fourth alternative was restricted to the improvement of road services by traffic management and minor intersection works.

The factors being examined in the study include:

- the effect on open space, historical buildings and residents in the areas under study,
- the number of properties that may have to be acquired and the ability of the residents affected to be relocated both physically and socially,
- landscape quality and vistas, and the ecology of the study area; and
- the bands of likely noise and atmosphere pollution, and positive remedial measures that could be adopted.

Reconstructed and realigned section of the Goulburn Valley Highway between Trawool and Kerrisdale.

The consultant engaged by the Board to carry out the study obtained views and suggestions from municipal councils, community groups and interested individuals. Because of a possible conflict of interests of a principal of one of the sub-consultants engaged in sociological aspects of the study, an independent Board of Review was appointed to review the work already carried out by the sub-consultant. In summary, the Board of Review found that the work that had been done on the sociological aspects of the study constituted a proper basis for a reasonable and objective assessment of the alternatives under consideration.

The adjacent section of the Eastern Freeway corridor between Thompsons Road, Bulleen and Mitcham Road, Donvale was being examined by the Melbourne and Metropolitan Board of Works for transportation improvements. In June 1975 the State Government directed that this study and the Ringwood study be combined. The management committee for the combined study includes representatives of the Ministry of Transport, Ministry of Planning, Ministry of Conservation, Melbourne and Metropolitan Board of Works, and the Country Roads Board. To assist the management committee Mr H. Watt, who has had extensive experience in the management field, has been appointed as an independent study manager.

Geelong Transportation Study

The Geelong Transportation Study was completed in 1972/73 and the consultants recommended three alternative road improvement proposals. The first alternative involved only those new arterial roads which were already envisaged in the Geelong Town Plan. The second alternative was based on a north-south freeway by-passing the urban centres to the west, and the third alternative was for a central freeway which would attract the maximum possible proportion of the local traffic demand.

A further study of the environmental and social benefits and costs of these alternatives was undertaken by the Geelong Regional Planning Authority with financial assistance from the Cities Commission and the Board. The Board also provided technical support concerning design feasibility and estimates of traffic, and was represented on the Technical Advisory Committee. The Study incorporated an extensive community involvement programme and the findings were recently made available to the public.

The Board has been requested by the Geelong Regional Planning Authority to comment on the findings and the discussion papers prepared by the consultants.

Ballarat Transportation Study

The consultant's final report on the Ballarat Transportation Study was released in December 1971. The recommendations generally provided for a freeway by-pass north of Ballarat to cater for traffic not destined for the city, the development of a by-pass through the northern suburbs and improvements in and near the central area.

The Board accepted responsibility for planning the freeway by-pass and design is in progress to ensure that residential and industrial development will be clear of the freeway. Ballaarat City Council has also undertaken to control development along the line of the by-pass through the northern suburbs.

A traffic management study including a public meeting concerning the central Ballarat area, which was commenced by the Board during 1973/74, was completed in financial year 1974/75. The Board and Ballaarat City Council held detailed discussions on the basis for future road planning and traffic management in the central city area.

The Western Highway, reconstructed to provide dual carriageways at Ballarat West.

Western Highway Corridor

The need for improvements in the Western Highway corridor in Sunshine City was the subject of detailed investigation during the year.

The results of the Board's investigation were summarised in a report and publication entitled "Road Planning Report, Western Suburbs, Sunshine–St Albans Area". The report contained information about the social, economic and physical structure of the corridor; road transportation needs at present and in 1990; road transportation improvement proposals including a comparison of five alternative alignments in the proposed Western Freeway corridor evaluated on the factors of community impact, traffic and accessibility, cost and economic impact; and further studies of the arterial road system in the corridor, integrated with other transportation systems.

The Sunshine City Council expressed opposition to the Board's suggested freeway route and employed a consultant to obtain independent advice. The consultant's report to the Council questioned the need for a freeway in this area, but concluded that if a freeway were to be provided it should be located along a southern route mentioned in the Board's report. The consultant's report is being examined by the Board.

MEDIAN SAFETY BARRIER WALL

A new type of median barrier wall designed to more safely protect traffic from out of control vehicles travelling in the opposite direction has been built by the Board along a section of the Princes Freeway (Geelong Road) near Laverton.

The wall will also reduce the severity of injury to the occupants of out of control vehicles. Head-on collisions, or side-swiping across the centre of the roadway, are virtually eliminated by the barrier.

The barrier wall, between 80 cm (32 inches) and 150 cm (60 inches) high, is made of solid concrete specially shaped to redirect vehicles back on to the carriageway on which they are travelling should they run off course and strike the wall. The shape is designed so that initially, only the tyres of the vehicle running off course strike the wall and are redirected towards the roadway. Tyres and vehicle suspension thus absorb much of the shock of impact, reducing the severity of damage to the vehicle.

The Board proposes to build similar barrier walls on some other busy highways and major roads where the relatively narrow width of the roadway reservation makes it impossible to provide wider medians.

Section of median barrier wall built along the Princes Freeway near Laverton.

The Board imported a special self-propelled concrete forming machine, the first of its type in Australia, to build the barrier walls efficiently and economically. The new machine, costing approximately $100,000 is capable of forming median barrier walls of up to 1.8 metres (70 inches) in height. It can also be used to form concrete bridge parapets and kerb and channelling and to line open drains. Completely automated, it is capable of forming more than 500 metres (550 yards) of median barrier wall 80 cm (32 inches) high per day.

Electronic sensors following a preset line automatically control the direction of the machine and its elevation above the ground to produce a barrier wall in the required position and of the required height.

Pre-mixed concrete is fed into a hopper at the front of the machine and lifted into a silp-form, called a 'mule', mounted under the machine. The concrete is then compacted by internal and surface vibration. As the machine moves forward the concrete is slip-formed through the mule to form the median barrier wall.

Even after severe impact, damage to the new barrier walls is minimal, thus reducing both maintenance costs and the period when the road must be partly closed whilst repairs are made.

PRICE ADJUSTMENT CLAUSES

During the year the Board found it necessary to depart from its long established practice of entering into fixed price contracts. Price adjustment clauses were included in new contracts entered into by the Board subsequent to August 1974.

Prior to August 1974, the Board's contracts did not include price adjustment clauses and it was left to the contractors to allow for expected price escalations in their tender prices. Many representations were received by the Board from contractors for financial relief as a direct result of the unprecedented rises in costs of labour and materials.

Reconstructed section of the Calder Highway providing dual carriageways in Bendigo City.

The risks involved in tendering on a fixed price basis in such an inflationary climate were far beyond those normally required to be taken into calculations by contractors. For these reasons the Board decided to include price adjustment clauses in its contracts.

The formula used by the Board in its price adjustment clauses for road and bridge construction contracts involved the use of a labour index and a material index. The "Adult Males Index Number for the Building and Construction Industry Group for Victoria" published by the Commonwealth Bureau of Statistics was selected for the

labour index and the "Wholesale Price Index of Materials Used in Building Other Than House Building — Special Purpose Index Group for Melbourne" was selected for the materials index. Price adjustments are made in relation to the completed work for the period concerned on the basis of 35% of labour cost increases as disclosed by the labour index and 45% of materials cost increases as disclosed by the materials index.

CHANGE IN MEMBERS OF BOARD

Retirement of Mr J. D. Thorpe

Mr J. D. Thorpe, C.E., F.I.E. Aust., M.I.T.E. (U.S.), F.C.I.T. retired as Deputy Chairman of the Board on 10th January 1975, after 49 years service.

Mr Thorpe joined the Board in 1926 as a junior clerk and transferred to the engineering staff as a junior engineering assistant the following year. He qualified as an engineer in 1933.

During his long and distinguished career with the Board Mr Thorpe held many positions including Assistant Asphalt Engineer, Assistant Divisional Engineer – Dandenong, and Assistant Highways Engineer. In 1956 he was seconded to the Traffic Commission and became the Commission's first Chairman. In 1968 Mr Thorpe returned to the Board as Board Member and was appointed Deputy Chairman in 1971.

As Chairman of the Traffic Commission for 12 years Mr Thorpe took a prominent part in the preparation of the Victorian Road Traffic Regulations, the setting up of the State Accident Record System, the Metropolitan Route Marking System and the Clearway System, as well as the preparation of standards for the design and use of traffic control signals and road signs in use in Victoria.

Mr T. H. Russell appointed as Deputy Chairman

Following Mr Thorpe's retirement Mr T. H. Russell, M.Eng.Sc., B.C.E., Dip.C.E., C.E., F.I.E.Aust. was appointed Deputy Chairman of the Board.

Mr Russell joined the Board's staff in January 1943 as a Diplomate Engineer and has held the positions of Assistant Divisional Engineer – Traralgon, Assistant Engineer for Plans and Survey, Assistant Bridge Engineer, Deputy Chief Engineer – Bridges, Deputy Chief Engineer, and Chief Engineer. In 1971 he was appointed as Board Member.

Mr W. S. Brake appointed as Board Member

Following the appointment of Mr T. H. Russell as Deputy Chairman of the Board, Mr W. S. Brake, B.C.E., C.E., M.I.E.Aust. was appointed as Board Member.

Mr Brake joined the Board's Bairnsdale Division in 1949 after completing his Civil Enginering Degree at the University of Melbourne. Between 1953 and 1958 he served in Benalla and Dandenong Divisions and later held the positions of Assistant Divisional Engineer – Dandenong, Assistant Deputy Chief Engineer – Road Design, Deputy Chief Engineer – Road Design, Deputy Chief Engineer, and Chief Engineer.

TRANSFER OF PERSONNEL FROM MELBOURNE AND METROPOLITAN BOARD OF WORKS

On 1st July 1974, the Metropolitan Bridges Highways and Foreshores Act No. 8573 came into effect and the Board became the principal road construction authority for the State by assuming responsibility for the design and construction of those metropolitan roads and bridges which were formerly under the control of the Melbourne and Metropolitan Board of Works.

The legislation also provided the opportunity for M.M.B.W. staff engaged on roadworks to transfer to the Board without loss of status or adverse effect on their previous conditions of employment. On 1st July 1974, 213 personnel made up of 114 salaried staff and 99 field employees transferred to the Board.

Salaried officers were absorbed into the establishments of the following areas within the Board:

Bridge Sub-branch	35
Materials Research Division	1
Metropolitan Division	3
Plans and Surveys Division	33
Road Planning Division	12
Traffic Engineering Division	9
Urban Projects Sub-branch	18
Metropolitan Transportation Committee (seconded)	1
Estates Section	2

Field employees were incorporated into the establishment of the Urban Projects Sub-branch, Metropolitan Division, Materials Research Division and Central Depot Store, Syndal.

The Urban Projects Sub-branch is a new Sub-branch created in July 1974 and staffed initially mainly by officers transferring from the M.M.B.W. to administer the planning, design and construction of specific major projects in the metropolitan urban area. The Sub-branch is headed by Mr V. R. Moll who has the title of Chief Urban Projects Engineer.

The Board greatly appreciates and welcomes the skill, expertise and technical knowledge possessed by the officers and employees who transferred from the Melbourne and Metropolitan Board of Works and is proud that these personnel have now joined the Board's work force.

FINANCE

After deducting the cost of collecting revenue received under the Motor Car Act, the the total funds available for expenditure by the Board during the year, including the allocation from the Roads (Special Projects) Fund, was $166,626,355. The funds were derived from:—

State sources	$ 86,817,945
Commonwealth sources	78,976,800
Balance brought forward from year 1973/74	831,610
	$166,626,355

RECEIPTS

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

A. 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 to the Roads (Special Projects) Fund).

2. Registration Number Plate Fees:

   Fees payable for the provision and/or replacement of number plates less the costs of providing the plates and collecting the fees.

3. Examiners' Licence Fees:

   Fees payable by persons licensed to conduct motor car roadworthiness examinations, less cost of collection of the fees.

4. Authorized Log Book Fees:

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

5. Learner Driver Permit Fees:

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

6. Drivers' Licence Testing Fees:

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

7. Motor Car Drivers' Licence Fees and Tractor Drivers' Licence Fees:

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

8. Motor Driving Instructors' Appointment and Testing Fees:

   Fees payable by candidates for Motor Driving Instructors' Licences, less cost of collection of the fees.

9. Motor Driving Instructors' Licence Fees:

   One-quarter of the fees payable for the issue of Motor Driving Instructors' Licences less one-quarter of the 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 on a highway 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 a proprietor of a motor car or trailer of repossession of the item under a hire purchase agreement, bill of sale or like instrument, less the costs of collection of the fee.

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

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

14. Municipal payments on account on main road works.

15. Special moneys appropriated by Parliament.

16. Loan Money.

17. Allocation from Roads (Special Projects) Fund.

Sealing the deck of the new bridge over Wattle Tree Creek on the Gelantipy Road, Tambo Shire.

B. Commonwealth Sources:

1. Receipts under the National Roads Act 1974, Roads Grants Act 1974, and Transport (Planning & Research) Act 1974.

2. Commonwealth grant for general employment purposes.

3. Grant towards Traffic Engineering and Road Safety Improvements.

The following table shows the funds available to the Board for the construction and maintenance of roads in 1974/75 compared with 1973/74:—

Item	1973/4		1974/75	
	$	$	$	$
RECEIPTS FROM STATE SOURCES				
Fees under the Motor Car Act less cost of collection	37,537,474		41,984,641	
Less: Payment to —				
(a) Interest and Sinking Fund	2,618,683		2,688,496	
(b) Research Grant — Melbourne University	4,000		—	
(c) Traffic Authority Fund	354,278		375,375	
(d) Tourist Fund	708,555		750,749	
(e) Transport Regulation Fund	584,684		621,528	
		33,267,274		37,548,493
Commercial Goods Vehicle Act		10,358,795		10,037,593
Municipalities Contributions		2,135,534		2,047,269
Loan Funds		300,000		300,000
Special Grant from State Treasury		568,162		772,371
General Receipts		860,433		1,247,398
Allocation from Roads (Special Projects) Fund		7,643,373		30,428,673
		55,133,571		82,381,797
Balance B/Fwd at 1st July		1,895,804		831,610
		57,029,375		83,213,407
RECEIPTS UNDER COMMONWEALTH AID ROADS ACT 1969				
Urban Arterial Roads		32,492,478		
Rural Arterial Roads		4,870,000		
Rural Other Roads		16,910,000		
Planning and Research		990,000		
		55,262,478		
RECEIPTS UNDER COMMONWEALTH GRANTS				
Regional Employment Development Scheme				133,583
Traffic Engineering and Road Safety		11,106		172,217
General Employment Purposes				3,000,000
		11,106		3,305,800
RECEIPTS UNDER NATIONAL ROADS ACT 1974				
National Highways				18,920,000
RECEIPTS UNDER ROAD GRANTS ACT 1974				
Urban Arterial Roads				35,890,000
Urban Local Roads				1,670,000
Rural Arterial Roads				4,150,000
Rural Local Roads				13,160,000
Minor Traffic Engineering and Road Safety Improvements				640,000
				55,510,000
RECEIPTS UNDER TRANSPORT (PLANNING AND RESEARCH) ACT 1974				1,241,000

Total funds available for expenditure by the Country Roads Board		112,302,959		162,190,207
Less: Expenditure on Planning and Research	1,035,694		2,204,749	
Capital Expenditure (Plant, Workshops, Offices, etc.)	1,680,563		2,589,526	
Salaries, Operating A/cs and Other Admin. Expenditure	16,206,533		21,431,592	
		18,922,790		26,225,867
Funds available for construction and maintenance of roads and bridges		93,380,169		135,964,340
The following amounts were allocated to the Melbourne and Metropolitan Board of Works for expenditure on roads in 1973/74:				
(1) Roads (Special Projects) Fund		12,115,037		
(2) Commonwealth Aid Road (Urban Arterial) Fund		10,617,678		
		22,732,715		
TOTAL		$116,112,884		$135,964,340

EXPENDITURE

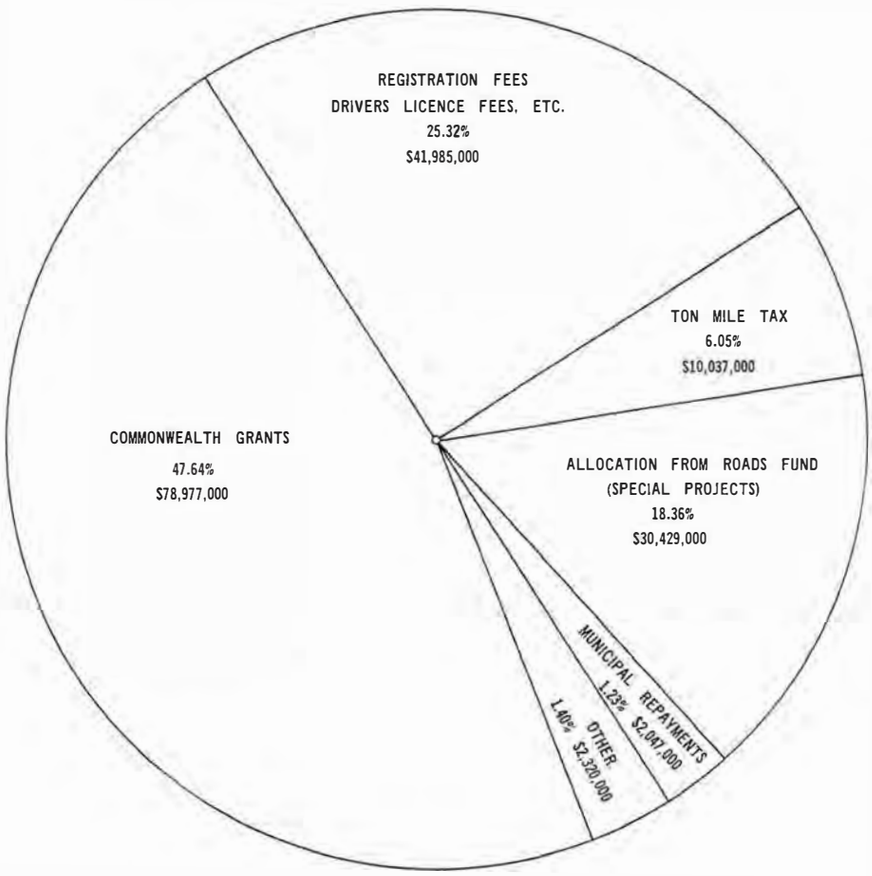
Expenditure in the form of cash payments during the financial year amounted to $165,969,127 leaving balances of $657,228 to be carried forward into financial year 1975/76.

The following table shows expenditure incurred by the Board, including that from the Roads (Special Projects) Fund, in the years 1973/74 and 1974/75.

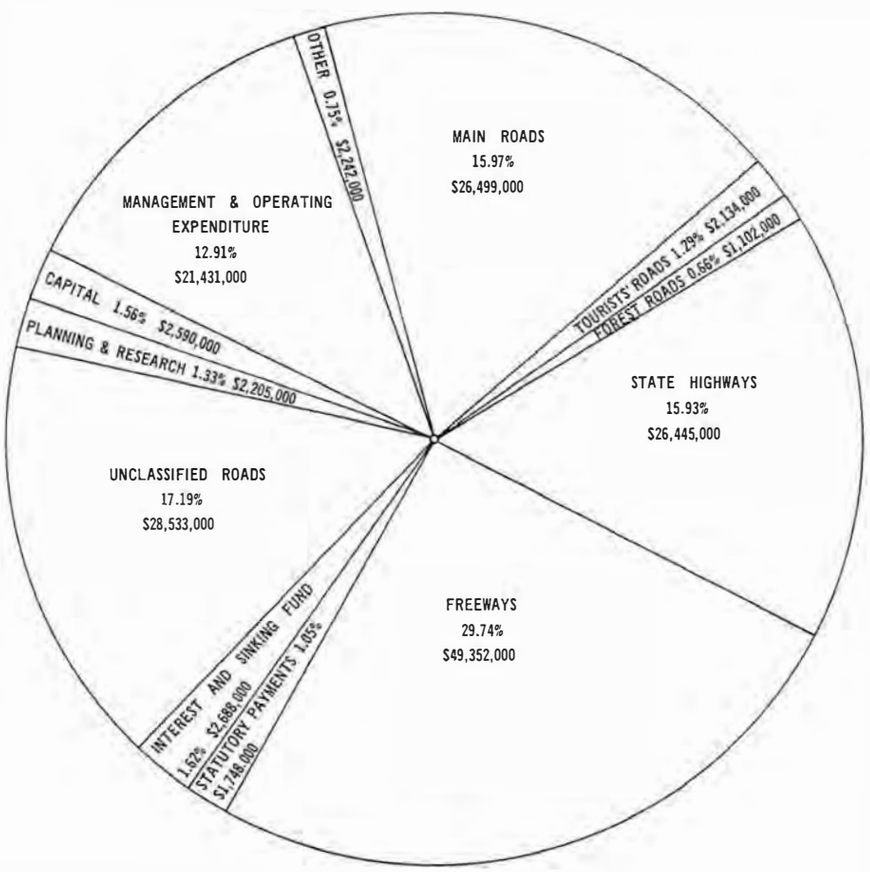
Item	1973/74	1974/75
	$	$
Construction and maintenance of roads and bridges	92,548,559	135,307,111
Capital expenditure (plant, workshops, offices, etc.)	1,680,563	2,589,527
Planning and Research	1,035,694	2,204,749
Salaries, operating accounts and other administrative expenditure	16,206,533	21,431,592
Statutory payments to Traffic Authority Fund, Transport Regulation Fund and Tourist Fund	1,651,517	1,747,652
Interest and Sinking Fund Payments	2,618,683	2,688,496
SUB-TOTAL	115,741,549	165,969,127
Expenditure by Melbourne and Metropolitan Board of Works from Commonwealth Aid Road funds and the Roads (Special Projects) Fund	22,732,715	—
TOTAL	$138,474,264	$165,969,127

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.



RECEIPTS 1974-75



EXPENDITURE 1974-75

In September 1974 expenditure on main roads in financial year 1973/74 was apportioned in accordance with the Country Roads Act, resulting in the following distribution of expenditure other than Loan Fund expenditure:

Dual carriageways constructed on the Geelong-Portarlington Road by the Bellarine Shire Council.

Expenditure from Country Roads Board Fund	$11,843,848
Expenditure from Commonwealth Aid Roads moneys	4,943,422
Expenditure from proceeds of ton/mile tax (Commercial Goods Vehicles Act)	3,354,661
TOTAL	$20,141,931
Amount of Country Roads Board Fund expenditure apportioned to councils	$1,993,317

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 1974/75 compared with 1973/74 was as follows:

	1973/74		1974/75	
	C.R.B.	Council Contribution	C.R.B.	Council Contribution
	$	$	$	$
Patrol Maintenance	2,112,282	929,251	2,200,195	937,103
Construction, Reconstruction and Other Maintenance	17,190,492	4,238,431	18,928,299	4,642,896
TOTAL	$19,302,774	$5,167,682	$21,128,494	$5,579,999

Municipal councils were not required to contribute towards the cost of works involving an expenditure during the year of $79,032,876 on State highways, freeways, tourists' roads and forest roads (including expenditure from the Roads (Special Projects) Fund).

Station Street, Box Hill South, reconstructed by the Box Hill City Council with financial assistance from the Board.

COMMONWEALTH FINANCIAL ASSISTANCE TO STATES FOR ROADS

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 being "hypothecated" for roads. This principle was retained for 33 years.

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 1964, which expired on 30th June 1969 continued this method of providing funds to the States for road construction and maintenance.

The Commonwealth Aid Roads Act 1969 covered the period from 1st July 1969 to 30th June 1974. The Act provided for the distribution to the States out of consolidated revenue over the five year period, of a total sum of $1,252,050,000 for expenditure on road construction and maintenance and on road planning and research.

From 1st July 1974 to 30th June 1977, Commonwealth financial assistance to the States for roads will be provided under the following Commonwealth Acts:

National Roads Act

This Act provides financial assistance for national roads including national highways, export roads and major commercial roads.

A national highway is a road or proposed road that in the opinion of the Commonwealth Minister for Transport is or will be the principal road linking —

(a) two or more State capitals,
(b) a State capital city and Canberra,
(c) a State capital city and Darwin,
(d) Brisbane and Cairns, or
(e) Hobart and Burnie.

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

The Hume Highway and the Western Highway are declared as national highways in Victoria.

An export road is a road or proposed road that facilitates or will facilitate trade and commerce or the development of trade and commerce with other countries.

A major commercial road is a road or proposed road that facilitates or will facilitate trade and commerce or the development of trade and commerce among the States.

No roads in Victoria were declared as export roads or major commercial roads during the year.

As at 30th June 1975 the amount allocated to Victoria under the National Roads Act for the three year period is $72,920,000 as indicated below:

The Omeo Highway, reconstructed north of Noorongong.

Year commencing	1 July 1974		1 July 1975	1 July 1976	Total
	Original	Supplementary			
	$	$	$	$	$
National Highways					
Construction	12,800,000	1,120,000	16,800,000	23,800,000	54,520,000
Maintenance	1,500,000	130,000	1,600,000	1,800,000	5,030,000
Export roads and major commercial roads					
Construction and Maintenance	3,100,000	270,000	4,800,000	5,200,000	13,370,000
	$17,400,000	$1,520,000	$23,200,000	$30,800,000	$72,920,000

Road Grants Act

This Act provides financial assistance for the following categories of roads and for minor traffic engineering and road safety improvements:

Rural Arterial Roads

Rural arterial roads are rural roads that are for the time being declared by the Commonwealth Minister for Transport to be rural arterial roads for the purposes of the Act. In general such roads are the principal highways and main roads connecting rural cities, towns and tourist areas to each other and to the system of national highways.

Developmental Roads

Developmental roads are rural roads that are for the time being declared by the Commonwealth Minister for Transport to be developmental roads for the purposes of the Act. In general such roads provide access to navigation installations, areas of mineral exploration or development, and roads opening up new tourist areas.

Rural Local Roads

Rural local roads are rural roads that are not national roads, rural arterial roads, developmental roads or beef roads

Urban Arterial Roads

Urban arterial roads are roads in an urban area that are for the time being declared by the Commonwealth Minister for Transport to be urban arterial roads or urban sub-arterial roads for the purposes of the Act. In general such roads carry the greatest volumes of traffic and the highest proportions of heavy vehicles.

Urban Local Roads

Urban local roads are roads in urban areas that are not national roads or urban arterial roads.

Beef Roads

Beef roads are rural roads that are for the time being declared by the Commonwealth Minister for Transport to be beef roads for the purposes of the Act.

Minor Traffic Engineering and Road Safety Improvements

Improvements under this heading include

(a) works for the purpose of regulating the movement of persons or vehicles on a road, and

(b) works designed to promote the safety of persons using a road. "Urban area" in Victoria means an area designated for the purposes of the Census taken in the year 1971 as —

Melbourne Statistical Division
Geelong Statistical District
Urban Ballarat
Urban Bendigo

"Rural road" means a road or a proposed road not in an urban area.

The following table shows the amounts allocated as at 30th June 1975 to the State of Victoria under this Act —

Year commencing	1 July 74		1 July 75	1 July 76	Total
	Original	Supplementary			
	$	$	$	$	$
Construction of Rural Arterial and Developmental Roads	3,700,000	450,000	3,000,000	2,800,000	9,950,000
Construction and maintenance of Rural Local Roads	12,100,000	1,060,000	5,100,000	4,700,000	22,960,000
Construction of Urban Arterial Roads	33,000,000	2,890,000	38,100,000	38,100,000	112,090,000
Construction of Urban Local Roads	2,000,000	170,000	3,200,000	4,600,000	9,970,000
Minor Traffic Engineering and Road Safety Improvements	1,500,000		2,100,000	2,600,000	6,200,000
	$52,300,000	$4,570,000	$51,500,000	$52,800,000	$161,170,000

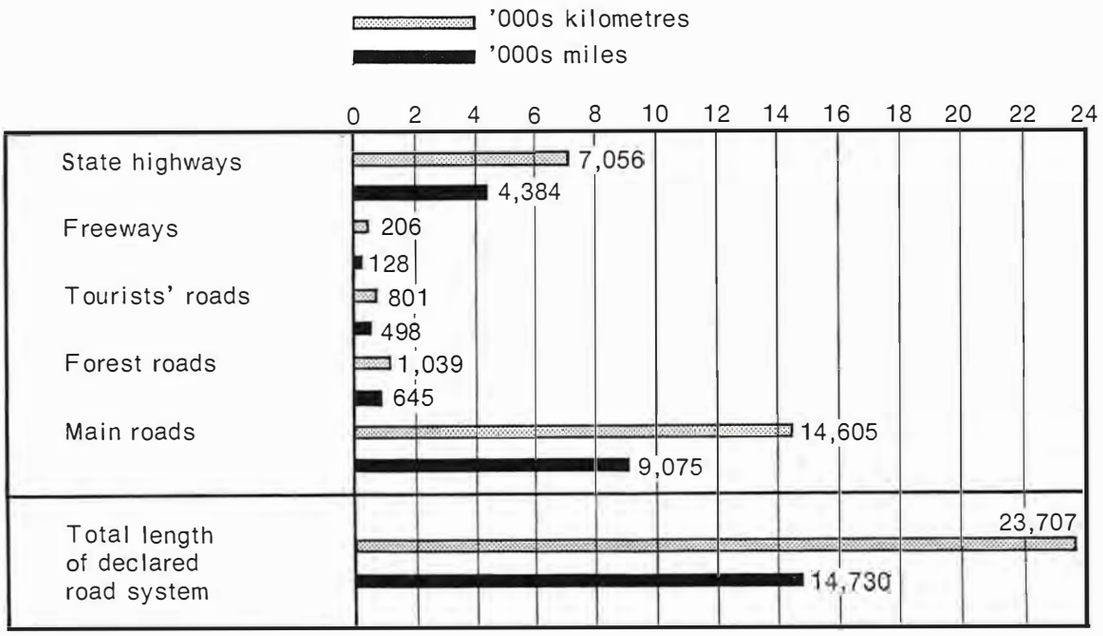
Each State is required each year to expend from its own resources on road construction and maintenance a "quota". Where, over the period of the operation of the Act, the amount of the quota exceeds the amount which a State has expended from its own resources the State shall pay to the Commonwealth an amount equal to the excess or such lesser amount as the Commonwealth Treasurer determines.

As at 30th June 1975 the quotas for Victoria were —

Year commencing	1 July 74	1 July 75	1 July 76	Total
	$	$	$	$
	83,300,000	93,700,000	104,200,000	281,200,000

THE DECLARED ROAD SYSTEM

The total length of roads declared or proclaimed in Victoria under the Country Roads Act was 23,707 kilometres (14,730 miles) as at 30th June 1975.



Apart from alterations consequent upon the newly completed sections of freeways and deviations from existing declared or proclaimed roads the Board's declared and proclaimed road network was not altered during the year.

The Board has on hand from municipal councils throughout the State a large number of applications for the declaration or proclamation of additional State highways, main roads, tourists' roads and forest roads. However, the funds available are insufficient to enable the Board to accept any further statutory financial responsibilities which would accrue from the extension of the declared road system. The applications have been recorded and will be considered when the Board's financial position permits.

Section of the Northern Highway reconstructed at Tooborac.

C

STATE HIGHWAYS

State highways are the principal arteries forming interstate connections and links between the larger centres of population in the State. Some State highways in Victoria form part of the National Route system of highways with uniform route numbering throughout Australia.

The Board bears the full cost of both construction and maintenance works required to meet the needs of through traffic.

The total length of State highways was reduced by approximately 4 km during the year, due mainly to the declaration of certain sections as freeways.

The total expenditure of $26,445,000 on Victoria's 32 State highways during the year included an amount of $2,003,000 made available from the Roads (Special Projects) Fund.

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

The Hume Highway and the Western Highway were declared by the Commonwealth Minister for Transport as national highways under the provisions of the Commonwealth National Roads Act. These declarations permitted funds made available under the Commonwealth National Roads Act to be spent on the Hume Highway and the Western Highway. During the year $15,597,000 from Commonwealth sources and $2,339,000 from State sources was spent on these two State highways.

FREEWAYS

A freeway is a road having dual carriageways with no direct access from adjoining properties and side roads. All crossings of a freeway are by means of overpass or underpass bridges, and traffic enters or leaves the freeway carriageway by means of carefully designed ramps.

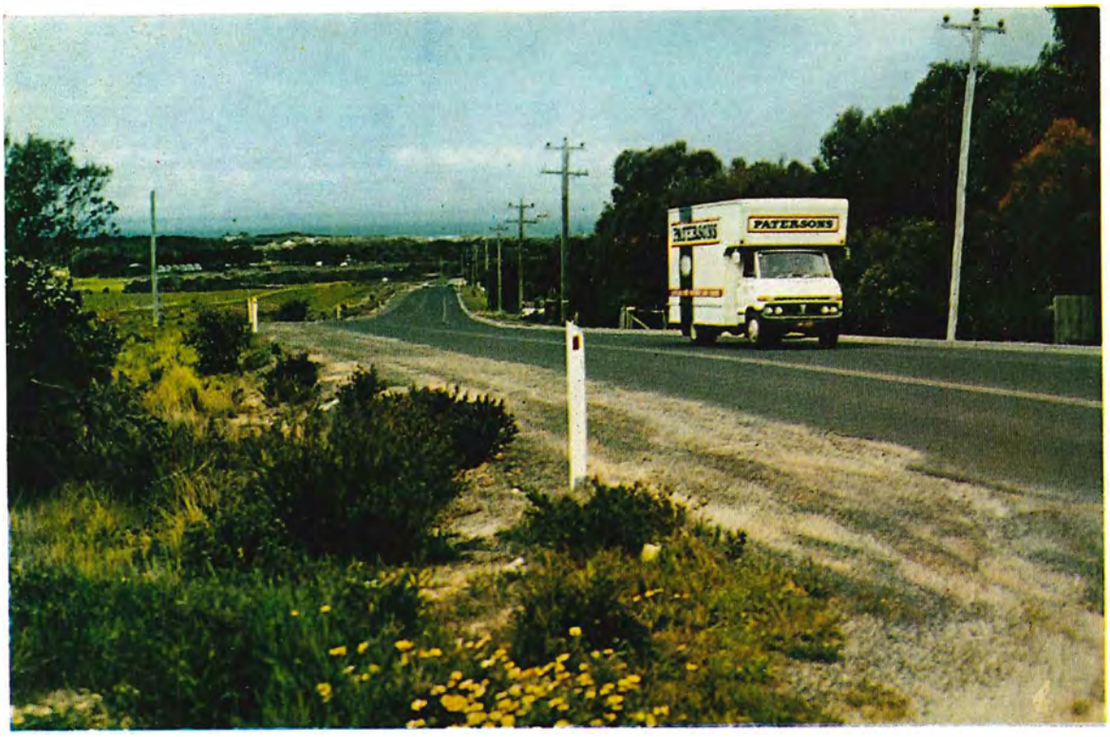
The Board bears the total cost of all work on freeways. The total expenditure of $49,352,000 on freeways during the year included an amount of $16,258,000 made available from the Roads (Special Projects) Fund.

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

The Frankston Freeway under construction south of Eel Race Road, Seaford.

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.



Reconstructed section of the Great Ocean Road west of Torquay.

Details of the more significant works carried out on tourists' roads during the year are listed in Appendix 3.

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

FOREST ROADS

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

Appendix 3 lists the more important works completed during the year.

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

MAIN ROADS

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

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

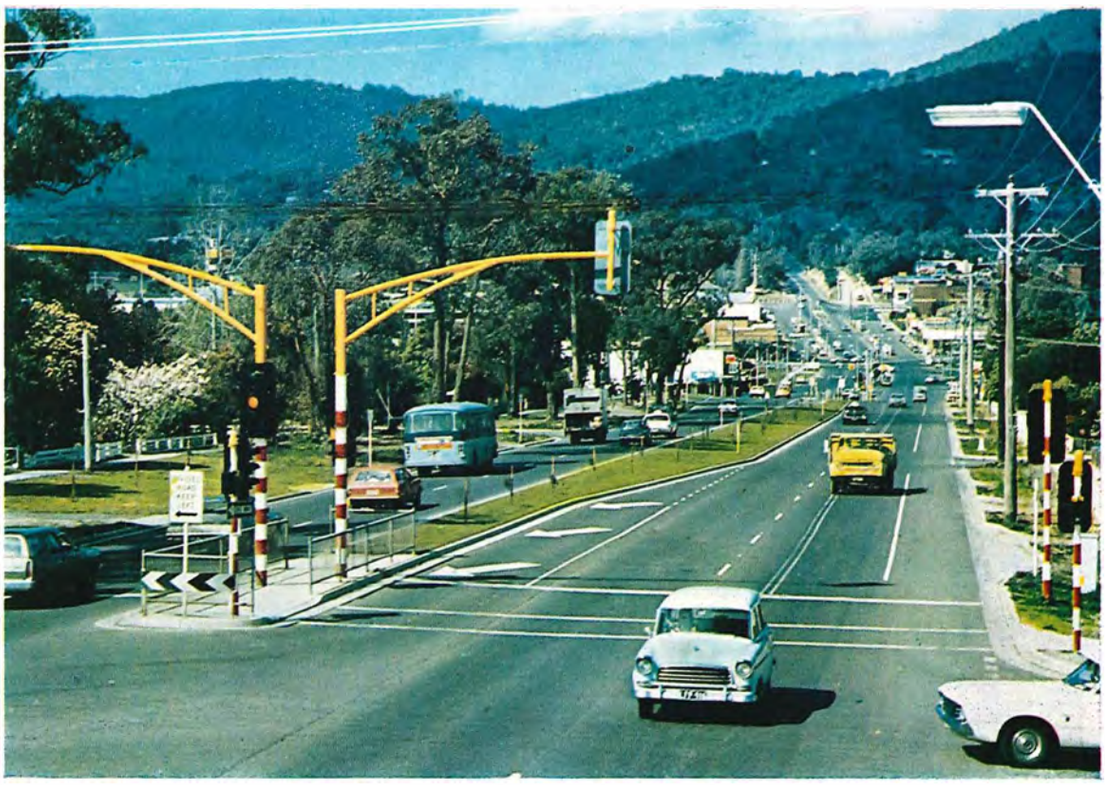
The Lilydale-Monbulk Road, reconstructed south of Mt Evelyn.

UNCLASSIFIED ROADS

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

Municipal contributions are determined at the time the allocation is made, and are based on many factors including the nature, extent, and location of the particular work and the financial position of the municipality concerned.

A list of the more significant works on unclassified roads carried out during the year with financial assistance from the Board appears in Appendix 5.



Boronia Road, reconstructed by the City of Knox with financial assistance from the Board.

ROAD CONSTRUCTION AND MAINTENANCE

Appendices 2 to 5 list the more significant works completed during the year with funds provided wholly or partly by the Board.

In Appendix 11, the report of the Engineer in Chief, a more detailed and technical account of road construction and maintenance activities for the year is given.

The following table shows the kilometres of road declared or proclaimed under the Country Roads Act as at 30th June 1975, and the expenditure incurred on such roads during the year.

Work in progress at the Greendale interchange on the Western Freeway (Myrniong Section).

Road Classification	Declared or Proclaimed Length	Road Expenditure (including Special Projects)		
		Patrol Maintenance	Other Maintenance	Construction and Reconstruction
	km	$000s	$000s	$000s
Freeways	206	1,262	107	47,893
State highways	7,056	7,124	2,156	17,165
Tourists' roads	801	991	111	1,032
Forest roads	1,039	504	178	416
Main roads	14,605	6,322	2,148	18,029
TOTALS	23,707	$16,203	$4,700	$84,625

CONTRACTS

Contracts under the Board's Supervision

Details of the types and numbers of contracts entered into showing their respective values, together with a comparison with those of financial year 1973/74 are shown in the following table:

Type of Contract	1974/75		1973/74	
	No. of Contracts	Value	No. of Contracts	Value
		$		$
Road Construction —				
1 Over $1,000,000	—	—	1	7,255,947
2 $100,000 to $1,000,000	2	1,313,472	6	1,867,422
3 Under $100,000	1	33,000	1	54,762
Supply of roadmaking materials	88	2,931,605	114	3,320,139
Bituminous treatment and supply of materials	45	4,009,145	49	4,208,730
Bridge Construction —				
1 Over $1,000,000	3	16,503,382	—	—
2 $100,000 to $1,000,000	7	1,317,133	14	2,366,333
3 Under $100,000	19	1,127,179	18	818,310
Components and Fabricated Steel	20	1,124,517	17	736,612
Concrete Pipes and Box Culverts	—	—	15	907,638
Construction Equipment	16	1,011,737	35	796,000
Divisional Facilities	7	287,535	1	32,000
Stores	12	2,096,800	15	2,003,256
Miscellaneous Services	29	2,210,014	18	640,40
TOTAL	249	$33,965,519	304	$25,007,550

These totals include contracts being financed from the Roads (Special Projects) Fund, which for the year amounted to 27 in number for a total value of $19,404,373.

Contracts under Councils' Supervision

During the year the Board approved the acceptance by municipal councils of 198 tenders for a total amount of $8,305,962 for road and bridge works for which the Board allocated funds in whole or part. In 1973/74 197 tenders were approved for a total amount of $5,329,396.

The Board also approved the use of 77 municipal contracts for the supply of materials for works partly financed from funds provided by the Board compared with 88 last year.

Contractors operating from fixed asphalt plants completed 176 km of plant mix work on densely trafficked roads at a cost of approximately $5,536,000, using 319,000 tonnes of asphalt.

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

250 km of sealing widened pavements,

52 km of initial sealing on dual carriageways,

751 km of restoration of sealed coats on reconstructed sections,

376 km of final sealing on initial treatments,

2,341 km of maintenance retreatments,

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

363 km of extensions to the bituminous sealed road system of the State including 103 km of roads declared or proclaimed under the Country Roads Act.

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

Material	Quantity
Bitumen for sprayed work	26,100 tonnes
Bitumen for bituminous concrete	16,000 tonnes
Aggregate for sprayed work	240,800 cubic metres
Aggregate for bituminous concrete	206,000 cubic metres
Other bituminous materials for sprayedwork and maintenance	10,700 tonnes

The total length of sealed roads in the Board's declared or proclaimed road network is 21,713 km or 92% of the total length of declared or proclaimed roads.

LINE MARKING

The Board's line marking operations were carried out during the year by an establishment consisting of one Superintendent of Works, seven overseers and twenty-six men based nominally at the Board's Central Depot at Syndal and an overseer and two men operating in each of Geelong and Bendigo Divisions. In all, ten line marking units were used consistently throughout the year.

The length of line marking maintained during the year is as follows:

State highways and freeways	7,385 km	(4,589 miles)
Other declared and proclaimed roads under the Country Roads Act	5,081 km	(3,517 miles)
Unclassified roads	1,502 km	(933 miles)
	13,968 km	(9,039 miles)

The total expenditure incurred on line marking was $673,245 compared with $652,327 last financial year. Due to inflationary factors the unit costs of line marking increased by approximately 30% during the year. The unit costs are shown below:

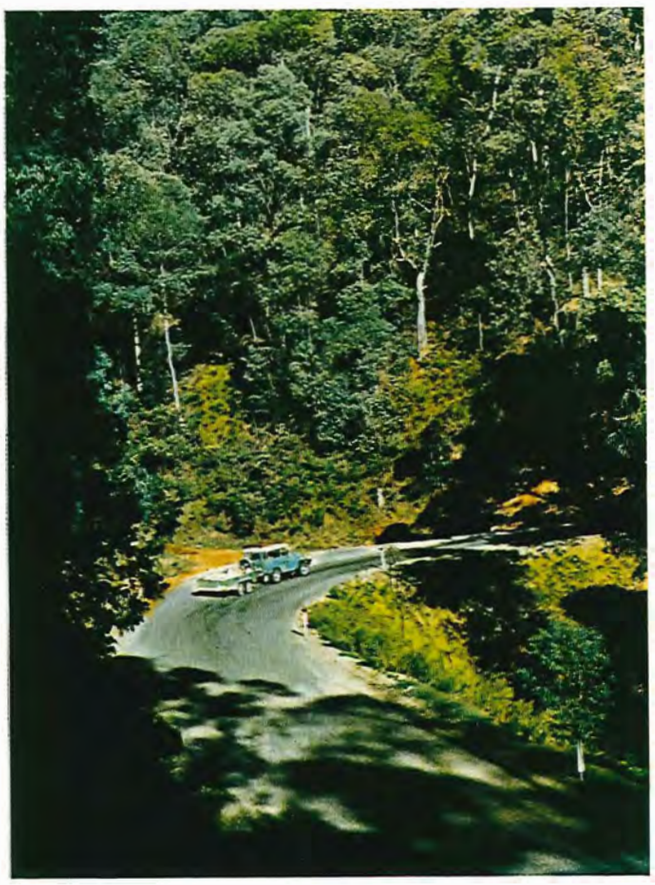
	1973/74 $	1974/75 $
Cost per km of standard stripe of 3 m with 9 m gap	12.29	16.08
Cost per km of solid stripe of 75 mm width	27.63	31.17
Cost per square metre	2.78	4.00

ROADS TO SNOW RESORTS

During the summer months the following major improvements were carried out on those tourists' roads which give access to snowfields.

The Alpine Road

Sealing 4.8 km (3.0 miles) between Harrietville and The Meg.



The Alpine Road near The Meg.

The Bogong High Plains Road

Sealing 1.8 km (1.1 miles) between Howmans Gap and Turnback Creek, and sealing 3.2 km (2.0 miles) between Crankie Charlie and Dynamite Creek.

Widening 3.2 km (2.0 miles) between Dynamite Creek and Mt. Beauty.

SNOW CLEARING

Snow clearing was carried out when required to maintain access on:

The Mount Buller Road,

The Mount Buffalo Road,

The Alpine Road to Mount Hotham, from both the Omeo and Harrietville approaches,

The Bogong High Plains Road from Mount Beauty to Falls Creek. The Bogong High Plains Road was closed beyond Falls Creek, towards the Omeo Highway, when snowfalls made it impassable.

Mansfield-Woods Point Road,

Mount Donna Buang Road,

Warburton-Woods Point Road,

Alpine Tourists' Road,

Bonang Highway,

Omeo Highway — Section 3.

Swiss built Rolba snow blowers were used in conjunction with specially equipped graders to clear the Mount Hotham Road and the car parks at Mount Buffalo and Mount Buller.

LAND PURCHASE

During the year the Board paid compensation and costs totalling $19.34 million for land required for the construction of new roads, the widening of existing roads or deviations from existing roads.

The following table shows the composition of the expenditure charged to the Board's funds on land purchase during the year, under both the Commonwealth road categories and the Board's road classifications.

Road Classification	Commonwealth Road Category					Totals
	National Highways	Urban Arterial Roads	Urban Local Roads	Rural Arterial Roads	Rural Local Roads	
	$000s	$000s	$000s	$000s	$000s	$000s
Freeways	889	9,499	—	374	—	10,762
State Highways	83	400	—	610	—	1,093
Tourists' Roads	—	42	—	5	—	47
Forest Roads	—	—	—	6	4	10
Main Roads	—	2,953	—	200	90	3,243
Unclassified Roads	—	367	3,677	—	144	4,188
Totals	$972	$13,261	$3,677	$1,195	$238	$19,343

The following table shows the number of land purchase transactions completed and the amount of compensation paid over the last five years.

	1970/71	1971/72	1972/73	1973/74	1974/75
Number of land purchase cases settled	1,022	977	865	864	923
Compensation and associated costs paid by the Board	$5.00m	$5.14m	$10.07m	$11.71m	$19.34m
Reimbursement to Councils for purchase of land for unclassified roadworks	$0.26m	$0.33m	$0.46m	$0.88m	$0.53m

The significant increase in the value of land purchased in the year 1974/75 over that of the previous year is largely attributable to the transfer to the Board of the road projects previously under the control of the Melbourne and Metropolitan Board of Works. The previous M.M.B.W. projects on which substantial land purchase expenditure was incurred were Eastern Freeway, Collingwood to Bulleen Section; Hoddle Street widening, City of Collingwood; and High Street widening, City of St. Kilda.

The average amount paid per settled case during the year was $20,954 compared with $13,553 in the previous year.

In order to assist owners of properties who incur hardship due to the Board's road proposals, it is frequently necessary for the Board to purchase properties well ahead of the time they are required for road construction purposes. Of the $19.34 million spent on land compensation and costs during the year $7.3 million was spent on properties purchased in response to owners' requests and this involved 143 individual property owners.

In some cases owners prefer the Board to purchase the whole of their properties where the portion required for road purposes has a significant effect on the continuing usage of the remainder of the property. The portion not required for road purposes can later be sold by the Board. During the year the Board sold 14 such areas of vacant land for $170,068 and 10 residential properties with dwellings for $241,550. Houses sold for removal resulted in receipts totalling $67,885.

Properties purchased well ahead of the time they are required for road construction purposes are rented or leased through local estate agents. During the year the Board received $958,868 from the rental of 628 properties with improvements erected thereon and 210 areas of vacant land.

BRIDGES

CONSTRUCTION OF NEW BRIDGES

During the year work was commenced on the construction of 103 new bridges estimated to cost $13,635,000, either under the direct supervision of the Board, or under municipal supervision with financial contribution from the Board. The table below shows a comparison between the number and estimated cost of bridge projects commenced in 1974/75 and those for the preceding year:

	1973/74		1974/75	
	No.	Estimated Cost	No.	Estimated Cost
Bridges commenced under the supervision of the Board's staff.	58	$12,400,000	40	$11,500,000
Bridges commenced under municipal supervision with financial assistance from the Board.	85	$2,350,000	63	$2,135,000
Total Bridges Commenced:	143	$14,750,000	103	$13,635,000

Plans were completed for 22 additional bridges estimated to cost $4,160,000. The construction of these bridges was deferred because of the lack of adequate funds.

LARGE BRIDGES COMPLETED IN RURAL AREAS

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

(a) **Hume Freeway — Wallan-Broadford Section:**
Ten prestressed and reinforced concrete bridges totalling approximately 549 lineal metres of bridging.

(b) **Princes Highway East — Nicholson River, Shire of Tambo:**
A major widening and construction of an end span on the existing bridge to finished dimensions of 111 m long by 8.5 m between kerbs, using steel girders and reinforced concrete.

Bridge over the Hume Freeway (Wallan-Broadford Section) at the Glenelgin interchange, and twin freeway bridges over Sunday Creek.

(c) **Princes Highway West — Hopkins River, at Allansford, Shire of Warrnambool:**
A four-span prestressed concrete beam and reinforced concrete bridge 99 m long and 10 m between kerbs.

(d) **Princes Freeway (Haunted Hills Section) — Shire of Morwell:**
A three-span prestressed concrete beam and reinforced concrete bridge 81 m long by 8.5 m between kerbs over the Princes Freeway at Hernes Oak.

The Hernes Oak interchange bridge over the Princes Freeway (Haunted Hills Section).

(e) **South Gippsland Highway — Bass Highway Intersection, Shire of Cranbourne:**
A four-span prestressed concrete beam and reinforced concrete overpass structure 87 m long by 10 m between kerbs over the Bass Highway near Lang Lang.

(f) **Western Freeway (Pentland Hills and Myrniong Sections) — Shires of Bacchus Marsh and Ballan:**
Three prestressed and reinforced concrete overpass structures totalling 223 lineal metres of bridging.

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

(a) **Gibson–Knox Bridge — Thomson River, Maffra–Rosedale Road, Shire of Rosedale:**
A complex of several bridges, the major one being a four-span reinforced concrete beam and slab bridge 55 m long and 8.5 m between kerbs. The Chairman, Mr R. E. V. Donaldson officiated at the opening ceremony on 28th May 1975.

(b) **McGauchies Bridge — Bendigo Creek, Old Murray Road, Shire of Huntly:**
A three-span precast reinforced concrete slab bridge 24 m long and 7.3 m between kerbs.

(c) **Pennyroyal Creek — Cape Otway Road, Shire of Winchelsea:**
A three-span precast reinforced concrete slab bridge 23 m long and 8.5 m between kerbs.

(d) **Henty Bridge — Salt Creek, Cape Nelson Road–Bentinck Street, Town of Portland:**
A three-span prestressed concrete beam and reinforced concrete bridge 33 m long and 8.5 m between kerbs.

(e) **House Creek — Brockley Street, Rural City of Wodonga:**

A three-span precast reinforced concrete slab bridge 31 m long and 8.5 m between kerbs plus a 1.7 m footway.

METROPOLITAN BRIDGES AND OVERPASSES

Among the larger vehicular bridges in the metropolitan area completed during the year under the direct supervision of the Board's Staff, were:

(a) **Mulgrave Freeway — Stephensons Road, City of Waverley:**

A four-span prestressed concrete beam and reinforced concrete bridge 156 m long by 13 m between kerbs plus two 1.8 m wide footways on Stephensons Road over the freeway and Scotchmans Creek.

(b) **Banksia Street — Yarra River Bridge, City of Heidelberg:**

A three-span steel plate girder and reinforced concrete duplicate bridge 85 m long providing, with the existing bridge, dual carriageways each 10 m wide between kerbs and two footways each 1.8 m wide.

(c) **Riggal Street, City of Broadmeadows:**

A four-span prestressed concrete beam and reinforced concrete overpass 108 m long by 10 m between kerbs plus a 1.8 m wide footway crossing Pascoe Vale Road and the adjacent railway line.

Bridge over the Mulgrave Freeway at Stephensons Road.

(d) **South Gippsland Freeway — Hallam Valley Contour Drain Bridges:**

Dual prestressed concrete slab and reinforced concrete bridges each 64 m long by 10.4 m between kerbs over the Hallam Valley Contour Drain.

(e) **Klauer Street — Overpass Structures, City of Frankston:**

A two-span prestressed concrete beam and reinforced concrete overpass structure 52 m long with dual carriageways respectively 8.5 m and 5.5 m between kerbs plus a 1.8 m wide footway over the Frankston Freeway on Klauer Street. A three-span precast concrete beam and reinforced concrete overpass structure 35 m long with dual kerbs plus a 1.8 m wide footway over the adjacent Frankston railway line.

GRADE SEPARATED PEDESTRIAN CROSSINGS

Grade separated pedestrian crossings considerably reduce the risk of conflict between motor vehicles and pedestrians. The Board can be involved in the provision of these crossings as follows:

(1) the construction of pedestrian overpasses across freeways or other important arterial roads to restore access to areas on either side of the road;

(2) the replacement of at-grade school crossings on heavily trafficked roads with pedestrian overpasses or underpasses, under a scheme introduced by the State Government in 1965. The scheme provides for:

- applications for subsidies to be submitted to the Board by municipal councils,
- priorities to be allotted by the Road Safety and Traffic Authority and the Board, taking into account traffic volume, average speed of traffic, the number and age range of children crossing the road, and the type of road to be crossed, and
- the costs of approved crossings to be shared equally between the Government, the Board and the municipal council concerned.

(3) assistance to municipal councils in the preparation of plans and specifications, and supervision of construction in cases where the whole cost of construction is borne by the Council.

During the past year the following grade separated pedestrian crossings were constructed by the Board:

Restoration of Pedestrian Access

(i) **Coonan's Road, Pascoe Vale South:**

A six-span prestressed concrete beam and reinforced concrete overpass 75 m long by 1.8 m wide.

This overpass restored access to two schools in the area.

(ii) **Frankston Freeway — Kananook Railway Station access overpass:**

A five-span prestressed concrete beam and reinforced concrete overpass 109 m long by 1.8 m wide providing pedestrian access over the Frankston Freeway to the new Kananook Railway Station.

Pedestrian overpass, Frankston Freeway, during construction.

The State Government's Scheme for Grade-separated Crossings to Serve Schools

Twenty-five structures have been approved under this scheme and sixteen have been constructed. Two overpasses were under construction at the end of the year.

The overpass across South Road in the City of Moorabbin to serve the Tucker Road Primary School, Moorabbin Technical School and St. Catherine's School was completed during the year. The overpass is a six-span prestressed concrete beam and reinforced concrete structure 143 m long and 1.8 m wide.

Pedestrian overpass of South Road, City of Moorabbin.

ELIMINATION OF RAILWAY LEVEL CROSSINGS

Since the inception of the State Government Scheme in 1954, the Board and the Victorian Railways Board have replaced 60 railway level crossings with overpasses or underpasses as a means of reducing accidents and traffic delays. The work represents a total expenditure to 30th June 1975 of approximately $32.6 million.

For some years up to 30th June 1974 expenditure on such projects was shared on the basis of the Country Roads Board 50%, Victorian Railways Board 5% and the Level Crossings Fund 45%. On 1st July 1974 moneys remaining in the Level Crossings Fund were transferred to the Transport Fund and expenditure on the elimination of railway level crossings has since been charged wholly to the Transport Fund in accordance with the Ministry of Transport (Transport Fund) Act 1974.

Construction continued on the following projects during 1974/75:

Princes Highway West — Colac

This project consists of a road-over-rail overpass of the Port Fairy railway which will make it possible to close three level crossings. Approximately 5,000 vehicles use the level crossings in a whole day and the normal rail traffic is 14 trains in a 24 hour day. The Board is the constructing authority. The estimated cost of the project is $870,000.

Melbourne Road — Spotswood

This project involves the construction of a road-over-rail overpass of the Newport-Sunshine railway. Approximately 11,000 vehicles use the level crossing between 7.00 a.m. and 7.00 p.m. daily, and approximately 40 trains use the railway in a 24 hour day. The Board is the constructing authority. The estimated cost of the project is $2,340,000.

NATIONAL PARKS ROADS

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

Allocations were made by the Board after consultation with the National Parks Service for works in or near —

Bulga National Park in Alberton Shire

Captain James Cook National Park in Orbost Shire

Ferntree Gully National Park in Sherbrooke Shire

Fraser National Park in Alexandra Shire

Glenaladale National Park in Bairnsdale Shire

Hattah Lakes National Park in Mildura Shire

Kingslake National Park in Eltham and Whittlesea Shires

Lind National Park in Orbost Sire

Lower Glenelg National Park in Portland Shire

Mount Buffalo National Park in Bright Shire

Mount Eccles National Park in Minhamite Shire

Mount Richmond National Park, Portland Shire

Organ Pipes National Park in Keilor City and Bulla Shire

Port Campbell National Park in Heytesbury Shire

Tarra Valley National Park in Alberton Shire

Wilsons Promontory National Park in South Gippsland Shire

Wyperfeld National Park in Karkarooc Shire

The works consisted of construction and sealing of access roads and roads within National Parks, parking areas and the maintenance of roads and parking areas already constructed. The works were carried out either by the Board or the local municipal council concerned.

The Government has made loan funds totalling $1,197,000 available for these purposes since 1st July 1963.

ROADS OF TOURIST INTEREST

The State Government again provided loan funds amounting to $200,000 during the financial year for expenditure on roads of a tourist nature other than roads proclaimed as tourists' roads under the provisions of the Country Roads Act.

As in previous years allocations for particular projects were made by the Board after consultation with the Ministry of Tourism. The total loan funds made available since 1960 is $2,994,000. The loan moneys are repayable by the Board.

Significant progress in the provision of adequate access to many tourist attractions in Victoria has been possible from the Government's allocations since 1960, even though the applications for financial assistance far exceed the amount of funds available.

The Board is required to make an annual payment into the Tourist Fund amounting to two per cent of the amount credited to the Country Roads Board Fund in the previous year from receipts under the Motor Car Act. An amount of $750,749 was paid during the year. The Tourist Fund is administered by the Ministry of Tourism.

MUNICIPALITIES FOREST ROADS IMPROVEMENT FUND

The Municipalities Forest Roads Improvement Fund was established in the State Treasury in 1955 for the purpose of assisting municipal councils in the improvement and protection of roads adjacent to State Forest areas to facilitate the extraction of forest produce.

The Board's Divisional Engineers and the appropriate Forests Commission Officers combine to determine the priorities of eligible works. Allocations for particular works are made by the Board with the agreement of the Forests Commission.

An amount of $50,000 was authorized to be contributed to the Fund by the Government during the year. Authorized contributions to the Fund to 30th June 1975 total $640,000.

Outstanding applications for assistance from the Fund at present total approximately $250,000. The limited funds have enabled grants to be made for only the most urgent works.

CONTROL OF HEAVY TRAFFIC

In the interests of providing safe conditions for road users and to protect road surfaces, it is necessary for the Government to impose statutory limits on the weight, width, height and length of vehicles and their loads. The limits are prescribed in the Motor Car Act.

The Motor Car Act also provides that the Board shall be the authority responsible for issuing permits for the movement of vehicles and loads exceeding the legal weight, height, length and width on:

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

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

Reconstructed section of the Calder Highway south of Ravenswood.

The number and types of permits issued during the year compared with those issued during financial year 1973/74 are shown below:

	1973/74	1974/75
Single trip permits issued Annual permits issued	28,138 4,262	26,760 3,833
Total number of permits issued	32,400	30,593

The number of offences reported by the Board's twenty-one Traffic Officers and four Police Officers on attachment from the Victoria Police was 7,494. This number represented an increase of 1,554 over last financial year.

This increase was attributable to:

- improved co-ordination of the activities of Traffic Officers,
- an increase in the incidence of overloading due to the general economic conditions, and
- the relatively low fines imposed as a result of offences under the Motor Car Act.

The revenue received during the year from fines under the Motor Car Act as a result of the Board's activities amounted to $541,000. The amount concerned was paid into consolidated revenue.

The present scale of fines under the Motor Car Act for overloading offences was introduced in September 1960. At that time the level of fines was adequate because the degree of overloading was limited by the vehicles then available. The vehicles were restricted to a comparatively low gross load because of the horsepower and design of the vehicles.

In recent years, however, it has become apparent that the scale of fines is insufficient to act as a real deterrent to the transport operator who intentionally exceeds the legal weights.

In view of the above factors the Board made representations during the year for the scale of fines under the Motor Car Act for overloading to be increased.

LEGISLATION AFFECTING THE BOARD

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

Town and Country Planning (Outdoor Advertising) Act 1975 No. 8716

This Act amongst other things amended the Country Roads Act by:

(a) removing all reference to hoardings and advertisements in Section 60 which prescribes the purposes for which the Board may make by-laws;

(b) inserting a new Section 61 which:

(i) sets out the purposes for which the Board may make by-laws concerning outdoor advertising within 1,000 metres from the centre of the road pavement of a State highway, main road, tourists' road, forest road or freeway,

(ii) gives the right of appeal to the Town Planning Appeals Tribunal by persons who feel aggrieved by a decision or determination of the Board to refuse to grant a permit; and

The Ballan-Daylesford Road, reconstructed in the Shire of Ballan.

(c) inserting a new Section 61A which enables the Board by proclamation to declare that any part of the area within 1, 000 metres of the centre of the road pavement of any State highway, main road, tourists' road, forest road or freeway (but not including any part of such a highway, road or freeway) :

(i) shall cease to be an area to which the Board's outdoor advertising by-laws apply; or

(ii) shall cease to be an area to which the Board's outdoor advertising by-laws other than by-laws in respect of specified classes of advertisements apply.

The Act will come into operation on a day to be fixed by proclamation of the Governor in Council and published in the Government Gazette.

Midland Highway, Castlemaine City, reconstructed to provide dual carriageways.

Country Roads (Salaries and Contributions) Act 1974 No. 8611

This Act made provision for:

(a) the Minister's consent to be obtained before the Board approves the appointment of an officer or employee at a salary exceeding the rate of $15,000 per annum (the amount was previously $8,500 per annum).

(b) the Board, with the Minister's approval, to make payments in excess of $20,000 in any one year to any person, body or fund engaged in or established to promote research into matters revelant to efficient transportation in Victoria or to the system of roads in Victoria. The Board may make payments up to a total of $20,000 in any one year on its own initiative.

Revocation and Excision of Crown Reservations Act 1974 No. 8601

This Act provided amongst other things for the excision of land from the site of the Kingston Centre Geriatric Hospital. This excision was required by the Board for road improvements at the intersection of Warrigal and Kingston Roads.

As the land had been granted by the Crown to the institution for charitable purposes it was agreed that the trustee institution was entitled to compensation for the loss of the land. By mutual agreement between the Board and the Kingston Centre the sum to be paid by the Board was fixed at $74,000.

Motor Car (Fees) Act 1974 No. 8596

This Act made provision for:

(i) the Driver's Licence fee to be increased from $12 to $18 for a three year period. Revenue for this fee is shared —

⅛ Country Roads Board Fund

⅛ Driver's Licence Suspense Account

¼ Municipalities Assistance Fund

½ Consolidated Fund;

(ii) the surcharge on Third Party Insurance premiums to be increased from $2 per annum to $4 per annum. The whole of the revenue from this source is payable to the Consolidated Fund.

The increase in the Third Party Insurance premiums came into operation on the 10th December 1974 and the increase in the Driver's Licence fee on the 1st January 1975.

Motor Car Act 1974 No. 8657

This Act provided amongst other things for:

(i) the increase of motor car registration fees generally by 35%. Approximately one-third of the additional revenue derived from these increased fees is paid in to the Roads (Special Projects) Fund and expended on the construction of major road projects approved by the Treasurer. The balance of the revenue received is paid into the Country Roads Board Fund and expended on the maintenance and construction of roads throughout the State; and

(ii) a reduction in registration fees from $15 per annum to $2 per annum for private buses licensed by the Transport Regulation Board for regular route services as metropolitan, urban and country stage omnibuses.

The Section of the Act which provides for the increases in registration fees was proclaimed to come into operation on the 5th February 1975. The other sections of the Act were proclaimed to come into operation on the 1st day of January 1975.

THIRTY-FIRST CONFERENCE OF MUNICIPAL ENGINEERS

The Thirty-first Conference of Municipal Engineers was held in the Board's theatrette on 4th and 6th March 1975, concluding with a tour of the Eastern Freeway, currently under construction.

The Conference, under the chairmanship of the Chairman of the Board, Mr R. E. V. Donaldson, was officially opened by the Hon. E. R. Meagher, M.B.E., E.D., M.P., Minister of Transport. Those attending totalled approximately 250 and included representatives of most Victorian municipal councils, civil engineers from State Government Departments and State Instrumentalities and senior C.R.B. engineers. Some municipal engineers from Tasmania also attended.

For the first time two half-day panel discussions were conducted to provide an opportunity for in-depth consideration of selected topics.

The first panel discussion was entitled "The New Legislation dealing with Roads". The speakers and panel members for this subject were Mr R. J. Nuttall, Shire Engineer, Avoca; Mr W. Sewart, City Engineer, Nunawading; Mr N. S. Guerin, the Board's Deputy Engineer-in-Chief, and Mr R. G. Cooper, the Board's Chief Accountant.

The second panel discussion was entitled "Transport Energy Problems". The leader of the discussion and Chairman of the panel was Professor S. R. Siemon, Dean of the Faculty of Engineering, University of Melbourne whose paper discussed "Production of Bitumen and Fuel from Coal". The other three speakers and panel members were Mr R. G. Chapman, Assistant General Manager (Marketing and Distribution), State Electricity Commission of Victoria, who spoke on "Electric Power as a Source of Energy for Transport"; Mr R. N. Morse, Director, Solar Energy Studies, Commonwealth Scientific and Industrial Research Organization, whose subject was "Solar Power for Australia"; and Mr R. B. Hamilton, Environmental Affairs Co-ordinator of the Shell Group of Companies, who spoke on "Fossil Fuel Usage and New Fields and Developments".

Other papers and addresses covered a wide range of engineering and technical interests. Mr I. Meacham, Divisional Engineer, State Rivers and Water Supply

Commission discussed the new drainage legislation, and Mr R. C. Page, Consulting Engineer, Borough of Koroit, spoke about the town's unique drainage. Country Roads

Board contributions included talks on rise and fall clauses in contracts; the introduction of priority roads; photogrammetry; the NAASRA Economics of Road Vehicle Limits Study; and the search for road making materials.

Reports on overseas study tours made during the preceding twelve months were presented by Mr K. H. Scott, Shire Engineer, Lillydale and Dr K. G. E. Moody, the Board's Engineer-in-Chief.

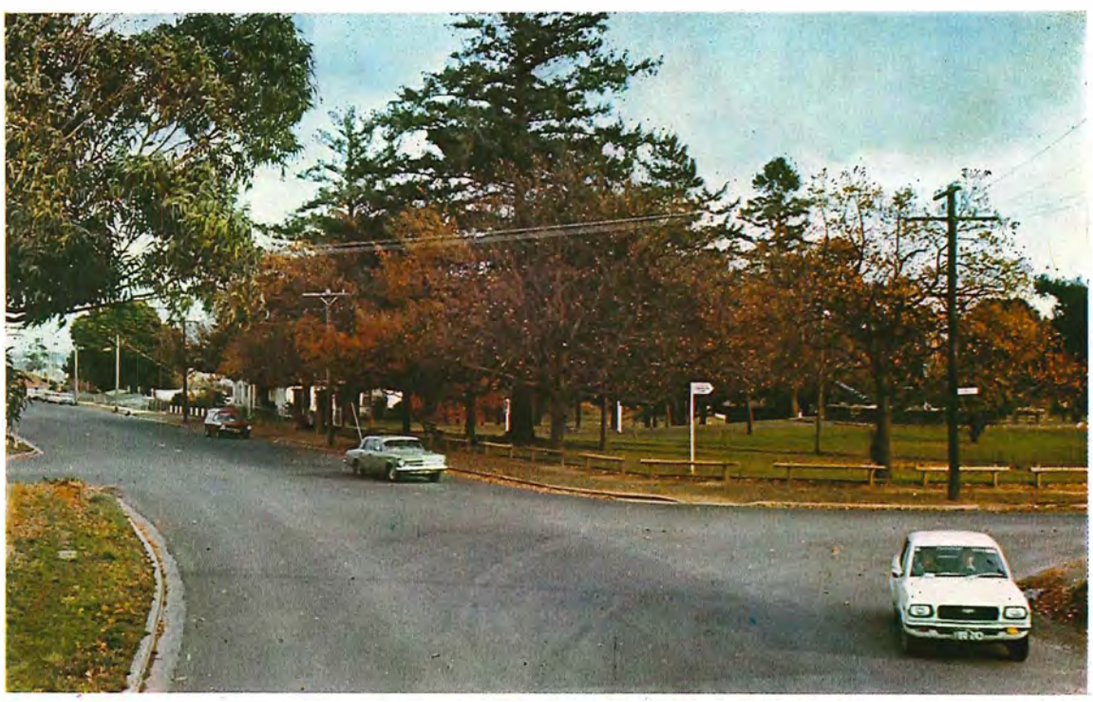
The Board expresses its thanks and appreciation to the Local Government Engineers Association of Victoria for its assistance in planning the Conference, and to the contributors of papers and speakers at the Conference, particularly the guest speakers who made a major contribution to the success of the Thirty-first Conference.

VISITS TO MUNICIPALITIES

Each year the Board Members visit a number of municipalities throughout the State. This has been the practice since the inception of the Board in 1913 and in a continuing programme every municipality in Victoria is visited at approximately six year intervals. These visits include a tour of the municipality's roads, in company with Councillors and Council officers, and discussions on local road problems. Through these visits the Board Members gain important information about road conditions and developments throughout the State.

During the year the Board made official visits to 36 municipalities:

the Shires of Bacchus Marsh, Belfast, Dundas, Euroa, Flinders, Huntly, Mirboo, Narracan, Nathalia, Numurkah, Orbost, Pakenham, Rodney, Romsey, Shepparton, Sherbrooke, Tallangatta, Violet Town, Wangaratta, Warragul, Warrnambool, Whittlesea and Wycheproof; the Borough of Port Fairy; the Towns of Bairnsdale and Kyabram; and the Cities of Berwick, Hamilton, Kew, Moe, Oakleigh, Prahran, Richmond, Shepparton, Wangaratta and Warrnambool.



Eureka Street, Ballaarat City, reconstructed with financial assistance from the Board.

The Board also visited —

Ballaarat City to discuss with the Council the Ballarat Transportation and Traffic Management Studies, and

Mildura for talks with both Mildura City Council and Mildura Shire Council about the location of the proposed new bridge over the Murray River at Mildura.

The Board places on record its appreciation of the assistance given by all councillors and municipal officers during these visits, and extends its thanks to the councils for the hospitality extended.

DEPUTATIONS

Every year the Board is requested to receive deputations, mainly from municipal councils but occasionally from local groups or organizations. The Board is always prepared to discuss matters of common interest with councils or other official bodies. These discussions provide a useful channel of communication between the Board and local administration.

During the year the Board received 31 deputations of which 28 were from municipal councils.

The principal subjects raised were the general inadequancy of road grants to meet the State's road needs, the allocation of road funds to municipal councils by the Board, road developments in provincial cities, and the development of freeways.

The Board appreciates being kept informed of matters of local importance through the discussions with council representatives.

NATIONAL ASSOCIATION OF AUSTRALIAN STATE ROAD AUTHORITIES

The National Association of Australian State Road Authorities (N.A.A.S.R.A.) is an organization consisting of the Heads of the road authorities of the six States and the Commonwealth Department of Housing and Construction which is the road constructing authority for the territories administered by the Commonwealth Government.

The aims of N.A.A.S.R.A. may be briefly stated as providing uniformity of practice in road design and operation, improved road construction methods, and the production of technical manuals to publish the results of N.A.A.S.R.A. findings.

The Association also collects and disseminates information relating to traffic, the types and standards of roads, and road finance. The information collected is used in the formulation of national road policies.

Meetings of the Authority are held at six monthly intervals.

There are a number of specialist committees within N.A.A.S.R.A. Eight of these assist the Principal Technical Committee, which plans and organizes the technical work of the Association. The Board's representative on the P.T.C. is Dr K. G. E. Moody, the Engineer-in-Chief.

The financial and administrative areas of the functions of the State Road Authorities are covered by the Secretarial and Accounts Committee, the Board's representatives on this Committee being Mr N. L. Allanson, Secretary and Mr R. G. Cooper, Chief Accountant.

Additional specialist committees are formed to perform specific tasks. For example a N.A.A.S.R.A. Sub-committee is studying community and environmental problems associated with urban highway proposals and another Sub-committee is studying land acquisition procedures.

Other committees cover a wide field of study, including legal matters, training, transportation planning, programme budgeting, roadside development, pavement testing, national and inter-regional routes and the preparation of technical and general information.

The joint work of the State Road Authorities through these Committees ensures co-ordination of effort, uniformity of approach and a pooling of experience in road and bridge planning, design, construction and maintenance.

During the past year two meetings of N.A.A.S.R.A. were held, namely:

52nd (Annual) Meeting in Townsville (Queensland) on 11th and 12th November 1974, attended by Mr R. E. V. Donaldson, the Board's Chairman.

53rd (Intermediate) Meeting, at the office of the Commonwealth Department of Housing and Construction, Hawthorn (Victoria), attended by the Chairman and Board Members.

AUSTRALIAN ROAD RESEARCH BOARD

The Australian Road Research Board was established in 1960 and is registered as a public company limited by guarantee.

The Board of Directors includes the Heads of the State Road Authorities, the Secretary, Commonwealth Department of Housing and Construction, and the Secretary, Commonwealth Department of Transport.

Up to 10% of the A.R.R.B.'s annual expenditure is borne by the Commonwealth Department of Housing and Construction and the remainder is shared by the six State Road Authorities on the percentage basis adopted by the Commonwealth Government in making grants to the States under the Commonweatlh Roads Grants Act 1974.

The major objective of the Board is to co-ordinate, encourage and arrange continuing research into problems associated with roads and traffic in Australia.

Projects being undertaken either by or with assistance from the A.R.R.B. include research into cheaper and improved road surfaces, road making materials, traffic management and control, road safety, and the economics of road transport. Grants are made to Universities for specific projects where particular facilities and specially skilled research staff are available.

The members of the Australian Road Research Board meet twice a year to consider management and policy matters, and to review the progress of research projects. Meetings were held in Brisbane on 13th and 14th November 1974 and in Melbourne on 14th and 15th May 1975.

At the May 1975 meeting held in Melbourne, the Chairman of the Country Roads Board, Victoria, Mr R. E. V. Donaldson, was elected Chairman of the Australian Road Research Board. Mr Donaldson had previously been that Board's Deputy Chairman.

With the growing pressures on resources, both financial and physical, the Australian Road Research Board will have an increasingly important role to play in developing low cost road construction techniques and in making the optimum use of scarce road making materials.

Mr D. F. Glynn, Director of A.R.R.B. since its inception in 1960, is due to retire in August 1975. Dr M. G. Lay, formerly Engineering Research Manager of the Broken Hill Proprietary Company Limited, has been appointed Executive Director.

CO-OPERATION WITH ARMY RESERVE (C.M.F.)

The Board continued its sponsorship of the Headquarters 22 Construction Regiment, Royal Australian Engineers, and 107 Plant Squadron and 104 Construction Squadron. The Commanding Officer is Lt. Col. G. W. Marshallsea, E. D., the Board's Divisional Engineer, Geelong.

The 1974 camp was held at the School of Military Engineering, Liverpool, New South Wales in November and 160 personnel in the Board's service attended.

The activities at the camp included the training of recruits, and rifle and sub-machine gun range practices, together with training in mine warfare, booby traps and floating equipment bridging.

PERSONNEL

The Board's personnel numbers as at 30th June 1975, were as follows:

Technological Staff (Professional)	637
Technical Staff	533
Administrative Staff	774
Supervisory Staff — Field	184
Depot	83
Clerks of Works	99
Construction and Maintenance Personnel	1,806
Workshop and Depot Personnel	628
Regional Employment Development Scheme	89
	4,833

Transfer of M.M.B.W. Personnel

Following the proclamation of the Metropolitan Bridges Highways and Foreshores Act 1974, 213 personnel transferred from the Melbourne and Metropolitan Board of Works to the Board's service on the 1st July 1974. These personnel represented a wide variety of occupations and their assimilation into the Board's service under the terms of the Act presented a number of problems in relation to differing salary structures, leave conditions, superannuation and other administrative matters. These problems have now been largely overcome.

Staffing

The prevailing economic conditions were reflected in the Board's recruiting activities throughout the year. With the exception of licensed surveyors and experienced draftsmen large numbers of applications were received for all positions advertised by the Board. Applicants of a high standard were available for appointment.

Although staff numbers were increased with the transfer of personnel from the Melbourne and Metropolitan Board of Works at the commencement of the year, the final staff figure was only 38 above that of the previous year. The reduction during the latter part of the year was a result of the Board's critical financial position and was achieved in two ways. Firstly, despite a reluctance to do so, the Board found it necessary to retrench approximately 360 employees. Secondly, in other areas the Board adopted a deliberate policy of not replacing officers who retired or resigned, unless the situation made it unavoidable. In order to maintain the efficiency of the organization this policy has resulted in some minor re-deployment of staff.

During the year two cadetships were awarded to students undertaking full-time surveying courses at the University of Melbourne and the Royal Melbourne Institute of Technology. As in the previous year, no cadetships were awarded to students in other disciplines because of the ready availability of graduates. There are currently 18 students undertaking their studies under C.R.B. cadetships.

Apprenticeships

During the year, the Board engaged 22 new apprentices and took over the indentures of a further 7 who had been retrenched from other organizations. Of the new apprentices, 14 represented the Board's usual annual intake and the remaining 8 were engaged with the assistance of a grant from the Commonwealth Government.

The Goulburn Valley Highway in Yea township—the west bound carriageway was reconstructed during the year.

The funds required to finance the training of the apprentices whose indentures were taken over from other organizations were also supplied by the Commonwealth Government.

As at 30th June 1975, the total number of apprentices in training was:

Trade	Apprentices
Motor Mechanics	48
Structural Steel (Fabrication)	4
Carpentry and Joinery	9
Painting and Decorating	2
Cooking	2
Electrical Mechanics	2
Automotive Electrics	1
Lithographic Printing	1
Plumbing and Gasfitting	1
TOTAL	70

Industrial Relations

The Board's wages and salaries costs increased considerably throughout the financial year, showing an increase of $11,452,000 or 34.1% over the previous year. The main reasons were the general community increases of $15 a week in the April-May 1974 period and $9 a week in the September-November 1974 period.

During the year the Board was involved in many arbitration cases, the highlight being the successful attempt in the face of strong opposition to become a respondent party to the National Building Trades Construction Award. This will ensure that the Board has the opportunity to put its views whenever this vital award is subject to possible change.

New reinforced concrete bridge on the Ovens Highway at Happy Valley Creek.

Of interest also was the creation of an award to cover the Board's senior administrative officers. All Board's salaried staff and wages employees are now covered by awards.

Training

The highlights of the Board's training programme during the year were metrication courses and the introduction of in-service management training.

Approximately 80 metrication courses were conducted for staff of all classifications to provide a basic appreciation of the metric system as affecting the Board in general and specialist areas.

To satisfy a growing need, the Board this year introduced its own in-service management training. Fifteen officers attended the first residential course of one week's duration at Jumbunna Lodge, Launching Place. The officers who attended meet at two-monthly intervals to develop suggestions made at the course and to review conclusions.

The Board sponsored certain officers to attend the Australian Administrative Staff College, the Government Administrative Staff Course at the University of New South Wales, the Traffic Planning and Control Course at the University of New South Wales and the Summer School of Business Administration at the University of Melbourne.

Retirements

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

			Years of Service
Thorpe, J. D.	Deputy Chairman	Board	49
Thomas, A. R.	Engineering Assistant	Bendigo Division	39
Steel, W. S.	Principal Traffic Officer	Traffic Section	38
Turnbull, J. E.	Senior Engineering Surveyor	Plans and Surveys Division	36
Clarkson, R. H.	Photographic Administration Officer	Advance Planning Division	35
Langham, G. M.	Chief Mechanical Engineer	Mechanical Sub-branch	35
Predl, L. F.	Overseer	Major Projects Division	34
Cooper, E. A.	Leading Hand Fitter	Mechanical Sub-branch	31
Murphy, G. J.	Patrolman in Charge	Bairnsdale Division	30
Burch, R. S.	Load Checker	Bendigo Division	28
Howe, E. L.	Overseer	Ballarat Division	28
McElgunn, J. T.	Load Checker	Warrnambool Division	28
Miles, W. E.	Traffic Officer	Bairnsdale Division	28
O'Neill, J. P.	Plant Operator	Warrnambool Division	28
Poulter, W.	Patrolman Gr. 2	Bendigo Division	28
Smith, T. D.	Clerk of Works	Major Projects Division	28
Lucas, W. J.	Reimbursement Clerk	Chief Accountant's Branch	27
*Roe, E. T.	Superintendent of Works	Benalla Division	27
*McLachlan, E. L.	Overseer	Geelong Division	26
Ferguson, R. C.	Painter (Depot)	Benalla Division	25
Healy, J. M.	Truck Driver	Horsham Division	25
Mathews, K. M. (Miss)	Senior Typist	Personnel Section	25
*Potter, L. L.	Patrolman in Charge	Geelong Division	25
Cain, E. V. (Miss)	Senior Clerical Assistant	Correspondence Registry	24
White, J. L.	Cost Accountant	Chief Accountant's Branch	24
Kaljee, G. J.	Senior Draftsman	Plans & Surveys Division -	23
Mills, R. A.	Patrolman Gr. 2	Traralgon Division	23
Plant, E. M.	Patrolman in Charge	Benalla Division	23
Raftopoulos, B.	Fitter	Mechanical Sub-branch	23
*Sanguinetti, M. J.	Administrative Officer	Asphalt Division	23
Spicer, A. L.	Officer in Charge	Correspondence Registry	23
*Wilson, R.	Patrolman in Charge	Dandenong Division	23
Beasley, A. J.	Instructor Driver	Warrnambool Division	22
Briggs, G. H.	Patrolman in Charge	Benalla Division	22
Chequer, C. R.	Fitter	Horsham Division	22
*Urban, S.	Powder Monkey	Traralgon Division	22
Alsop, J. R.	Patrolman Gr. 2	Geelong Division	21
Butler, C. F.	Articulated Vehicle Driver	Mechanical Sub-branch	21
*Monaghan, P. T.	Patrolman in Charge	Horsham Division	21
*Newsome, R. E.	Truck Driver	Dandenong Division	21
Tasker, C. L.	Patrol Assistant	Bairnsdale Division	21
Gullifer, N. T.	Plant Operator	Dandenong Division	20
Hill, R. G.	Storeman	Bairnsdale Division	20
McClure, R. G.	Ganger	Ballarat Division	20
Riekhoff, G.	Welder	Traralgon Division	20
Sammut, S.	Laboratory Assistant	Materials Research Division	20
Turner, A. J.	Overseer	Urban Projects Sub-branch	20

*Deceased.

APPENDIX 1

LENGTHS OF STATE HIGHWAYS, FREEWAYS, FOREST ROADS AND TOURISTS' ROADS

As at 30th June, 1975

STATE HIGHWAYS

NAME	ROUTE	LENGTH (kilometres)	(miles)
BASS	Lang Lang-Inverloch	61.6	38.3
BELLARINE	Geelong-Queenscliff	31.8	19.8
BONANG	Orbost-N.S.W. border near Delegate	115.9	72.0
BORUNG	Dimboola-Charlton	123.4	76.6
BURWOOD	Burwood-Ferntree Gully	20.4	12.7
CALDER	Melbourne-Mildura	554.1	344.3
CANN VALLEY	Cann River-N.S.W. border	46.4	28.9
GLENELG	Ballarat-S.A. border near Mt. Gambier	283.1	175.9
GOULBURN VALLEY	Eildon-Strathmerton	223.2	138.7
HAMILTON	Geelong-Hamilton	232.2	144.3
HENTY	Portland-Lascelles	337.3	209.6
HUME	Melbourne-N.S.W. border near Albury	246.6	153.2
KIEWA VALLEY	Bandiana-Mt. Beauty	78.7	48.9
LODDON VALLEY	Bendigo-Kerang	123.7	76.8
MAROONDAH	Melbourne-Mansfield	184.6	114.7
McIVOR	Heathcote-Bendigo	44.2	27.5
MIDLAND	Geelong-Ballarat-Bendigo-Shepparton-Benalla-Mansfield	416.0	258.5
	Morwell-Port Welshpool	78.9	49.0
MURRAY VALLEY	Corryong-Hattah	742.3	461.2
NEPEAN	Melbourne-Portsea	88.8	55.2
NORTHERN	Kilmore-Echuca	142.5	88.5
OMEO	Bairnsdale-Tallangatta	285.1	177.1
OUYEN	Ouyen-S.A. border near Pinnaroo	130.2	80.9
OVENS	Wangaratta-Bright	76.2	47.3
PRINCES (EAST)	Melbourne-N.S.W. border near Genoa	487.5	302.9
PRINCES (WEST)	Melbourne-S.A. border near Mt. Gambier	398.1	247.4
PYRENEES	Elphinstone-Ararat	148.0	91.9
SOUTH GIPPSLAND	Dandenong-Yarram-Sale	254.2	157.9
STURT	Mildura-S.A. border near Renmark	114.5	71.1
SUNRAYSIA	Ballarat-Calder Highway	341.1	212.0
WARBURTON	Lilydale-Warburton	34.6	21.5
WESTERN	Melbourne-Serviceton	390.3	242.5
WIMMERA	Apsley-St. Arnaud	220.1	136.8

FREEWAYS

NAME	SECTION	LENGTH (kilometres)	(miles)
CALDER	Keilor	2.8	1.7
	Elphinstone	2.7	1.7
FRANKSTON	Seaford Road to Beach Street	5.4	3.4
HUME	Craigieburn to Kalkallo	8.3	5.2
	Beveridge	3.2	2.0
	Broadford to Tallarook	15.4	9.6
	Chiltern	21.3	13.3
LOWER YARRA	Bertie Street to Graham Street	0.3	0.2
	Williamstown Road to Princes Freeway	5.1	3.2
MIDLAND	Yinnar	9.6	6.0
MORNINGTON PENINSULA	Dromana to Rosebud	8.4	5.2
PRINCES	Mulgrave	12.4	7.7
	Moe to Haunted Hills	16.2	10.0
	Laverton	31.4	19.5
	Lara	16.0	9.9
	Dartmoor	3.0	1.9
SOUTH EASTERN	Anderson Street to Tooronga Road	6.8	4.2
SOUTH GIPPSLAND	Whitelaw	3.8	2.3
	Princes Freeway to Princes Highway	1.4	0.9
TULLAMARINE	Flemington Bridge to Melbourne Airport	19.4	12.1
WESTERN	Rockbank	13.3	8.3
	Bacchus Marsh	8.3	5.2
	Pykes Creek	5.8	3.6
	Gordon	10.8	6.8

FOREST ROADS

NAME	MUNICIPALITIES	LENGTH (kilometres)	(miles)
BAIRNSDALE-DARGO	Avon and Bairnsdale Shires	20.8	12.9
BEALIBA-MOLIAGUL	Bet Bet Shire	9.0	5.6
BEECH FOREST-MT. SABINE	Otway Shire	12.6	7.8
BENAMBRA-CORRYONG	Omeo, Tallangatta, and Upper Murray Shires	76.5	47.5
BENAMBRA-LIMESTONE	Omeo Shire	14.3	8.9
BENDOC-ORBOST	Orbost Shire	20.9	13.0
BROOKVILLE	Omeo Shire	15.8	9.8
BRUTHEN-BUCHAN	Tambo Shire	36.5	22.7
BUCHAN-ENSAY	Tambo Shire	19.8	12.3
BULLUMWAAL-TABBERABBERA	Bairnsdale Shire	30.3	18.8
CARRAJUNG-WOODSIDE	Alberton Shire	17.7	11.0
DARGO	Avon Shire	74.8	46.5
DEAN MARSH-LORNE	Winchelsea Shire	24.0	14.9
DRUMMOND-VAUGHAN	Daylesford and Glenlyon and Newstead Shires	20.9	13.0
EPSOM-FOSTERVILLE	Huntly Shire	21.2	13.2
FORREST-APOLLO BAY	Otway Shire	22.4	13.9
GREENDALE-TRENTHAM	Ballan and Kyneton Shires	23.8	14.8
HEYFIELD-JAMIESON	Mansfield and Maffra Shires	145.5	90.4
INGLEWOOD-RHEOLA	Korong Shire	17.3	10.7
KIMBOLTON	Strathfieldsaye Shire	13.5	8.4
LAVERS HILL-COBDEN	Heytesbury and Otway Shires	46.7	29.0
MEREDITH-STEIGLITZ-MAUDE	Bannockburn Shire	20.7	12.9
MURRUNGOWER	Orbost Shire	21.3	13.2
PORTLAND-NELSON	Portland Shire	38.6	24.0
RED KNOB	Tambo Shire	6.7	4.2
TATONG-TOLMIE	Benalla Shire	36.3	22.6
WALHALLA	Narracan, Mansfield and Upper Yarra Shires	110.7	68.8
WARBURTON-WOODS POINT	Healesville, Upper Yarra ond Mansfield Shires	103.4	64.2
WARROWITUE	McIvor Shire	16.5	10.2

TOURISTS' ROADS

NAME	MUNICIPALITIES	LENGTH (kilometres)	(miles)
ACHERON WAY	Healesville and Upper Yarra Shires	35.4	22.0
ALPINE	Bright and Omeo Shires	83.0	51.6
ARTHUR'S SEAT	Flinders Shire	8.1	5.0
BOGONG HIGH PLAINS	Bright and Omeo Shires	67.1	41.7
CAMERON DRIVE	Gisborne and Newham and Woodend Shires	4.3	2.7
DONNA BUANG	Healesville and Upper Yarra Shires	34.0	21.1
GIPSY POINT	Orbost Shire	2.4	1.5
GRAMPIANS	Ararat, Dundas and Stawell Shires and Stawell Town	69.5	43.2
GREAT OCEAN ROAD	Barrabool, Winchelsea, Otway, Heytesbury and Warrnambool Shires	212.8	132.2
MALLACOOTA	Orbost Shire	22.5	14.0
MOUNT ABRUPT	Ararat and Mount Rouse Shires	24.8	15.4
MOUNT BUFFALO	Bright Shire	39.0	24.2
MOUNT BULLER	Mansfield Shire	25.5	15.8
MOUNT DANDENONG	Sherbrooke and Lillydale Shires	21.8	13.6
MOUNT VICTORY	Arapiles, Stawell and Wimmera Shires	30.7	19.0
MARYSVILLE-WOODS POINT	Healesville Shire	18.9	11.7
OTWAY LIGHTHOUSE	Otway Shire	12.9	8.0
PHILLIP ISLAND	Bass and Phillip Island Shires	23.4	14.5
SILVERBAND	Stawell Shire	9.1	5.7
SYDENHAM INLET	Orbost Shire	21.6	13.4
WARTOOK	Wimmera Shire	3.5	2.2
WILSON'S PROMONTORY	South Gippsland Shire	31.0	19.2

APPENDIX 2

STATE HIGHWAYS AND FREEWAYS

Significant Works Completed During Financial Year 1974/75

BASS HIGHWAY

BASS SHIRE	Reconstruction and widening of 4.0 km from Bass to Anderson to provide a sealed pavement 7.4 m wide.

BELLARINE HIGHWAY

BELLARINE SHIRE	Construction of 1.9 km of dual carriageways each 10.4 m wide through Leopold.
GEELONG CITY	Reconstruction of 0.2 km between Bellarine Street and Swanston Street to provide dual carriageways each 9.7 m wide.

BONANG HIGHWAY

ORBOST SHIRE	Reconstruction of 0.8 km in Orbost to provide dual carriageways each 7.4 m wide.

CALDER FREEWAY

KEILOR CITY	Construction of 1.9 km of four lane freeway between The Avenue and Erebus Street to provide dual carriageways each 7.4 m wide.

CALDER HIGHWAY

BENDIGO CITY	Reconstruction of 0.3 km from View Street to Eaglehawk Road to provide dual carriageways each 6.8 m wide.
KEILOR CITY AND MELTON SHIRE	Reconstruction and widening of 3.5 km to make provision for a climbing lane at Corkscrew Hill.
KORONG SHIRE	Reconstruction of 4.8 km at Kurting to provide a sealed pavement 7.4 m wide.
MALDON SHIRE	Realignment of 1.3 km and removal of crest at Ravenswood South to provide a sealed pavement 7.4 m wide.
MARONG SHIRE	Realignment of 0.8 km and removal of crest and dip at Ravenswood to provide a sealed pavement 7.4 m wide.
MELTON SHIRE	Reconstruction of the intersection with Vineyard Road north of Diggers Rest.

FRANKSTON FREEWAY

FRANKSTON CITY	Construction of 1.4 km of four lane freeway from Eel Race Road to Armstrongs Road to provide dual carriageways each 7.4 m wide.

GLENELG HIGHWAY

GLENELG SHIRE	Reconstruction of 4.3 km east of Cawkers Creek to provide a sealed pavement 7.4 m wide.
GRENVILLE SHIRE	Reconstruction and realignment of 3.0 km between Smythesdale and Scarsdale to provide a sealed pavement 7.4 m wide.

GOULBURN VALLEY HIGHWAY

BROADFORD SHIRE AND SEYMOUR SHIRE	Reconstruction and realignment of 2.2 km between Trawool and Kerrisdale to provide a sealed pavement 7.4 m wide.
GOULBURN SHIRE	Widening of 6.1 km south of Murchison East to provide a sealed pavement 7.4 m wide.
YEA SHIRE	Reconstruction of 0.5 km of the west-bound carriageway in Yea township to provide a sealed pavement 7.4 m wide.

HAMILTON HIGHWAY

GEELONG WEST CITY AND NEWTOWN CITY	Reconstruction of 0.6 km between Pakington Street and Shannon Avenue to provide a sealed pavement 12.8 m wide.
HAMPDEN SHIRE	Reconstruction of 7.0 km west of and through Derrinallum to provide a sealed pavement 7.4 m wide.
LEIGH SHIRE	Reconstruction of 5.6 km near Cressy to provide a sealed pavement 7.4 m wide.
MORTLAKE SHIRE	Reconstruction of 5.0 km between Darlington and Mortlake to provide a sealed pavement 7.4 m wide.

HENTY HIGHWAY

KARKAROOK SHIRE	Widening and resurfacing of 3.7 km south of Rosebery to provide a sealed pavement 7.4 m wide.
WARRACKNABEAL SHIRE	Widening and resurfacing 4.3 km between Lah and Brim to provide a sealed pavement 7.4 m wide.
WIMMERA SHIRE	Resurfacing 3.6 km at Byrneville to provide a sealed pavement 7.4 m wide.

HUME HIGHWAY

BENALLA CITY	Reconstruction of 0.4 km of dual carriageways between Faithfull Street and Clarke Street to provide sealed pavements each 7.4 m wide.
WANGARATTA CITY	Reconstruction of 2.4 km of the southern approach to Wangaratta to provide dual carriageways each 7.4 m wide.

MAROONDAH HIGHWAY

HEALESVILLE SHIRE	Reconstruction of the intersection with Crowley Road, Healesville.
MANSFIELD SHIRE	Widening 1.1 km at Woodfield to provide a sealed pavement 7.4 m wide.

MIDLAND HIGHWAY

CASTLEMAINE CITY	Reconstruction of 2.2 km between the railway overpass and Forest Creek Bridge to provide dual carriageways each 7.4 m wide.

MURRAY VALLEY HIGHWAY

NATHALIA SHIRE	Resurfacing of 1.6 km east of McCoys Bridge to provide a sealed pavement 7.4 m wide.
NUMURKAH SHIRE	Reconstruction of 2.6 km between Strathmerton and Rockliffs Road to provide a sealed pavement 7.4 m wide.
RUTHERGLEN SHIRE	Reconstruction of 4.2 km west of Rutherglen to provide a sealed pavement 7.4 m wide.
RUTHERGLEN SHIRE AND YARRAWONGA SHIRE	Reconstruction and realignment of 2.4 km of approaches to a new bridge over the Ovens River to provide a sealed pavement 7.4 m wide.
SWAN HILL SHIRE	Reconstruction of 2.0 km at Tyntynder to provide a sealed pavement 7.4 m wide.

NEPEAN HIGHWAY

FLINDERS SHIRE	Widening 1.3 km between Weeroona Street and Dundas Street, Rye, to provide a sealed pavement 16.5 m wide.

NORTHERN HIGHWAY

McIVOR SHIRE	Reconstruction of the intersection with the Seymour-Tooborac Road at Tooborac.

OMEO HIGHWAY

BAIRNSDALE SHIRE	Reconstruction of 0.9 km between Bairnsdale and Sarsfield to provide a sealed pavement 7.4 m wide.
TOWONG SHIRE	Reconstruction of sections totalling 1.9 km between Noorongong and Tallangatta East to provide a sealed pavement 6.8 m wide.

OVENS HIGHWAY

MYRTLEFORD SHIRE	Reconstruction of 1.4 km at Panlooks to provide a sealed pavement 7.4 m wide.
	Construction of a reinforced concrete bridge 32 m long and 8.5 m wide over Happy Valley Creek at Ovens together with realignment of 1.1 km of approaches to provide a sealed pavement 7.4 m wide.

PRINCES FREEWAY

ALTONA CITY	Widening 3.5 km between the Lower Yarra Freeway and Kororoit Creek Road to provide dual carriageways each 11.0 m wide.
WERRIBEE SHIRE	Widening 3.5 km between Kororoit Creek Road and Point Cook Road to provide dual carriageways each 11.0 m wide including reconstruction and widening of four bridges over the railway line and the adjacent local road.

PRINCES HIGHWAY EAST

BERWICK CITY	Reconstruction of the intersection with the Belgrave-Hallam Road.
OAKLEIGH CITY	Reconstruction of the intersections with Blackburn Road and McNaughton Road.

PRINCES HIGHWAY WEST

BAIRNSDALE SHIRE AND TAMBO SHIRE	Widening of the bridge over the Nicholson River east of Bairnsdale by 1.8 m and replacement of a timber approach span with a steel and concrete span.
PORTLAND SHIRE	Construction of a new bridge 43 m long and 8.5 m wide over the Fitzroy River.
	Reconstruction of 5.5 km at Lyons to provide a sealed pavement 7.4 m wide.
WARRNAMBOOL SHIRE	Construction of 2.4 km of deviation at Allansford to provide a sealed pavement 7.4 m wide and the construction of a new bridge 91.5 m long and 8.5 m wide over the Hopkins River.
	Reconstruction of 2.4 km at Cudgee to provide a sealed pavement 7.4 m wide.

PYRENEES HIGHWAY

AVOCA SHIRE TALBOT AND CLUNES SHIRE AND TULLAROOP SHIRE	Reconstruction and realignment of 1.6 km at Bung Bong to provide a sealed pavement 7.4 m wide.
CASTLEMAINE CITY	Widening by 1.7 m and redecking Pattersons Bridge over Forest Creek.

SOUTH GIPPSLAND HIGHWAY

CRANBOURNE SHIRE	Reconstruction of 8.3 km between Cairns Road, Hampton Park and Brunt Street, Cranbourne to provide dual carriageways each 7.4 m wide.
	Construction of an overpass bridge 88 m long and 8.5 m wide and reconstruction of the intersection with the Bass Highway.

SUNRAYSIA HIGHWAY

AVOCA SHIRE	Reconstruction of 1.1 km at Lamplough to provide a sealed pavement 7.4 m wide.

BIRCHIP SHIRE AND DONALD SHIRE	Widening and resurfacing of 6.5 km north of Watchem to provide a sealed pavement 7.4 m wide.
DONALD SHIRE AND KARA KARA SHIRE	Widening and resurfacing 2.7 km at Cope Cope to provide a sealed pavement 7.4 m wide.

WESTERN HIGHWAY

BALLAARAT CITY	Reconstruction of 0.5 km at Ballarat West to provide dual carriageways each 7.4 m wide, including the reconstruction of the Gillies Street intersection.
KANIVA SHIRE AND LOWAN SHIRE	Reconstruction and realignment of 5.6 km through the Lawloit Ranges to provide a sealed pavement 7.4 m wide.

WIMMERA HIGHWAY

DUNMUNKLE SHIRE	Reconstruction of 11.0 km between Murtoa and Rupanyup to provide a sealed pavement 7.4 m wide.
KOWREE SHIRE	Reconstruction and widening of 7.1 km between Edenhope and Apsley to provide a sealed pavement 7.4 m wide.

APPENDIX 3

TOURISTS' ROADS AND FOREST ROADS

Significant Works Completed During Financial Year 1974/5

TOURISTS' ROADS

ALPINE ROAD	Widening 4.2 km between Harrietville and "The Meg" to provide a sealed pavement 6.2 m wide.
BOGONG HIGH PLAINS ROAD	Widening 3.2 km north of Crankie Charlie to provide a sealed pavement 7.4 m wide.
	Widening 1.8 km between Turnback Creek and Howmans Gap to provide a sealed pavement 7.4 m wide.
GREAT OCEAN ROAD	Reconstruction and realignment of 3.2 km between Torquay and Bellbrae to provide a sealed pavement 7.4 m wide.

FOREST ROADS

DEANS MARSH — LORNE	Reconstruction and realignment of 3.9 km near Benwerrin to provide a pavement 6.8 m wide.
LAVERS HILL — COBDEN	Reconstruction and realignment of 2.1 km south of Simpson to provide a pavement 6.8 m wide.

APPENDIX 4

MAIN ROADS

Significant Works Completed During Financial Year 1974/75

BAIRNSDALE DIVISION

TAMBO SHIRE	Gelantipy Road — Construction of a new bridge 15.9 m long and 7.4 m wide between kerbs over Wattle Tree Creek north of Murrindal.

BALLARAT DIVISION

ARARAT SHIRE	Ararat-Warrnambool Road — Reconstruction of 2.6 km south of Ararat to provide a sealed pavement 7.4 m wide.
BALLAN SHIRE	Ballan-Daylesford Road — Reconstruction and realignment of 2.0 km south of Spargo Creek to provide a sealed pavement 6.8 m wide.
BUNINYONG SHIRE	Buninyong-Mt. Mercer Road — Reconstruction and realignment of 2.1 km south of Garibaldi to provide a sealed pavement 6.2 m wide.
NEWHAM AND WOODEND SHIRE	Mt. Macedon Road — Reconstruction and realignment of 1.0 km at Mt. Macedon to provide a sealed pavement 6.8 m wide.
ROMSEY SHIRE	Melbourne-Lancefield Road — Reconstruction of 3.3 km at Bolinda Vale to provide a sealed pavement 7.4 m wide.

BENALLA DIVISION

BEECHWORTH SHIRE	Beechworth Road — Reconstruction of junction with the Yackandandah-Wodonga Road.
COBRAM SHIRE	Benalla-Tocumwal Road — Reconstruction of two sections totalling 4 km north of Cobram South Road to provide a sealed pavement 6.2 m wide.
	Cobram South Road — Reconstruction of 5.2 km to provide a sealed pavement 7.4 m wide.
MANSFIELD SHIRE	Mansfield Road — Construction of reinforced concrete bridge 22.8 m long and 8.5 m wide between kerbs near Mansfield.
	Mansfield-Whitfield Road—Reconstruction of 2.4 km at Tolmie to provide a sealed pavement 6.2 m wide.
	Mansfield-Woods Point Road — Construction of 1.6 km between Jamieson and Kevington to provide a sealed pavement 6.2 m wide.
	Widening 3.3 km near Knockwood to provide a pavement 7.4 m wide.
TALLANGATTA SHIRE	Yabba Road — Reconstruction and realignment of 2.3 km in the Parish of Yabba to provide a sealed pavement 5.6 m wide.
UPPER MURRAY SHIRE	Tallangatta-Corryong Road — Reconstruction and realignment of 2.0 km at Berringama to provide a sealed pavement 6.8 m wide.
WODONGA CITY	Beechworth-Wodonga Road — Reconstruction including construction of 1.6 km of service roads.
YACKANDANDAH SHIRE	Dederang Road — Reconstruction and realignment of 3.2 km east of Glen Creek to provide a sealed pavement 6.8 m wide.
YEA SHIRE	Whittlesea-Yea Road — Reconstruction including realignment of 2.1 km at Junction Hill to provide a sealed pavement 6.8 m wide.

BENDIGO DIVISION

BENDIGO CITY	Mandurang Road — Reconstruction and duplication between Hallam Street and Spring Gully Road to provide dual carriageways each 9.8 m wide.
EAST LODDON SHIRE	Mitiamo-Boort Road — Reconstruction of 4.9km west of Mitiamo to provide a sealed pavement 6.8 m wide.
METCALFE SHIRE	Bendigo-Sutton Grange Road — Reconstruction and realignment of 2.4 km north of Elphinstone to provide a sealed pavement 6.8 m wide.
ROCHESTER SHIRE	Echuca-Mitiamo Road — Widening of 3.7 km west of Kotta to provide a sealed pavement 6.2 m wide.
RODNEY SHIRE	Mooroopna-Wyuna Road — Reconstruction of 3.3 km east of Undera to provide a sealed pavement 7.4 m wide.
SWAN HILL SHIRE	Nyah-Ouyen Road — Reconstruction of 1.8 km west of Murray Valley Highway at Nyah to provide a sealed pavement 7.4 m wide.
WARANGA SHIRE	Rushworth-Stanhope Road — Reconstruction of 1.7 km north of Stanhope to provide a sealed pavement 6.8 m wide.

DANDENONG DIVISION

CRANBOURNE SHIRE	Baxter-Tooradin Road — Reconstruction of 3.2 km west of Pearcedale Road to provide a sealed pavement 7.4 m wide.
FLINDERS SHIRE	Rosebud-Flinders Road — Reconstruction of intersection with Eastbourne Road.
LILLYDALE SHIRE	Lilydale-Monbulk Road — Reconstruction of 1.2 km south of Mt. Evelyn to provide a sealed pavement 7.4 m wide.

GEELONG DIVISION

BELLARINE SHIRE	Geelong-Portarlington Road — Duplication of 1.8 km near Point Henry Road to provide a sealed pavement 7.4 m wide.

HORSHAM DIVISION

WYCHEPROOF SHIRE	Birchip-Wycheproof Road — Reconstruction of various sections totalling 3.8 km to provide a sealed pavement 6.8 m wide.

METROPOLITAN DIVISION

WHITTLESEA SHIRE	Whittlesea Road — Reconstruction from Grants Road to Laurel Street to provide a sealed pavement 7.4 m wide.

TRARALGON DIVISION

KORUMBURRA SHIRE	Korumburra-Drouin Road — Reconstruction and realignment of 2.4 km south from Shire boundary to provide a sealed pavement 6.8 m wide.
MORWELL SHIRE AND TRARALGON SHIRE	Tyers Road — Construction of a reinforced concrete bridge 39 m long and 8.5 m wide between kerbs over the Tyers River.
ROSEDALE SHIRE AND MAFFRA SHIRE	Maffra-Rosedale Road — Construction of a reinforced concrete bridge (Gibson Knox Bridge) 73.2 m long and 8.5 m wide between kerbs over the Thompson River.
TRARALGON SHIRE	Yarram-Traralgon Road — Reconstruction of 1.5 km north of South Gippsland Highway to provide a sealed pavement 7.4 m wide.
WARRAGUL SHIRE	Darnum-Allambee Road — Reconstruction and realignment of 1.8 km south of Darnum to provide a sealed pavement 6.2 m wide.
	Warragul-Lardner Road — Reconstruction of 0.8 km west of Warragul to provide a sealed pavement 7.4 m wide.

WARRNAMBOOL DIVISION

DUNDAS SHIRE	Dartmoor-Hamilton Road — Construction of 0.9 km of bridge approaches at Violet Creek to provide a sealed pavement 6.2 m wide.
	Construction of reinforced concrete bridge 19.2 m long and 8.5 m wide between kerbs over Violet Creek.
	Macarthur-Penshurst Road — Reconstruction of 2.8 km north of Macarthur to provide a sealed pavement 6.2 m wide.
MINHAMITE SHIRE	Woolsthorpe-Heywood Road — Reconstruction of 2.9 km north of Orford to provide a sealed pavement 6.2 m wide.
WANNON SHIRE	Harrow-Balmoral Road — Construction of new bridge 18.9 m long and 7.4 m wide between kerbs over railway line at Balmoral.

APPENDIX 5

UNCLASSIFIED ROADS

Significant Works Completed During Financial Year 1974/75

BAIRNSDALE DIVISION

TAMBO SHIRE	Bonang-Gelantipy Road — Reconstruction and realignment of 2.5 km south of Craigneish Creek to provide a sealed pavement 6.2 m wide.

BALLARAT DIVISION

ARARAT SHIRE	Tatyoon Road — Reconstruction and realignment of 3.8 km to provide a sealed pavement 6.8 m wide.
BALLAN SHIRE	Ballan-Egerton Road — Construction of reinforced concrete bridge over Eastern Moorabool River, 32 m long and 7.4 m wide between kerbs.
BALLAARAT CITY	Eureka Street — Reconstruction and realignment of 1.3 km east from Fussell Street to provide a sealed pavement between 12 m and 7.4 m wide.
	Peel Street — Reconstruction of 0.8 km between Scott Parade and Napier Street to provide a sealed pavement 12.2 m wide.
NEWHAM AND WOODEND SHIRE	Kyneton-Lancefield Road — Installation of a 3.7 m corrugated multiplate pipe culvert at Dry Creek Crossing.
ROMSEY SHIRE	Mt. Eliza-Mullays Road — Reconstruction of 3.2 km south-east of Monegeetta to provide a sealed pavement 3.7 m wide.

BENALLA DIVISION

TALLANGATTA SHIRE	Kurrajong Gap Road — Reconstruction and realignment of 3.1 km at Bethanga to provide a pavement 5.8 m wide.
UPPER MURRAY SHIRE	Briggs Gap Road — Reconstruction including realignment of 2.3 km to provide a sealed pavement 5.6 m wide.
WANGARATTA CITY	Sisely Avenue — Reconstruction of 0.5 km to provide a sealed pavement 18.2 m wide.
WANGARATTA SHIRE	Three Chain Road — Reconstruction of 5.7 km to provide a pavement 6.2 m wide.
	Warby Range Road — Reconstruction of 1.5 km to provide a sealed pavement 5.6 m wide.
WODONGA CITY	Brockley Street — Construction of a bridge 31.5 m long and 8.5 m wide between kerbs over House Creek.
YEA SHIRE	Ghin Ghin Road — Reconstruction and realignment of 1.7 km to provide a sealed pavement between 3.7 m and 5.6 m wide.

BENDIGO DIVISION

BENDIGO CITY	Nolan Street — Reconstruction between Midland Highway and Hargreaves Street to provide a sealed pavement 15 m wide.
DEAKIN SHIRE	Finlay Road — Reconstruction of 3.7 km east of Tongala to provide a sealed pavement 6.8 m wide.
	Simmie Road — Reconstruction of 3.7 km north of Echuca-Kyabram Road to provide a sealed pavement 5.6 m wide.
EAST LODDON SHIRE	Dunn's Road — Reconstruction of 3.2 km east of Dingee to provide a sealed pavement 3.7 m wide.
	Echuca-Serpentine Road — Reconstruction of 5.8 km north of Serpentine to provide a sealed pavement 3.7 m wide.

HUNTLY SHIRE	Old Murray Road — Construction of a reinforced concrete bridge 24.4 m long and 7.4 m between kerbs over Bendigo Creek at Bagshot North.
KERANG SHIRE	Lalbert-Kerang Road — Reconstruction of 2.8 km east of Lalbert to provide a sealed pavement 3.7 m wide.
PYALONG SHIRE	Pyalong-Lancefield Road — Widening of 3.5 km south of Pyalong to provide a sealed pavement 6.2 m wide.
RODNEY SHIRE	Toolamba Road — Reconstruction of 2.0 km south of Toolamba to provide a sealed pavement 7.4 m wide.
STRATHFIELDSAYE SHIRE	Strathfieldsaye-Eppalock Road — Reconstruction of 3.2 km south of Eppalock to provide a pavement 6.8 m wide.

DANDENONG DIVISION

CRANBOURNE SHIRE	Robinson's Road — Reconstruction of 1.8 km from West Boundary Road to Warrandyte Road to provide a sealed pavement 6.2 m wide.
CROYDON CITY	Eastfield Road — Reconstruction of 0.3 km from The Pass to Pleasant Rise to provide a sealed pavement 13.4 m wide.
HASTINGS SHIRE	New Cemetery Road — Reconstruction of 1.6 km from Bayview Road to Cemetery Road to provide a sealed pavement 7.4 m wide.
KNOX CITY	Boronia Road — Reconstruction of 0.7 km from Erica Avenue to Zeising Court to provide a sealed pavement 9.8 m wide.
MORNINGTON SHIRE	Bungower Road — Reconstruction of 3.2 km from Nepean Highway to Moorooduc Road to provide a sealed pavement 7.4 m wide.
SHERBROOKE SHIRE	Belgrave-Ferny Creek Road — Reconstruction and realignment of 1.1 km from Sandells Road to Ham Road to provide a sealed pavement 6.4 m wide.
WAVERLEY CITY	Forster Road — Reconstruction of 0.4 km from Waverley Road to Wilga Street to provide a sealed pavement 16.8 m wide.
	Lum Road — Reconstruction of 1.0 km from Mackintosh Road to Ferntree Gully Road to provide a sealed pavement 12.8 m wide.

GEELONG DIVISION

CORIO SHIRE	Station Street — Reconstruction between Donnelly Avenue and Tulip Street to provide dual carriageways each 8.8 m wide.
CORIO AND BANNOCKBURN SHIRES	Steiglitz Road — Construction of new bridge 24.4 m long and 7.4 m wide between kerbs over Sutherlands Creek.
SOUTH BARWON SHIRE	Barwon Heads-Torquay Road — Construction of 2.7 km north of Breamlea to provide a sealed pavement 6.2 m wide.
WERRIBEE SHIRE	Ballan Road—Reconstruction and widening of 2.8 km north of Werribee to provide a sealed pavement 7.4 m wide.
	Werribee Street — Reconstruction between Watton Street and Deutgam Street to provide a sealed pavement 18.3 m wide.

HORSHAM DIVISION

HORSHAM CITY	Baillie Street — Reconstruction of 1.0 km from Henty Highway to Menadue Street to provide a sealed pavement 12.2 m wide.

KARA KARA SHIRE	Swanwater Road — Reconstruction of 2.2 km north of Sunraysia Highway to provide a sealed pavement 3.7 m wide.
KOWREE SHIRE	Mitre Road — Construction of 6.1 km east of Nhill-Gymbowen Road to provide a sealed pavement 3.7 m wide.
MILDURA SHIRE	Red Cliffs-Colignan Road — Reconstruction and widening of 5.8 km east of the Calder Highway to provide a sealed pavement 6.2 m wide.
STAWELL SHIRE	Great Western-Red Bend Road — Construction of reinforced concrete bridge 31.9 m long and 8.5 m wide between kerbs, east of the Western Highway.

METROPOLITAN DIVISION

BOX HILL CITY	Station Street — Reconstruction between Lynden Street and Piedmont Street to provide a sealed pavement 12.8 m wide.
BROADMEADOWS CITY	Camp Road — Reconstruction of southern half from the Upfield railway line to Pascoe Vale Road to provide a sealed pavement 14 m wide.
CAULFIELD CITY	Booran Road — Reconstruction between Woodville Avenue and North Road to provide a sealed pavement 11.9 m wide.
HAWTHORN CITY	Power Street-Riversdale Road and Wallen Road — Reconstruction of intersection.
HEIDELBERG CITY	Southern Road — Reconstruction between Waterdale Road and Bamfield Road to provide a sealed pavement averaging 10 m wide.
KEILOR CITY	Broadmeadows Road — Reconstruction between Sharps Road and Lancefield Road to provide a sealed pavement 7.4 m wide.
MELTON SHIRE	Hopkins Road — Reconstruction of 2.6 km south of the Western Highway to provide a sealed pavement 7.4 m wide.
MORDIALLOC CITY	Governor Road — Reconstruction between Lamana Road and Doncaster-Mordialloc Road to provide a sealed pavement 12.5 m wide.
NORTHCOTE CITY	High Street — Reconstruction of west side between Beavers Road and Normanby Avenue to provide a sealed pavement 5.8 m wide.

TRARALGON DIVISION

KORUMBURRA SHIRE	Jeetho Road — Reconstruction and realignment of 1.8 km south from South Gippsland Highway to provide a sealed pavement 6.2 m wide.
SOUTH GIPPSLAND SHIRE	Foster-Promontory Road — Reconstruction of 1.5 km south of Foster to provide a sealed pavement 6.8 m wide.
WARRAGUL SHIRE	Bull Swamp Road — Construction of a reinforced concrete bridge 18.3 m long and 7.4 m wide over Bear Creek.

WARRNAMBOOL DIVISION

DUNDAS SHIRE	Chatsworth Road — Reconstruction of 2.4 km east of Hamilton to provide a sealed pavement 6.2 m wide. Gardeners Road — Reconstruction of 4.2 km east of Cavendish to provide a sealed pavement 3.7 m wide.
WANNON SHIRE	Coleraine-Nareen-Moree Road — Reconstruction of 3.3 km north-west of Coleraine to provide a sealed pavement 6.2 m wide.
WARRNAMBOOL CITY	Albert Street — Reconstruction and realignment of 3.6 km west of Warrnambool to provide a sealed pavement varying in width from 7.4 m to 12.2 m.

APPENDIX 6

SPECIAL PROJECTS

Details of Special Projects on which work was carried out during the year

Project No.	Project	Progress of Work
17.	Hume Freeway—Construction of a four-lane freeway from south of Wallan to north of Broadford.	Work continued over the entire length of 34 km during the year.
20.	Mallacoota-Wingan Inlet Road—Construction of a new tourists' road.	A bridge over the Betka River and associated road works were constructed.
24.	Eastern Freeway—Construction of a multi-lane freeway from Alexandra Parade, Collingwood to Thompsons Road, Camberwell.	Work continued over the entire length of 9 km during the year.
25.	Yarra River Bridge, Johnson Street, South Melbourne.	Work commenced on the construction of the bridge and approach roads.
33.	Princes Highway East—Construction of a new bridge over the Snowy River at Orbost and realignment of approaches.	Work commenced on the construction of the bridge and approaches.
40.	Princes Freeway—Construction of a second carriageway between Moe and Hernes Oak.	Work continued on the construction of the Hernes Oak interchange and work commenced on the construction of the Gunns Gully interchange.
41.	Princes Freeway/Princes Highway—Construction of dual carriageways between Morwell and Traralgon including a by-pass of Morwell.	A second carriageway was constructed between Traralgon and Airport Road, a distance of 3.2 km.
42.	Bass Highway—Improvements from South Gippsland Highway to Dalyston, including grade separation at the South Gippsland Highway intersection.	Grade separation at the South Gippsland Highway intersection and a deviation to the west of Bass township were completed.
44.	Tullamarine Freeway—Grade separation at the intersection of Lancefield Road and English Street.	Drainage work commenced.

APPENDIX 7

MOTOR REGISTRATIONS

Registrations under the Motor Car Act during the year 1974/75 totalled 2,006,354, an increase of 5.1% over the total for the previous year.

Vehicle	Financial Year 1973/74		Financial Year 1974/75		Increase	Decrease
Private						
New	126,282		138,210			
Secondhand:						
Re-registered	46,957		44,048			
Renewed	1,222,661		1,289,832			
		1,395,900		1,472,090	76,190	
Commercial and Hire						
New	17,654		17,706			
Secondhand:						
Re-registered	5,679		4,653			
Renewed	121,734		127,079			
		145,067		149,438	4,371	
Primary Producers' Trucks and Tractors						
New	4,661		3,969			
Secondhand:						
Re-registered	4,349		2,912			
Renewed	79,136		80,736			
		88,146+		87,617*		529
Licences under the Motor Omnibus Act		764		826	62	
Trailers		232,616		251,630	19,014	
Motor Cycles		45,706		44,753		953
TOTALS		1,908,199		2,006,354	99,637	1,482

+ Includes 45,020 no-fee tractors.
* Includes 45,228 no-fee tractors.

APPENDIX 8

COUNTRY ROADS BOARD

Statement of Receipts and Payments for Year Ended 30th June 1975
(Adjusted to Nearer Dollar)

			Country Roads Board Fund	Loan Funds	Roads (Special Projects) Fund	National Roads Act 1974	Roads Grants Act 1974	Transport (P&R) Act 1974 Sections 7 & 8	C'wealth Traffic & Road Safety Improve. Trust A/c	C'wealth Employment Scheme 1975	Regional Employment Dev. Scheme		Total
RECEIPTS			$	$	$	$	$	$	$	$	$	$	$
Balance as at 1st July 1974			831,610	..	..	..	..	..	..	..	..	..	831,610
Motor Car Act 1958 (No. 6325)													
Motor Car Registration Fees		45,243,583											
Additional Registration Fees		129,604											
Drivers' Licence Fees		1,194,501											
Drivers' Licence Testing Fees		485,133											
Trailer Registration Fees		1,171,554											
Learner Drivers' Permit Fees		159,982											
Examiners' Licence Fees		7,414											
Sale of Log Books		9,668											
Motor Driving Instructors' Licence—Appointment and Testing Fees		2,220											
Motor Driving Instructors' Licence Fees		4,330											
		48,407,989											
Less Cost of Collection		6,423,348	41,984,641	..	..	..	..	..	..	..	..	41,984,641	
Municipalities Contributions—													
Permanent Works—Main Roads		128,269											
Maintenance Works—Main Roads		1,919,000	2,047,269	..	..	..	..	..	..	..	..	2,047,269	
Fees—*Commercial Goods Vehicles Act* No. 6222—Road Maintenance A/c.			10,037,593	..	..	..	..	..	..	..	..	10,037,593	
Public Works and Services Act No. 8635			149,500	..	..	..	..	..	..	..	..	149,500	
Fines—*Country Roads Act* No. 6229			5,998	..	..	..	..	..	..	..	..	5,998	
General Receipts			1,241,400	..	..	..	..	..	..	..	..	1,241,400	
Grant—Flood Relief			622,871	..	..	..	..	..	..	..	..	622,871	
State Loan Funds Act No. 6229			..	300,000	..	..	..	..	..	..	..	300,000	
Allocation—Roads (Special Projects) Fund			..	..	30,428,673	..	..	..	..	..	..	30,428,673	86,817,945
Commonwealth Grants—													
National Roads Act 1974			..	..	..	18,920,000	..	..	..	..	..	18,920,000	
Roads Grants Act 1974			..	..	..	..	55,510,000	..	..	..	..	55,510,000	
Transport (Planning and Research) Act 1974			..	..	..	..	..	1,241,000	..	..	..	1,241,000	
Traffic and Road Safety Improvement			..	..	..	..	..	..	172,217	..	..	172,217	
Commonwealth Employment Scheme 1975			..	..	..	..	..	..	..	3,000,000	..	3,000,000	
Regional Employment Development Scheme			..	..	..	..	..	..	..	..	133,583	133,583	78,976,800
			$56,920,882	$300,000	$30,428,673	$18,920,000	$55,510,000	$1,241,000	$172,217	$3,000,000	$133,583		$166,626,355
PAYMENTS													
Road Expenditure													
Main Roads—													
Construction and Reconstruction			9,712,080	..	2,889,399	..	5,368,715	..	59,241	..	..	18,029 435	
Maintenance			4,174,676	..	..	..	..	..	..	..	..	4 174,676	
Road Maintenance A/c—Act No. 6222			4,294,743	..	..	..	..	..	..	..	..	4,294,743	26,498,854
State Highways—													
Construction and Reconstruction			7,019,900	300,000	2,002,590	1,486,353	5,006,015	..	35,520	1,314,679		17,165,057	
Maintenance			1,341,162	..	..	1,120,972	..	..	..	1,456,043	74,179	3,992,356	
Road Maintenance A/c—Act No. 6222			5,287,600	..	..	..	..	..	..	..	..	5,287,600	26,445,013
Freeways—													
Construction and Reconstruction			282,546	..	16,257,671	12,673,647	18,708,836	..	..	39,386	21,312	47,983,398	
Maintenance			614,022	..	..	299,028	..	..	..	..	..	913,050	
Road Maintenance A/c—Act No. 6222			455,250	..	..	..	..	..	..	..	..	455,250	49,351,698
Tourists' Roads—													
Construction and Reconstruction			2,036	..	..	..	828,300	..	50	189,892	11,960	1,032,238	
Maintenance			389,362	..	..	..	712,865	..	..	..	..	1,102,227	2,134,465
Forest Roads—													
Construction and Reconstruction			..	..	..	..	415,603	..	..	..	..	415,603	
Maintenance			190,389	..	..	..	495,708	..	..	..	..	686,097	1,101,700
Unclassified Roads—													
Construction and Reconstruction			674,069	..	7,379,013	..	16,038,160	..	77,406	..	..	24,168,648	
Maintenance			3,708,062	..	..	..	430,798	..	..	..	26,132	4,164,992	
Contribution to Melbourne & Metropolitan Tramways Board—Tram Tracks Reconstruction			200,000	..	..	..	..	..	..	..	..	200,000	28,533,640
Metropolitan Bridges			1,448	..	..	..	..	..	..	..	..	..	1,448
Metropolitan Intersection Control Programme			333,440	..	..	..	..	..	..	..	..	..	333,440
Murray River Bridges and Punts			122,985	..	..	..	..	..	..	..	..	..	122,985
Traffic Line Marking			783,869	..	..	..	..	..	..	..	..	..	783,869
													135,307,112
Statutory Payments													
Interest and Sinking Fund		2,688,496											
Traffic Authority Fund		375,375											
Tourist Fund		750,749											
Transport Regulation Fund		621,528	4,436,148	..	..	..	..	..	..	..	..	..	4,436,148
Planning and Research			989,372	..	..	..	..	1,215,377	..	..	..	..	2,204,749
Capital Expenditure													
Plant Replacement and Additions		1,783,436											
Buildings, Workshops, etc.		806,090	2,589,526	..	..	..	..	..	..	..	..	..	2,589,526
Management and Operating Expenditure			8,701,592	..	1,900,000	3,340,000	7,490,000	..	..	..	..	..	21,431,592
			$56,304,277	$300,000	$30,428,673	$18,920,000	$55,495,000	$1,215,377	$172,217	$3,000,000	$133,583	..	$165,969,127
Balances available to the Board as at 30th June 1975			$616,605	..	..	..	$15,000	$25,623	..	..	..	..	$657,228

R. G. COOPER,
Chief Accountant,
22nd October, 1975.

AUDITOR GENERAL'S CERTIFICATE

The accounts of the Country Roads Board for the year ended 30th June, 1975, have been audited. In my opinion the above Statement of Receipts and Payments fairly presents in summary form the transactions during that period.

B. HAMILTON,
Auditor-General,
27th October, 1975.

APPENDIX 9

COUNTRY ROADS BOARD

Loan Liability as at 30th June, 1975

	Main Roads, etc.	Developmental Roads	TOTAL
Permanent Works			
Main Roads	16,730,322.16		16,730,322.16
State Highways	18,304,304.20		18,304,304.20
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	743,435.35	583,722.84	1,327,158.19
Total Amount Borrowed	$39,007,546.04	$13,435,237.93	$52,442,783.97
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	3,407,266.34		3,407,266.34
National Debt Sinking Fund	7,827,517.46	7,486,187.52	15,313,704.98
Consolidated Fund	21,321.14		21,321.14
	$11,997,919.81	$8,889,126.27	$20,887,046.08
Loan Liability at 30th June 1975	$27,009,626.23	$4,546,111.66	$31,555,737.89

APPENDIX 10

Works Executed on Behalf of Commonwealth and State Government Authorities for the Year Ended 30th June 1975

(Adjusted to Nearer Dollar)

Departments	Description of Works	Expenditure	
Commonwealth—			
Department of Works	Access roads to various Commonwealth establishments		21,623
Victoria—			
Housing Commission	Overpass at Riggall Street, Broadmeadows City	684,513	
Lands & Survey Department	Reconstruction of Dunmoor Road, Glenelg Shire	2,984	
Melbourne and Metropolitan Board of Works	Roadworks in connection with Cardenia Reservoir, maintenance of Marysville–Woods Point Road	311,230	
Ministry of Tourism	Additional snow clearing on the Alpine Road to Mt Hotham	20,874	
Ministry of Transport	Grade separated level crossing projects etc. charged to the Transport Fund	1,893,187	
	Grade separated pedestrian crossings charged to State Treasury, Municipalities and Transport Fund	168,468	
Premier's Department	Roadworks in connection with Wonderland and Sundial Roads, Stawell Shire	300	
Rural Finance & Settlement Commission	Roadworks in Commission land settlement areas throughout the State	13,408	
State Electricity Commission	Road and bridge works in connection with the extension of Morwell Open Cut, removal of tram tracks in Bendigo	449,385	
State Rivers & Water Supply Commission	Roadworks in connection with Dartmouth Dam Project	1,064	3,545,413
State Treasury	Kings Bridge—sundry expenditure less proceeds of rental of properties acquired in connection with construction of Kings Bridge	7,036 Cr	
,, ,,	Improvements to various roads adjacent to State Forests to facilitate the extraction of timber and charged to Municipalities Forest Roads Improvement Fund	47,361	
,, ,,	Restoration works on roads and bridges damaged by floods	8,660,803	8,701,128
			$12,268,164

APPENDIX 11

CHIEF ENGINEER'S REPORT

Country Roads Board
Melbourne

THE CHAIRMAN,

I have the honour to submit the Engineer in Chief's Report for 1974/75. The report deals with those activities within the Engineer in Chief's Branch which are considered to be of general and special technical interest.

K. G. MOODY,
Engineer in Chief

BRIDGE SUB-BRANCH

1. DESIGN

Consideration of Aesthetics in Bridges

No formal statement has ever been made concerning the extent to which bridge design prepared for projects under the Board's control should be influenced by notions of aesthetics. Careful consideration has always been given to the appearance of bridges, but with the increasing interest of the community in the environment, and the opportunities now available to individuals and groups to express their opinions and to make their views known during the design phase, it is likely that this aspect of the Board's work will receive increased attention. It is therefore appropriate at this stage to comment on the extent to which this matter has affected consideration of bridge designs.

The subject of aesthetics is complex and the acceptability of a particular configuration of structure depends to a large degree on personal feelings, rather than any logical process. Certain basic principles have been established, but these are by no means universal and cultural indoctrination is so dominant that what may be praised under one set of circumstances may be barely tolerated under others.

Structural adequacy has no bearing on the question of aesthetic value, so an obviously decrepit structure may be received with romantic admiration in an appropriate setting. Conversely it is clear that a design which satisfied all the engineering requirements, structural and geometric, for a particular site will not necessarily gain favour aesthetically. This is not surprising since there are usually many solutions that will satisfy the engineering requirements of any particular bridge problem.

The first stage in the design of a bridge is the selection of the most satisfactory design by comparison of all feasible configurations in the light of a number of criteria. The criteria which are usually applicable are cost, appearance, amenity, convenience of construction, and availability of resources such as materials, labour, special equipment and technical expertise. The significance of each of these criteria varies from job to job but usually the limitations of the funds available for the Board's total programme dictates that a strong emphasis is placed on cost.

However, when a structure is located in a prominent position and by effect on its environment is likely to excite some feelings, the practice has been to select alternatives on a basis of aesthetic merit. Rather than attempting to produce highly dramatic effects, this has generally been limited to the consideration of the basic elements of line, proportion and form, with subsequent attention to surfaces, finishes and details to achieve a result which is deemed to be fitting at at small cost premium.

This approach has resulted in the adoption of slightly longer than optimum span lengths on some river bridges, one and two column pier arrangements rather than multi-column piers, and piers with crossheads on columns rather than long solid walls on railway overpass structures. Generally the result has been to produce structures that suit the purpose and fit into the surroundings without arousing comment.

At the present time the larger and more prominent bridges constructed by the Board are those crossing freeways, and improvements in techniques have made it possible to build these bridges with relatively slender supporting members and simple clean lines that harmonize with the surroundings. In the "standard" two span arrangement that fits most situations the superstructure is a shallow box, continuous with crossheads incorporated within its depth so that the pier is reduced to a simple unobtrusive column which is shaped to provide pleasing lines and avoid the suggestion of crudity. Abutments are minimal and located near the tops of cuttings or approach fills without piers in the verge to avoid interruption of the continuous vista that is presented to the driver. During 1972/73 and 1973/74, the cost of bridges constructed on these lines was approximately $236 per sq.m. compared with $215 per sq.m. for prestressed beam bridges of shorter, simply supported spans used in earlier years.

Special situations call for special solutions, and at Burrell Road on the Mornington Peninsula Freeway a deep cutting has become the site for a frame structure with sloping legs, constructed at a cost of $328 per sq.m. A cheaper structure might have been constructed for as little as $250 per sq.m. but it would have been very much inferior in appearance. The premium paid for improved appearance in this case may be regarded as abnormally high but it was at the time considered to be justified because of the prominent location of the structure.

It is difficult to produce hard and fast rules from a review of this nature. The field of aesthetics is entirely subjective, and this would include any opinion on the extra cost which should be allowed in the selection of an aesthetically superior bridge layout. Each situation must be judged on its merits, considering the environment, exposure to the public, the sensitivity of those affected and most importantly, the availability of funds.

2. CONSTRUCTION

(a) Segmental Beam Manufacture and Erection

The prestressed beams for the North East Railway Overpass Bridges, and the Sunday Creek Bridges on the Wallan–Broadford Section of the Hume Freeway Project were manufactured in segments at the Board's depot in Bendigo. The completed lengths of the beams varied between 74′4⅝″ and 121′2″ and were formed of three or four segments respectively.

For setting up to line and level, the segments were supported on concrete plinths, and level adjustments were made with steel shims. Six inch gaps between each segment were filled with concrete after the cable ducts were connected, and after a suitable curing period, the pre-stressing cables were drawn through the ducts, care being taken to avoid movement and mis-alignment of the segments.

The beams were post-tensioned by the B.B.R. system as soon as the infill concrete had acquired the necessary strength. On completion of stressing and grouting of the cable ducts, the anchorages were covered with concrete and the beams were ready for erection on the bridge.

Beams were erected at the North East Railway Overpass site by employing two 70 ton and two 35 ton capacity mobile cranes. The space over the railway tracks was only available on Sunday nights so as to avoid interference with train schedules. Under these conditions beams were erected at the rate of two per hour, including the transportation of the beams 0.4 km from the storage area to the bridge site by low loader.

Plate 1—Launching a beam across the temporary Bailey bridge.

Beams were erected at the Sunday Creek Bridge site by the use of three 35 ton capacity mobile cranes, one low loader, and a double-single Bailey bridge placed between the twin bridges. The method adopted involved placing a beam weighing 54 tons on the low loader and backing up the vehicle to the end of the Bailey bridge. The end of the beam was then placed on a trolley on the Bailey bridge, the low loader end bogey was removed, and the prime mover then pushed the beam along the Bailey bridge. When the beam was fully supported on the Bailey bridge, it was lifted by two 35 ton cranes and placed on the abutment bearings.

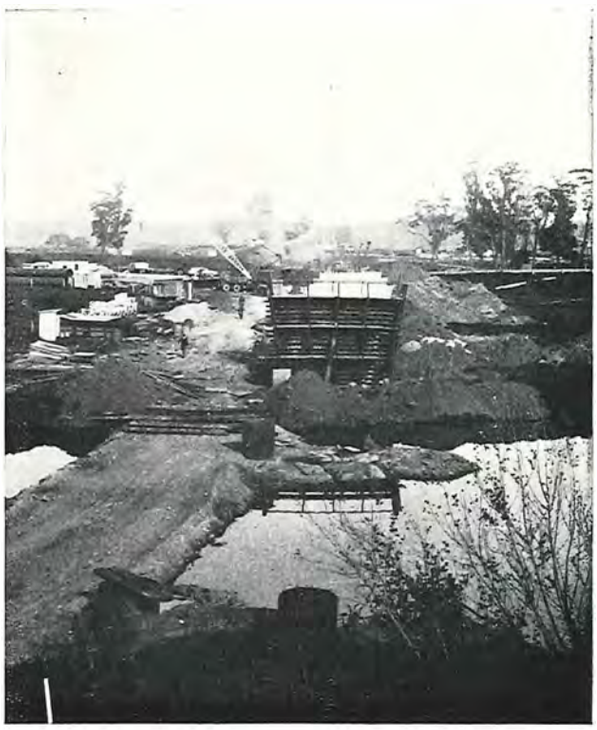


Plate 2—Construction of land piers for the main river bridge.

A comparison of overall costs has revealed that for long prestressed beams the difference in costs between segmental construction and pretensioned construction is small. Where access to a bridge site is difficult the segmental beam has distinct advantages, particularly in country areas. Where a bridge site is readily accessible from a precasting depot, pretensioned beams are usually more economical.

(b) Snowy River Bridges at Orbost

In December 1974, the Board accepted the tender of Pearson Bridge Pty Ltd for the construction of the Snowy River Bridges at Orbost. This contract comprises the construction of three major bridges with a total length of 3,900 ft.

Construction work commenced in January 1975. The driving of test piles for the bridges at Ashby's and Watts' Gulches is now complete and work is proceeding on the construction of the substructure of the Snowy River Bridge.

Plate 3—Driving and cleaning out steel cylindrical piles for the piers in the main river channel.

A brief description of the various aspects of work completed so far, follows:

(i) Construction of sub-structure of the Snowy River Bridge.

Each pier of this bridge is supported on two 4′6″ dia. reinforced concrete cylinders which extend from the pier cap, through alluvial silts to the siltstone bedrock. The specification requires each cylinder to be socketed 9 ft. into the siltstone to provide fixity of the cylinders in the bedrock.

Steel casing of 4′6″ internal diameter and $\frac{1}{2}$″ wall thickness was supplied in lengths up to 40 feet. The lower edge of the casing was strengthened with an external sleeve type cutting edge, 1′6″ long and $\frac{3}{4}$″ thick.

When driving the initial lengths of casing on the land piers, a tubular mast was attached to an Atlas C543 crane and used as a guide to correctly position the casing. The tubular mast was attached to the jib "cathead" and fine adjustment was provided by hydraulic arms attached between the base of the mast and the crane body. The casing was held in position against the mast by top and bottom gates attached to leaders on the mast.

The casing was driven by a Kobe K32 diesel hammer with an energy rating of 54,000 ft. lb., positioned centrally over the casing. The hammer energy was imparted to the casing by a

Plate 4—Kobe K32 diesel hammer with steel driving plate bellmouth and mast leaders attached.

6″ thick steel driving plate. Both the hammer and the driving plate were attached to the mast leaders.

Casings were extended by welding in position and were then redriven by diesel hammer and bellmouth attached to a set of leaders holding the diesel hammer. The driving plate encloses the top of the bellmouth sleeve and the whole system was suspended from the crane.

At the river piers, the casing was pitched to the correct position through a rigid template system attached to the temporary access bridge. Casings were driven using the bellmouth system.

After driving the casing to solid rock, the casing was cleaned out using hammer grabs. After completion of excavation a rock chopper was employed to penetrate approximately 6″ into the siltstone and then the casing was redriven into this socket. This procedure was repeated until the toe of the casing was sealed one foot into solid rock.

Penetration to toe level, 9 feet below the top of solid rock, was carried out by chopping and excavating with grabs. The rock choppers, which weigh up to 4½ tons, consisted of tapered, star-shaped tools with stepped shoulders of hardened steel. These choppers were dropped through a height of approximately 35 feet to shatter the rock. Final trimming and cleaning was carried out manually.

Reinforcement cages were prefabricated on site and after final positioning, concreting was carried out using a 10″ diameter tremie tube.

The toe level of the deepest cylinder constructed in this manner so far, is approximately 70 feet below natural surface.

The work on the construction of the cylinders is being carried out by Frankipile Australia Pty Ltd and 14 No. have been completed to date.

(ii) Driving of test piles at Ashby's and Watts' Gulches.

These two bridges are supported on 12″ x 12″ steel H-piles driven through alluvial silts and gravel layers to bedrock at an average depth of 140 feet. The piles are designed to withstand down-drag forces which are expected to result from the process of driving the piles through the compressible silts.

Fifteen test piles have been driven to investigate this phenomenon.

Ten test piles are instrumented and these will be monitored to assess the magnitude of the anticipated down-drag forces. Some piles are bitumen coated to assess the value of such a coating for the reduction of down-drag forces by reducing the friction between the pile and its surrounding material.

All piles were driven by a 5 ton drop hammer to a safe load of 70 tons given by the Hiley formula. Two piles will be test loaded to 140 tons.

(iii) Manufacture of beams.

The beams for these bridges are U-shape in section and are designed so that the beam formwork can be used for spans varying from 70 feet to 100 feet.

All beams will be precast, pretensioned, prestressed concrete members. The longest beams, 100 ft. span, will have 59 No. 0.6″ dia. strands providing a total initial prestress force of 1,960,000 lb. All tendons are horizontal and partial debonding will be employed. The minimum concrete cylinder strength at release of prestress is 5,500 p.s.i. and at 28 days, 7,000 p.s.i.

All beams will be manufactured on site. A precasting yard with a prestressing bed, steam curing facilities, and beam storage area served by a gantry crane, is being constructed in the road cutting at Ashby's Gulch.

Plate 5—Beam formed with tendons and reinforcing placed ready for casting.

MECHANICAL SUB-BRANCH

1. DESIGN AND DEVELOPMENT

The following development and construction work was either completed or in progress during 1974/75.

(a) Priority Intersection Linemarker—

In order to provide a more economical means of marking priority road intersections a linemarker is being developed to paint and repaint intersection markings at a rate of up to 200 intersections per shift compared to about one tenth of such an output per day as at present. Further, the machine will also apply glass beads to reflectorise the lines which is, at present, not done in most municipalities.

This has been achieved by replacing the air atomised paint application system and gravity feed glass bead application system with a specially developed high output airless spraying paint system and a pneumatically actuated and operated glass bead dispensing gun. Manufacture of a prototype unit is well under way, and it is expected to be available for full field use in late summer 1976.

(b) Dust Suppression—

The rotary road brooms used by the Board on unsealed pavements prior to bitumen spraying create a cloud of dust which at times completely obscures the machines and constitutes a traffic hazard on windless or slightly windy days. The dust cloud comprises the finer particles from the road surface and a process of dust suppression has been developed by spraying a very small quantity of finely atomised water on to the pavement just ahead of the broom. Prototype tests indicate that the method reduces the dust cloud to an acceptable

degree without wetting the pavement, so that sealing can proceed immediately after brooming. A prototype unit is undergoing field tests and full scale field tests will be carried out in the early summer of 1975.

(c) Aggregate Loaders—

Work has been commenced to develop a new aggregate loader which, while generally based on the proven features of the present model, will be capable of screening and precoating material within the machine and discharging it at a rate of 2 cubic metres per minute.

2. NEW TYPES OF PLANT

The following two machines of a type not previously owned by the Board have been obtained:—

(a) Lacroix Deflectrograph, made in Switzerland and mounted on a Berliet (France) truck.

The unit records pavement deflection at forward speeds of between 2–4 km/h.

(b) Slipform paver:

An Automated Paving Equipment Co., Model GL5, Slipform Pavement machine made in USA. The unit which can be used for a variety of slipform applications was employed initially to form a concrete median barrier on the Princes Freeway at Laverton. The machine is capable of producing a 32 inch high median barrier at a rate of 700 feet per day, and walls up to a maximum height of 68 inches, at a rate of 300 feet per day. The unit is very versatile and can be used for forming kerbs, channels and a variety of other facilities where a continuous extrusion process is feasible.

3. GENERAL

Low allocation of capital funds for purchase of replacement plant due to financial shortages is placing a severe strain on the resources for plant maintenance, and it is expected that because of the worsening situation the coming year will not bring any improvement.

PLANNING SUB-BRANCH

1. ADVANCE PLANNING DIVISION

THIRD AUSTRALIAN ROADS SURVEY

When the Commonwealth Acts granting financial assistance to the States for roads during the period of 1974/75–1976/77 were under consideration in the Commonwealth Parliament, it was announced that legislation for the following three years would be introduced by the Government in December 1975. This legislation is to encompass all forms of transport, including roads.

To assist the Commonwealth Government, the Commonwealth Bureau of Roads (CBRds) has been directed to submit a report on the road element of transport.

The CBRds decided to use as its principal source of data about roads a revision of the Australian Roads Survey 1969/74, and in November 1974 sought and obtained the help of the State Road Authorities to perform this work. Because of the short time available the survey revision by the State Road Authorities has been restricted to National Highways and to rural and urban arterial roads.

The generation and costing of improvement projects on rural and outer urban roads has been done by computer using the simulation model called NHUPAC which was developed by NAASRA personnel during the National Highway Study. The system for adapting road inventory data for use in NHUPAC and the methods of updating the inventory were devised for CBRds by State Road Authority personnel.

CBRds has used the same techniques for economic evaluation and scheduling as in previous road surveys but with revised values of the parameters to conform to the changed economic circumstances now existing. The State Road Authorities have been informed of the techniques but not yet of the changed values of the parameters.

In Victoria, the data for revising the inventory of the National Highways and of Class 1, 2 and 3 roads in rural areas and Class 6 and 7 roads in outer urban areas has been collected by Advance Planning Division with the help of the staff in regional Divisions. Engineers in the regional Divisions have also provided unit cost data from which the cost matrices for the NHUPAC simulation programmes have been developed. This latter task has involved the development of separate cost matrices for National Highways, Classes 1 and 2, Class 3, Class 6 and 7 roads. The matrices contain between 16 and 151 cost areas with up to 80 items of data in each cost area, in total over 20,000 items.

The same procedure as in the Australian Road Survey 1969/74 were adopted for the revision of the survey of inner urban arterial roads. This has involved the collection of data to bring

the inventory up to date and the design of a new network of road improvements. The improvement network is significantly different from that of the previous survey since greater emphasis has been given to developing existing roads with a lower level of service. Allowance has also been made for a restrained budget.

As with the rural survey the CBRds has used the existing economic evaluation and scheduling processes with parameters revised for current economic conditions. Details of the processes have been supplied but not as yet revised parameters.

Effects of Inflation on Advance Planning

Inflation has had a serious effect on the financing of road construction and maintenance. The Board's Price Index for "Composite Direct Works and Salaries" has shown the following increases recently:—

From	*To*	*Increase*
30/6/69	30/6/70	6.0%
30/6/70	30/6/71	10.4%
30/6/71	30/6/72	8.7%
30/6/72	30/6/73	12.4%
30/6/73	30/6/74	23.0%
30/6/74	30/6/75	18.7%

The total funds available for roads comprising the Commonwealth Government grants for roads, the nett total of State funds made available for roads are shown in the first three columns of the following table. The second three columns of the table show these amounts converted to 1974/75 values using the price index quoted above:—

Financial Year	Actual Receipts for Roadworks			Receipts converted to 1974/75 values		
	Nett State Funds	Cwth Funds	Total	Nett State Funds	Cwth Funds	Total
	$ Millions			$ Millions		
69/70	53.4	38.2	91.6	104.7	74.8	179.5
70/71	57.0	43.5	100.5	101.2	77.2	178.4
71/72	59.5	49.8	109.3	97.7	81.8	179.5
72/73	62.2	57.2	119.4	90.8	83.6	174.4
73/74	65.4	65.7	131.1	77.6	78.0	155.6
74/75	73.5	77.1	150.6	73.5	77.1	150.6
75/76	88.7 (estimated)	89.3 (including supplementary grants)	178.0	77.1*	77.6*	154.7*

*Assuming a 15% increase in the Price Index from 1974/75 to 1975/76.

In terms of 1974/75 constant prices the amount of money made available for roads remained more or less constant at about $180m a year until 1971/72. Since then, a rapid continuing fall has occurred and it is this decline in the real amount of money available which is the cause of the problems facing the Board.

The serious financial position described above is exacerbated by the controls which have been placed on the use of the available funds. Only the Country Roads Board fund, comprising $36m nett or 24 per cent of the nett total revenue available for roads in 1974/75, was available for general use.

2. ROAD PLANNING DIVISION

(a) Development in Road Planning—Environmental Impact Studies

An environmental impact study is being conducted so that transport, economic, social and environmental factors can be equally considered before arriving at a decision for the Ringwood Section of the Eastern Freeway. This particular road study, one of the first in Australia, is being carried out by a multi-disciplinary team of Board officers and consultants, including town planners, engineers, economists, socialogists, transportation planners, landscape architects, ecologists, noise and vibration experts and public relations officers.

The main object of the study is to ensure that matters affecting the environment to a significant extent are fully examined and assessed in order to avoid or reduce adverse consequences and improve the desirable consequences of road development. An essential part of the study is the public participation programme which allows the opportunity for those sections of the community which have an interest to become involved in the consideration of the social and environmental effects. This approach has been widely welcomed by the community and in political circles.

(b) Rural Road Location

A further development in rural route investigation procedures was achieved for a study which investigated the corridor of the proposed Western Freeway in the vicinity of Ballarat. The study integrated landscape/planning and highway engineering design principles in the evaluation of alternative freeway locations.

In addition to satisfying engineering and economic criteria, the route was chosen with the following objectives in mind:

Reduction of disturbance to attractive landscape areas

Reduction of disturbance on the social and physical environment

Enhancement of scenic aspects from the freeway as well as external to the freeway.

(c) The F6 Corridor Study

In the F6 Study, the use of community input data and the analysis of this data by the development of factor profiles for each alternative for comparison purposes shows how such information can be handled in a complex urban route location study.

This study was carried out by the Joint (CRB–MMBW) Working Group and Loder and Bayley, consulting engineers and planners under the direction of the Joint Planning and Co-ordinating Committee. The study, which commenced in 1972/73, will result in the provision of a freeway reservation in the Metropolitan Planning Scheme from the Mornington Peninsula Freeway at Springvale Road to South Road, Moorabbin. The new freeway reservation is located east of Moorabbin Airport and will join the Dingley Freeway reservation at Heatherton.

The study was divided into four basic phases:—

- The definition of the study area and the collection of basic data describing the physical attributes and social networks in the area.
- The establishment of bands within which a freeway could be located and an initial appraisal of these alternative bands resulting in the selection of a particular band for further study.
- The detailed assessment and comparison of alternatives within the selected band and an arterial road alternative.
- The final selection of a scheme and definition of a reservation for inclusion in the Metropolitan Planning Scheme.

The techniques used to compare and appraise alternatives in the second phase of the study consisted of three basic steps:—

- Engineering and economic analysis to rank the alternatives according to right-of-way, construction, maintenance and operating costs compared with vehicle operation, travel time and accident costs or savings using conventional benefit-cost analysis.
- Study of community factor profiles to express the order of preference of each alternative in terms of a percentage of the maximum value for each particular item (e.g. number of dwellings taken or percent of length of freeway forming a useful barrier). For this purpose, value of each factor can be plotted on a horizontal scale with the value at the left hand end. The values for each factor for each alternative can then be arranged to give a factor profile which allows the visual comparison of the relative impact of the alternatives.

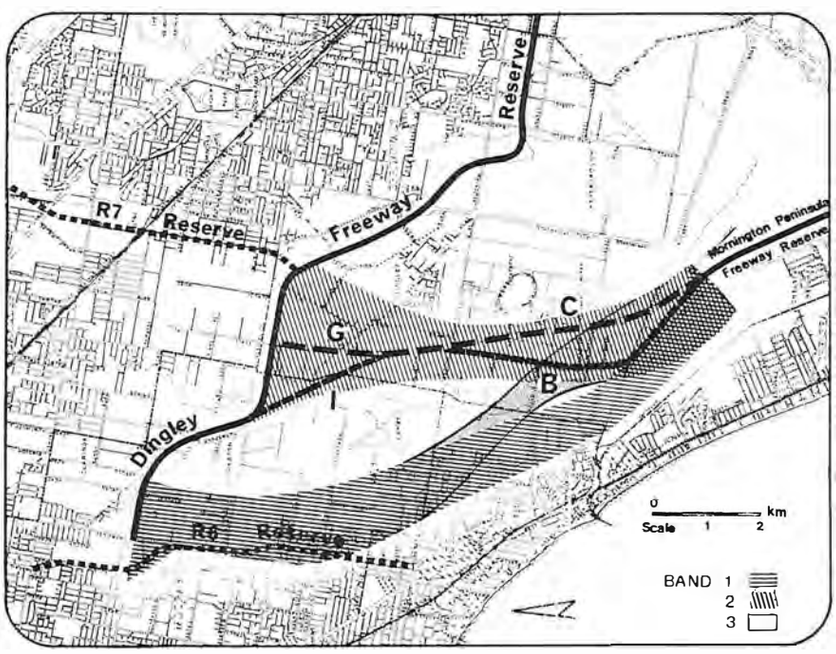


Figure 1—F6 Corridor–Freeway alternative bands.

- Analysis of the economic and community factors by pairing alternatives to eliminate those which are less attractive. It was a simple process to narrow down the number of alternatives to the few which required more thorough analysis in the third phase.

Such an approach usually involves the assessment of trade-offs between various factors from the points of view of different groups within the community. This was made possible by the wide distribution of brochures and reports, by contact with individuals, key persons and Councils, and by the use of a Citizens Committee which was set up for this purpose.

As a result of the second phase of the study, alternatives B, C, G and I in band 2 (Figure 1) were selected for detailed assessment and comparison along with an arterial road solution which utilised the R6 reservation from Mentone to Moorabbin.

(d) Computer Techniques for Urban Sub-Region Traffic Studies

One of the joint (CRB–MMBW) Working Group's functions is to investigate the road needs of selected areas or corridors within the Metropolitan area. The investigations are an extension of the work of the Melbourne Transportation Study.

New techniques have been adopted to reduce the cost of these studies. These involved the use of a series of computer programmes developed by the U.S. Federal Highways Administration as an aid to urban transportation planning. This series of programmes enables the user to isolate the sub-regional network and corresponding trip movements for further detailed study.

The main programme designated "DONUT" is used to extract a portion of a network from a selected base network. The programme draws an imaginary cordon line around the small study area crossing all the network links giving access to or egress from the area. Links in the network crossing this cordon are cut so that the study area is isolated and these links become the external loading points for traffic assignments.

Once the study area has been defined the "SELINK" programme is used to isolate all the trips which use links within the area. Those trips which had an origin or destination, or both origin and destination outside the study area are truncated at the new external centroids which were created by the "DONUT" programme. This is done by the programme "TRPCORD" which also sums up all the remaining trips to the internal centroids, thus creating a sub-regional trip movement table.

The advantages of using this series of programmes is as follows:

- When a sub-regional study is being undertaken the study team, by observation, can determine local congestion points, local filtering routes and other problem areas. The sub-regional network can be easily altered to reflect these observations. For example, the travel speed and traffic capacity of a street through a proposed shopping centre can be reduced to obtain a more realistic assignment.
- By determining the origins and destinations of the trips using the links which cross certain traffic barriers (e.g. a major river), travel patterns can be discovered which help in deciding which road improvement projects are likely to improve traffic flow in the sub-region.
- Suggested "solutions" to ease congestion can be tested by assigning the sub-regional trip table to the revised network at a much reduced cost.

ROAD DESIGN SUB-BRANCH

1. PLANS AND SURVEYS DIVISION

During the year, the Plans and Surveys E D P section completed the first stage of the development of the "RIDGE" (Roadway Integrated Design and Geometry) System. This system allows the road designer to select a range of computational and automatic plotting systems as desired. Some of the tasks that may be selected are:

Digital representation of terrain cross sections

Natural surface longitudinal and cross section plotting

Design cross section plotting

Vertical alignment calculations

Horizontal alignment and offset calculation

Design surface and earthwork calculation

Construction listing

Roadway perspective plots

Mass haul/section cutfill plots

Further expansion of base mapping orthophotography was carried out over the area studied in locating the Western Freeway in the vicinity of Ballarat. In conjunction with the Department of Crown Lands and Survey, the orthophotographs were compiled from two differing scales of photography, but the results showed no marked differences of definition.

Major photogrammetric mapping surveys for route definition purposes were carried out along the Hume Corridor. Associated with this mapping, and using the same photography, a method of evaluating catchment areas from stereoscopic aerial photography was evolved. This proved to be an accurate, speedy and economical solution for defining large catchment areas.

Volume calculations of quarry holes and material stockpiles were compiled from photogrammetric measurement comparisons between early and recent aerial photographs at various sites throughout the State.

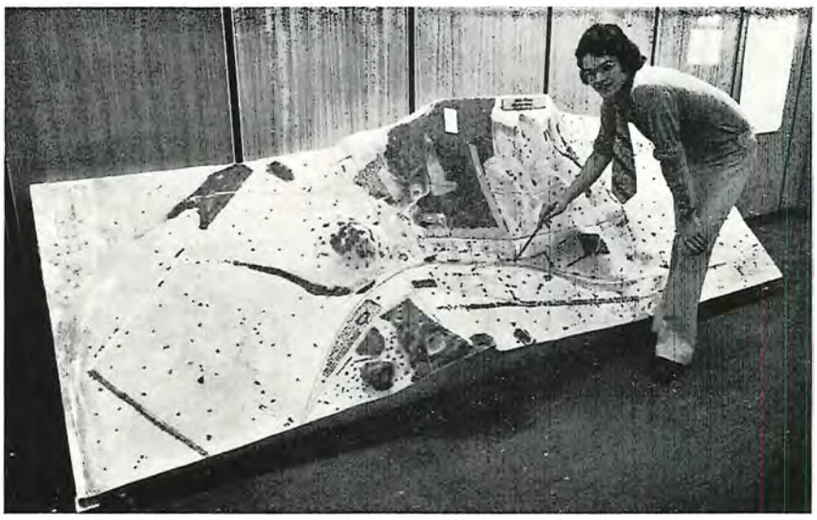


Plate 6—Model for comparison of alignments at Glenrowan during investigation stage.

The Board is using the skills of a wide range of disciplines in the road planning and design process. Previous reports have noted the increasing attention being placed on the aesthetic aspects of road design. A landscape architect was appointed to the staff of the Division during the year to assist in aesthetic design. The landscape design of Princes Freeway at Drouin was completed and landscaping design was also carried out on other projects during the design stage.

The use of models to assist in roadway design continues to increase. Current practice is to model critical sections of major projects, using cardboard cut-outs of computer plotted cross sections or the Three Dimensional Design System reported in the fifty-sixth annual report.

To compare various alignments, a more elaborate model is constructed from photogrammetric information, using plastic foam sheeting. On this model, the various trial alignments can be superimposed for comparison. Plate 6 shows a model of the Hume Freeway Corridor at Glenrowan, which was prepared for the above purpose.

Computer Drawn Perspective

A suite of computer programmes that allow for automatic plotting of perspective views of a road have been included in RIDGE, the Country Roads Board package of road design programmes. A joint effort between Road Planning Division and Plans and Surveys Division has enabled composite views of roadway form and natural landscape to be drawn from the data base used for other detailed design.

A model of the Mornington Peninsula Freeway highlighted a problem area where the coordination of the horizontal and vertical alignments resulted in a portion of the road disappearing from the driver's view. The perspective plots in Figure 2 were made of successive improvements to the vertical alignment until a satisfactory result was obtained.

Recording of Construction Drawings

Records are now kept of nearly 200,000 construction drawings, and the number of originals or "stat-file" negatives held in file is approximately 150,000. As circumstances permit, work is proceeding on the task of "stat-filing" all recorded plans. For security reasons, two negatives are made of each drawing—one being held in the Plan Filing Room and the other in the Division

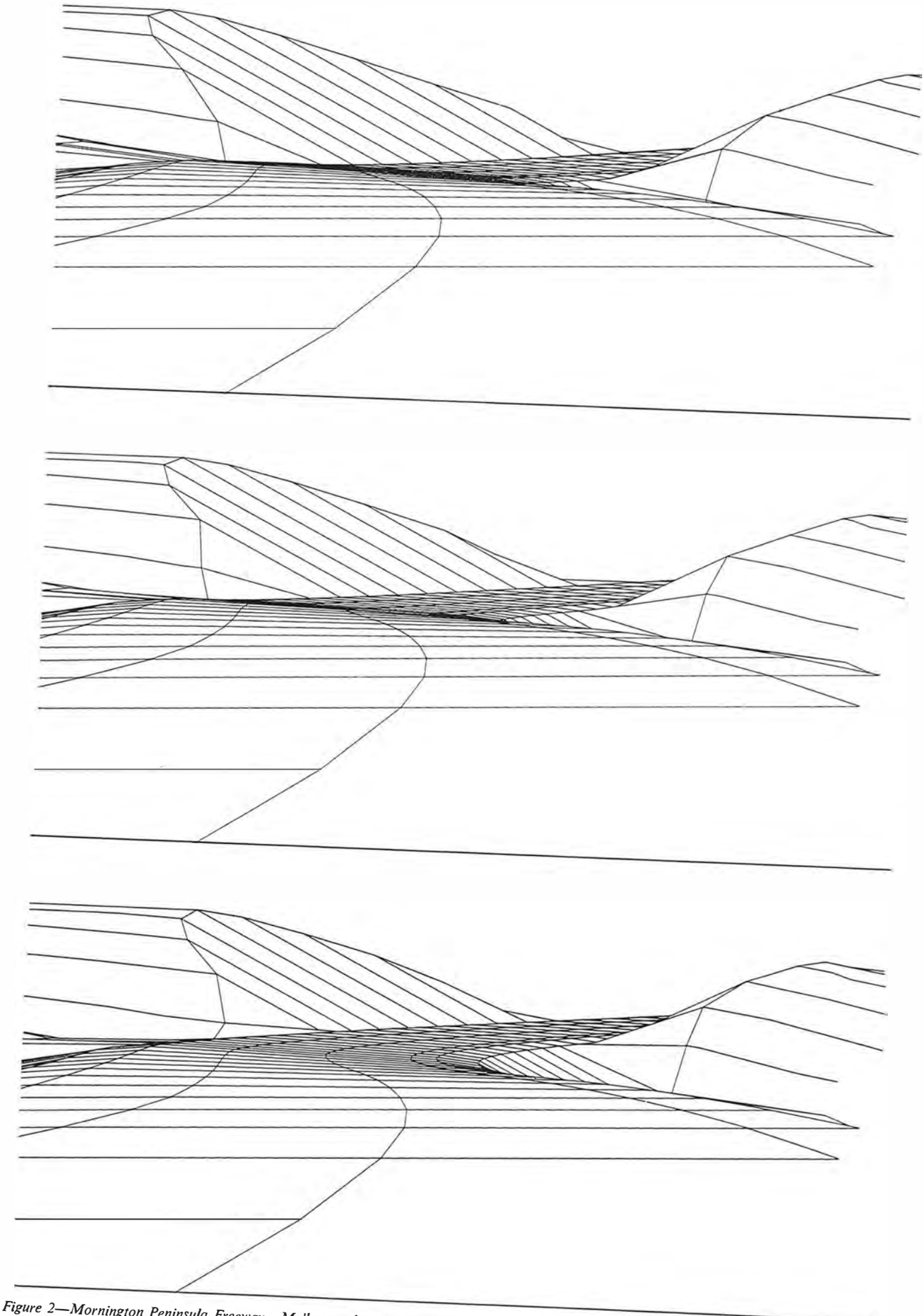


Figure 2—Mornington Peninsula Freeway—Melbourne-bound carriageway Computer drawn perspective showing successive improvements to vertical alignment.

of origin, but under the control of the Plan Filing Clerk. To save filing space, the original drawings are destroyed after a suitable period of time, but the plan information can be reproduced true to scale or at any required scale by reprinting with the "stat-file" camera.

If true-to-scale prints are not required, immediate copies can be made directly from the negatives using the 105 mm viewer-printer purchased in June 1974, thus relieving the work load on the slower and more costly stat-file machine.

2. TRAFFIC ENGINEERING DIVISION

(a) Traffic Design

Because of the inadequacy of funds available for new construction, increasing emphasis has been placed on improvement of the existing road system to cope with road needs. The development of new arterial road routes, the reconstruction of existing routes and investigation of the adequacy of approach roads to newly constructed facilities have assumed a particularly important place in the work of the Division.

Detailed studies have been made of roads leading to the Mulgrave Freeway, the Lower Yarra Freeway and the Eastern Freeway. Detailed examination has also been made of traffic movements through a number of suburban areas.

(b) Traffic Control Systems

A number of projects involving extensive traffic signal systems are currently being carried out in the Division. The Eastern Freeway system is being planned on the basis of three co-ordinated signal groups being installed along Hoddle Street, Alexandra Parade–Princess Street and Chandler Highway to aid the flow of traffic to and from the freeway.

These systems will be controlled by a digital computer which will also enable traffic counting along the route to be simplified. In addition investigations into weaving manoeuvres, merging operations and queuing and delay studies will be possible. The system will also have the flexibility to incorporate other control mechanisms should they be required. A computer controlled linked signal system is being installed along High Street, St. Kilda, to achieve co-ordinated operation of traffic using this route. Vehicle detectors placed along the route will collect and then transmit vehicle flow information to the computer which will control the traffic signals to achieve optimum co-ordination in both directions.

(c) Detector Loops on Freeways

The installation of traffic detector loops on freeways during the construction phase has been found to provide a number of benefits. Cutting the loops into the base-coarse material prior to the application of the wearing coarse affords substantial protection to the loops from later alterations to the pavement; also disruption of traffic is avoided.

A system of detectors is being installed along the Eastern Freeway to be used to count traffic on the various section and ramps when the freeway is opened. It will also be possible, using the detectors, to study the operational characteristics of single lane and two-lane on and off ramps, merging and weaving manoeuvres and speed-flow relationships under varying conditions.

(d) Metcon

In September 1974 the Government directed the Road Safety and Traffic Authority and the Country Roads Board to undertake a programme for the installation of control devices at all intersections throughout the State, with the objective of dispensing with the 'Give-way to the Right' rule as soon as possible.

The first stage of the programme, which was code named METCON (Metropolitan Intersection Control), involved the placing of 'STOP' and 'GIVE-WAY' signs and associated pavement markings at all unsignalized intersections on arterial and sub-arterial roads in the Melbourne Metropolitan area. The target date for completion of this stage was Easter 1975. Approximately 500 'Give-way to Right' signs will be placed at intersections which require traffic signals in the future.

In the short planning period prior to the installation work commencing in January 1975 the Board's engineers contributed significantly through discussion and liaison with the Road Safety and Traffic Authority to the development of the design and specification of the signs and markings subsequently used. In order to obtain the most cost-effective treatment and minimise future maintenance costs associated with the programme, particularly in respect to the pavement markings, the Board approved of the Mechanical Sub-branch developing a special pavement line-marking machine for this work. The machine is expected to reduce the cost of re-painting the markings to approx. 20% of their initial cost.

The Board was responsible for the implementation of 'METCON' on the Board's declared roads in the Metropolitan area. The work involved the placing of approx. 5,550 signs and markings of which 2,500 were installed directly by the Board and 3,050 by municipalities on behalf of the Board. The total cost is expected to be approx. $370,000. All 'Stop' and 'Give-way' signs were installed by May 16th 1975.

Subsequent stages of the intersection control programme are now being planned, and, on declared roads, these include:—

- The design and installation of approx. 280 sets of intersection control signals within the 'METCON' area.
- The extension of the programme to declared roads in the remainder of the State.

The programme for implementation of these subsequent stages is dependent on the provision of funds.

(e) Origin and Destination Traffic Surveys

During the year a number of origin and destination surveys were carried out including roadside interview surveys at Mitcham on the Maroondah Highway and Clifton Hill on Hoddle Main Road.

During the survey at Mitcham, approximately 3,500 drivers or 8% of the traffic stream were interviewed during a 16-hour period. The information was collected to assist in evaluation of the Ringwood area freeway proposals.

During the survey at Clifton Hill, 1,690 south-bound drivers or 35% of the traffic stream were interviewed over a period of two days at a point south of the Clifton Hill overpass.

Other surveys were carried out at Balwyn, Belgrave, Ararat and near Cudgee.

The Rural Traffic Index for 1975 was calculated to be 272 compared with the figure of 248.9 in 1974. This represents an average increase over the past five years of 5% per annum which is approximately equal to the rate of increase predicted in 1959 in Technical Bulletin No. 17.

The traffic index was computed statistically from counts taken at 70 selected rural counting stations throughout the State.

WORKS SUB-BRANCH

1. ROAD CONSTRUCTION AND MAINTENANCE

Direct Labour Road Construction Costs

Tables 1 to 4 set out analyses of 76 construction and reconstruction jobs completed by the Board in 1974/75 at a total cost of $14.8 m, together with the corresponding analysis for the preceding four years. Because of the annual variations in regional and job mix factors and the number of cost statements submitted for analysis, the unit costs indicate only the general level of unit costs of carrying out particular stages of construction work.

TABLE 1—DISTRIBUTION OF EXPENDITURE

	Labour	Material	Plant	Stores	Total
	%	%	%	%	%
1970/71	34.3	20.7	33.9	11.1	100.0
1971/72	34.3	23.0	31.5	11.2	100.0
1972/73	33.9	27.5	28.0	10.6	100.0
1973/74	37.8	22.2	31.1	8.9	100.0
1974/75	31.9	27.7	29.0	11.4	100.0
Five Year Average 1970/71—1974/75	33.9	25.0	30.3	10.8	100.0

TABLE 2—WORKS OVERHEAD EXPENDITURE

(Percentage of Productive Costs)

	Construction Overhead Expenses %	Camp Expenses %
1970/71	14.9	11.0
1971/72	15.6	9.8
1972/73	15.6	8.3
1973/74	17.2	9.4
1974/75	12.2	6.7
Five Year Average 1970/7—1974/75	14.6	8.6

TABLE 3—FORMATION COSTS
(Including distributed overhead expenditure)

	Rock		Earth Unclassified		Total	
	Quantity	Unit Cost	Quantity	Unit Cost	Quantity	Average Unit Cost
	c.m.	$	c.m.	$	c.m.	$
1970/71	35,042	1.93	1,199,842	1.54	1,234,884	1.55
1971/72	—	—	1,319,371	1.59	1,319,371	1.59
1972/73	64,251	2.76	1,063,271	1.55	1,127,522	1.62
1973/74	18,348	5.11	910,258	1.89	928,599	1.95
1974/75	19,048	4.52	1,459,550	2.27	1,478,598	2.30
Five Year Average 1970/71–1974/75	27,337	3.11	1,190,458	1.78	1,217,795	1.81

TABLE 4—PAVEMENT COSTS
(Compacted in place, including distributed overhead)

	Fine Crushed Rock		Coarse Crushed Rock		Gravel etc.		Total	
	Quantity	Unit Cost	Quantity	Unit Cost	Quantity	Unit Cost	Quantity	Average Unit Cost
	c.m. loose	$	c.m. loose	$	c.m. loose	$	c.m. loose	$
1970/71	72,727	6.56	59,260	6.24	588,749	3.02	720,736	3.64
1971/72	139,942	7.65	48.874	7.72	943,714	3.36	1,132,530	4.07
1972/73	107,325	8.87	59,485	7.74	516,793	3.18	683,603	4.47
1973/74	72,261	8.00	36,924	8.09	600,080	3.76	709,265	4.42
1974/75	116,833	8.02	119,297	6.75	574,078	3.78	810,208	4.83
Five Year Average 1970/71–1974/75	101,818	7.89	64,768	7.14	644,683	3.42	811,268	4.27

Table 5 sets out the movement in indices of prices affecting the Board's operations, as at 30th June of the years 1967 to 1975 inclusive (base = 100, 30th June 1967). The indices are based on actual prices ruling at the close of each period, and no attempt has been made to give weight to the duration for which price changes operated throughout the year.

TABLE 5—INDICES OF PRICES AFFECTING THE BOARD'S OPERATIONS
(Base 30/6/67 = 100)

	30/6/67	30/6/68	30/6/69	30/6/70	30/6/71	30/6/72	30/6/73	30/6/74	30/6/75
Maintenance (all groups)									
Urban	100.0	103.4	113.7	120.1	134.1	146.8	166.4	210.5	245.9
Rural	100.0	103.3	113.0	120.2	133.6	146.3	166.5	210.1	245.2
Construction (all groups)									
Urban	100.0	106.3	114.6	118.6	129.1	137.7	152.0	183.2	229.2
Rural	100.0	103.9	111.9	117.9	128.7	139.0	157.8	196.0	229.7
Land Acquisition									
Urban	100.0	101.2	117.0	119.5	*125.5	*144.3	*160.0	*160.0	200.0
Rural	100.0	106.9	110.6	114.4	*118.8	*126.8	*137.0	*166.3	216.2
Board's direct works									
Urban	100.0	105.2	114.9	119.9	128.8	139.5	154.4	181.2	225.4
Rural	100.0	103.8	112.1	118.4	129.7	140.6	159.6	198.7	233.5
Composite urban (41%) and rural (59%)	100.0	104.4	113.3	118.6	129.3	140.1	157.4	191.5	230.2
Composite direct works and salaries	100.0	105.0	112.0	118.7	131.0	141.8	159.4	196.0	232.7
Annual % increase	—	5.0	6.7	6.0	10.4	8.2	12.4	23.0	18.7

*Estimated

2. MATERIALS RESEARCH DIVISION

Load Tests on Socketed Piles

The site of the River Yarra Bridge–Eastern Freeway includes a significant fault zone through the moderately weathered Silurian mudstones and sandstones. Two test piles were constructed and loaded to provide information on the following matters:

(i) the practicability of constructing socketed piles below river level in severely fractured rock,
(ii) the side friction and end-bearing capacities of such piles, and
(iii) the settlement characteristics of the pile-rock system.

The fault zone comprises severely sheared (slickensided) and fractured mudstone and sandstone. The bedding and slickensides are subvertical and often the slickensides are along the bedding planes. The faulting has produced a variety of rock conditions, from fairly intact rock where joints are 0.5 m or so apart to shattered zones where the joints are about 10 mm apart to grit or clay. The load tests were made in an area where the joint spacing was about 20–50 mm.

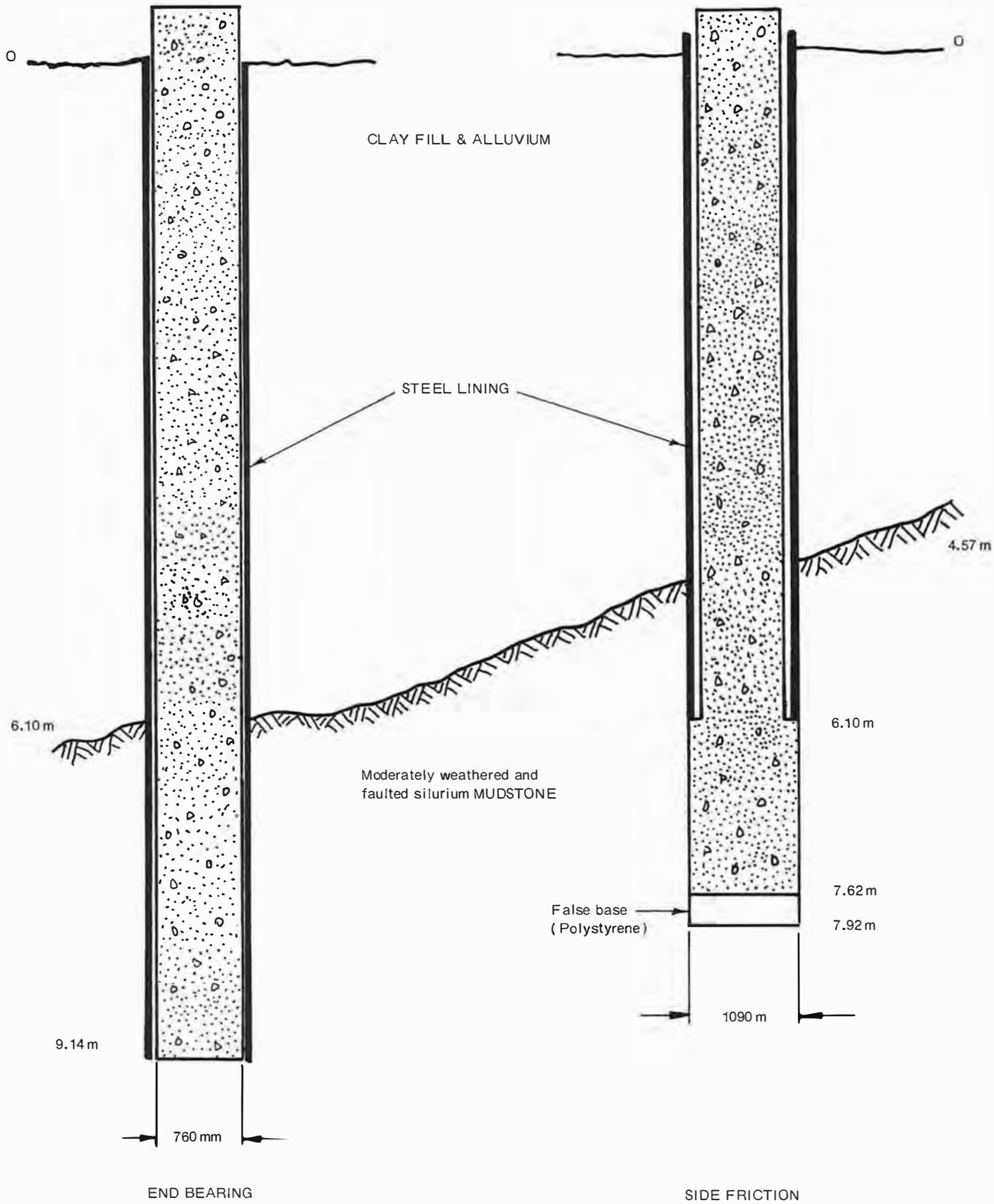


Figure 3—Diagram of piles used to study "end bearing" and "side friction" characteristics.

Two piles were constructed to enable "side friction" and "end bearing" characteristics to be studied independently. To achieve an "end bearing only" situation, one pile was sleeved over its entire length. For "side friction" a partly sleeved pile was cast with a false base. (Figure 3.)

Reaction for the load tests was provided by 3No. 5000 kN anchor cables grouted into the mudstone in 150 mm dia. holes over a 20 m bond length. About 10 m was allowed between the top of the anchor grout and bottom of the piles. The load was applied to the piles (Plate 7) by two pre-stressing jacks working against a reaction beam.

Plate 7—Pile Load Testing in Progress.
5000 kN anchor cables were tensioned against a reaction beam to load the test piles.

Pile settlements were measured with datum beams and dial gauges to within 0.01 mm and with a precision level sighting to scale rules to within 0.1 mm.

The load settlement curves (Figure 4—end bearing test) indicated pile capacities much less than would be expected from an intact rock, and it was concluded that failure occurred by sliding along the many joint planes.

The results of the test have allowed the design of the socketed pile foundations for the two bridges to proceed with confidence.

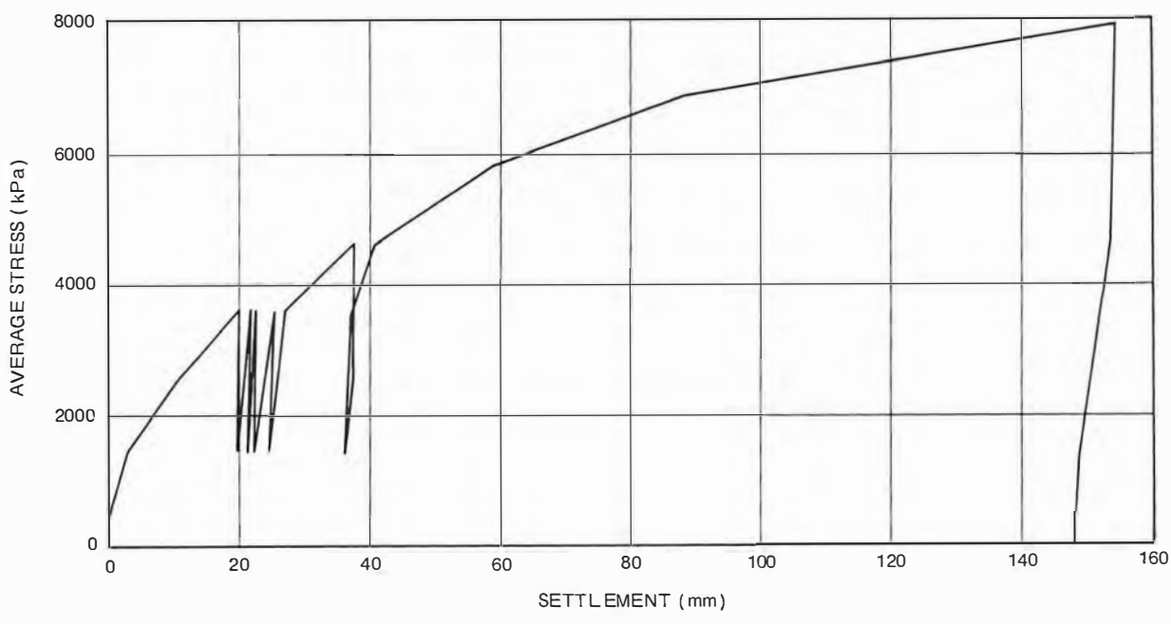


Figure 4—Stress–Settlement curve End Bearing Pile 760 mm dia.

Settlement Gauge

In situations where embankments are constructed on compressible ground, settlements of up to 1 m are not uncommon. The construction of such embankments may require stage construction to guard against failure during construction or surcharging to speed up consolidation and reduce post-construction settlements. The effectiveness of stage construction or surcharging may be determined in part by measurements of settlement.

Conventionally, settlements have been measured by vertical rods attached to a plate at natural surface level and extended as the height of fill increases. Although this rod system is cheap and simple, it causes significant interference to construction vehicles which must work around the rods.

An alternative system has been developed to overcome the interference difficulty. The system (Figure 5) has been used successfully to measure settlements of embankments forming the approaches to the bridge over the Fisher Parade, between the Cities of Essendon and Footscray. The outer tube is installed with a uniform slope, to prevent the formation of air bubbles in the inner tube. The inner tube is initially fully inserted into the outer tube and it is filled with water. The level of water at each end of the inner tube is the same as is measured against a staff at the outer end. Readings of water level are taken as the inner tube is withdrawn and are plotted to provide the typical settlement profiles shown in Figure 5. The settlements may be determined to within about 5 mm.

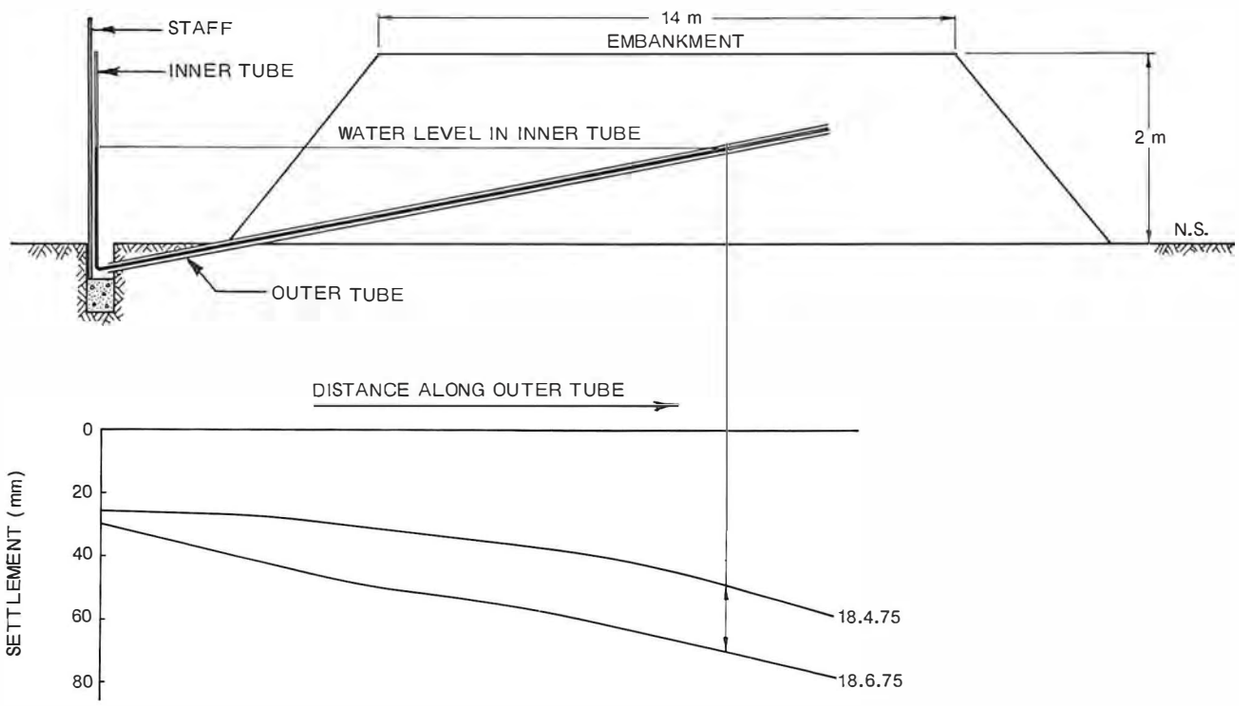


Figure 5—Diagram of Settlement gauge and Settlement profile.

Compaction of "Overwet" Materials

Materials Research Division and Traralgon Division have carried out investigations into the feasibility of working and compacting "overwet" materials from cuttings on the Princes Freeway (Drouin and Warragul Sections) project. The materials are highly weathered Older Basalts, existing as stiff clays.

In geological investigations carried out as part of pre-construction activities, the moisture content of some cut materials was found to range up to 169% of optimum (optimum moisture content for the material was 38%). Usually this would be indicative of overwet material unsuitable for fill construction and earthworks specifications acknowledge this by precluding the use of material wetter than 125% of optimum. In this particular case however the insitu moisture contents were at about the plastic limit of 40% and this might predict a better workability than the relationship of field moisture content to optimum moisture content suggests.

As very large quantities of the "overwet" material will be encountered in construction it was considered that a field trial of workability should be staged. An excavation 6.7 metres deep was taken out using an open bowl scraper push loaded by a D7 dozer. Excavated material was compacted nearby using a 72T Vibrating sheeps foot roller towed by a D4 dozer.

Excavated material from below 2.75 metres had a moisture content which varied from 135% to 154% of optimum. Four passes of the roller achieved 85% to 89% of standard compaction while 6 passes achieved 86% to 89%. After 6 roller passes the dynamic cone CBR averaged 6.

This field trial established that satisfactory methods of handling and compacting this material can be achieved. The importance of the relationship between field moisture content and plastic limit in assessing workability is highlighted.

Penetrometer Testing Vehicle

Materials Research Division and Mechanical Sub-branch have developed a new Penetrometer Testing Vehicle for use in routine foundation investigations. The principal testing device is the deep sounding cone penetrometer, developed by Materials Research Division.

Use of the friction cone penetrometer enables a detailed soil strength profile to be obtained quickly and economically. The new vehicle is completely self sufficient and replaces an obsolete trailer-mounted unit.

The friction cone penetrometer used by the Foundation Investigations Section consists of a 60° cone, 10 sq cm in cross sectional area, which is followed by a friction sleeve, 150 sq cm in area (See Figure 6). The penetrometer is advanced into the ground at a speed of approximately 2 cm/sec.

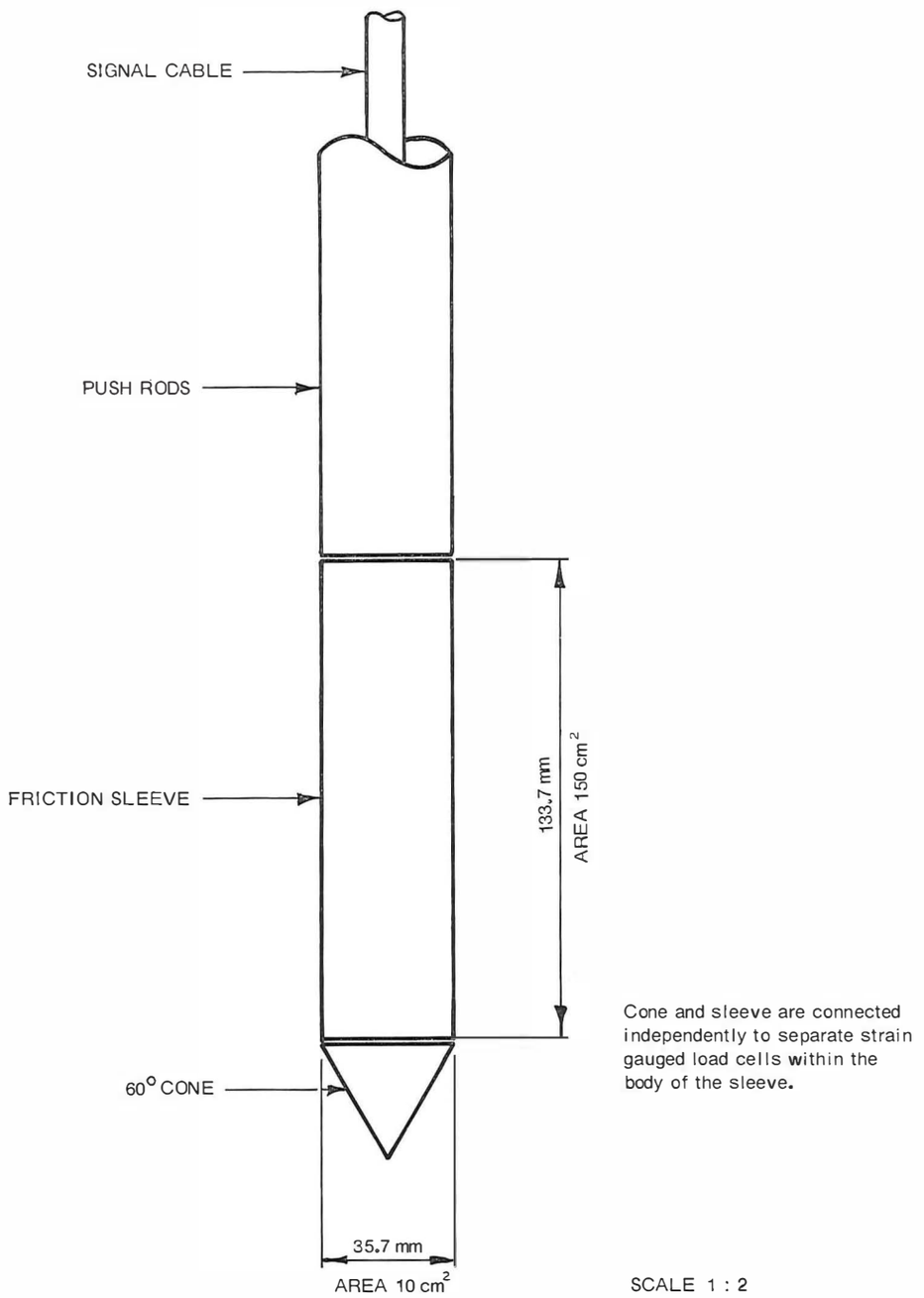


Figure 6—Electrical Friction Cone Penetrometer Diagrammatic only.

The cone and sleeve are strain gauged to allow the resistance to penetration to be recorded on a continuous chart recorder and on punched paper tape. The paper tape is processed by computer to give a print out of cone and sleeve resistance and of friction ratio

$$\text{(friction ratio} = \frac{\text{sleeve resistance}}{\text{cone resistance}} \times 100\%).$$

The penetrometer unit is mounted on an Army designed 6-wheel drive truck (see Figure 7 and Plate 8). The truck has been designed to traverse very steep and rough terrain. This feature, together with a powerful self-recovery winch, means that the truck is able to gain independent access to most sites.

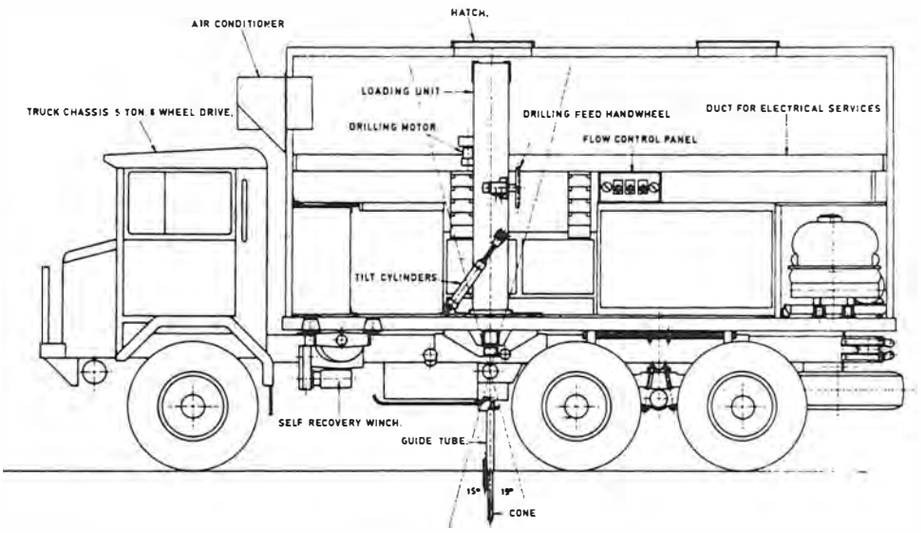


Figure 7—Layout of the Penetrometer Testing Vehicle.

Plate 8—Penetrometer Testing Vehicle during trials at the Army's Monegeeta proving ground.

The penetration operation is carried out by two men. Power for the electrical and hydraulic functions is provided by an industrial Volkswagen engine, equipped to run on either petrol or LP gas. A 7.5 kVA generator and an hydraulic pumping unit are coupled to this motor.

The penetrometer is pushed into the ground hydraulically through a loading frame (Plate 9) which can be tilted to allow vertical penetrations to be made from sloping ground. The operation of all functions on the loading unit is done by means of push-buttons and relays.

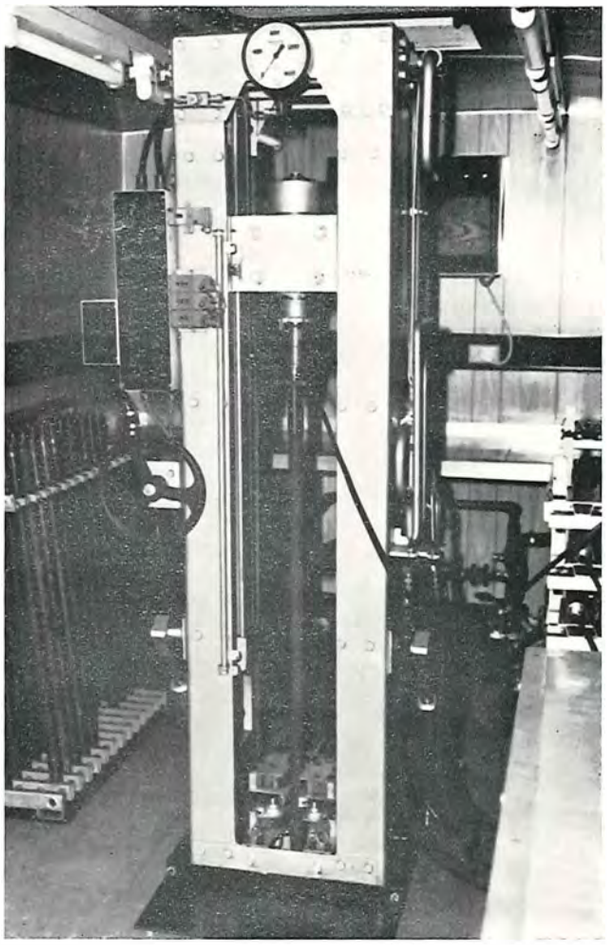


Plate 9—Automated hydraulic loading frame inside air-conditioned cabin showing push button controls, hand feed, and limit switches.

The truck has a weight of 12.5 tonne, 9 tonne of which can be utilised as reaction to the penetration of the cone. This reaction has already enabled several penetrations to be made to depths in excess of 40 metres. Penetration to these depths can be completed in about 4 hours.

The cone resistance and the friction ratio are plotted against depth and a consideration of these enables an interpretation of site conditions to be made. For example: (i) Sand – cone resistance in the sand is relatively high whilst friction on the sleeve is relatively low. This results in low friction ratios, typically less than 3%. (ii) Clay – cone resistance in clay is relatively low whilst friction on the sleeve is relatively high. This results in high friction ratios, generally greater than 5%.

Interpretation for silty clays, clayey sands, etc. is difficult, but values in between the above would be expected. An assessment of the cone resistance also allows an estimate of soil strength to be made.

Because a relatively detailed profile of ground conditions can be obtained quickly and cheaply using the friction cone penetrometer, the number of conventional and much more expensive borings can be significantly reduced. Analysis of the penetrometer results prior to boring enables strata to be identified and a selective sampling programme to be prepared. This generally means fewer samples and less laboratory testing.

As experience with the penetrometer develops, and where conditions allow, it is intended to reduce the number of bore holes. For example, the 6–8 bores usually put down for a 3-span bridge could be reduced to 2 bores and 8 cone penetration tests. Correlations between the penetrometer results and laboratory tests are proceeding and are expected to allow further use of the penetrometer as a design tool.

New Cone Penetrometer for Soft Area Investigation

One of the tasks of the field party investigating proposed new alignments is to detect and determine the extent of soft deposits which may cause problems of settlement beneath embankments or may be unable to carry construction plant and allow proper compaction of fill or pavement materials.

It has been customary to determine the depth of such soft deposits by measuring in-situ values of California Bearing Ratio, using either a hand-held Dutch cone penetrometer or the pavement investigation static cone penetrometer mounted on a vehicle. It is assumed that material having an in-situ CBR value of 4% or greater will adequately support construction plant, and so penetration with either cone is continued to the depth where such a CBR value is first encountered.

There are disadvantages associated with each of the penetrometers. The Dutch cone can be used only to that depth where the friction force on the outer casing matches the maximum downward force that two men can apply to the instrument. With the static cone penetrometer the force required to cause penetration is measured by a proving ring above the ground surface and it is not possible to determine what proportion of this force is required to overcome side friction on the rods and what is the actual resistance to the cone penetration.

To overcome these problems a cone has been developed for use with the static penetrometer incorporating a strain gauge load cell (Plates 10 and 11). A simple manually operated strain gauge bridge is used to measure the force acting on the cone. To provide sufficient sensitivity to measure the relatively small forces, the cell was manufactured from aluminium. It has a maximum load capacity of 1 ton, which is greater than the reaction that can be provided by either the present pavement investigation vans or a Land-Rover so that damage by overloading is not possible.

Plate 10—Penetrometer in operation.

Plate 11—Penetrometer cone, coupling and strain bridges.

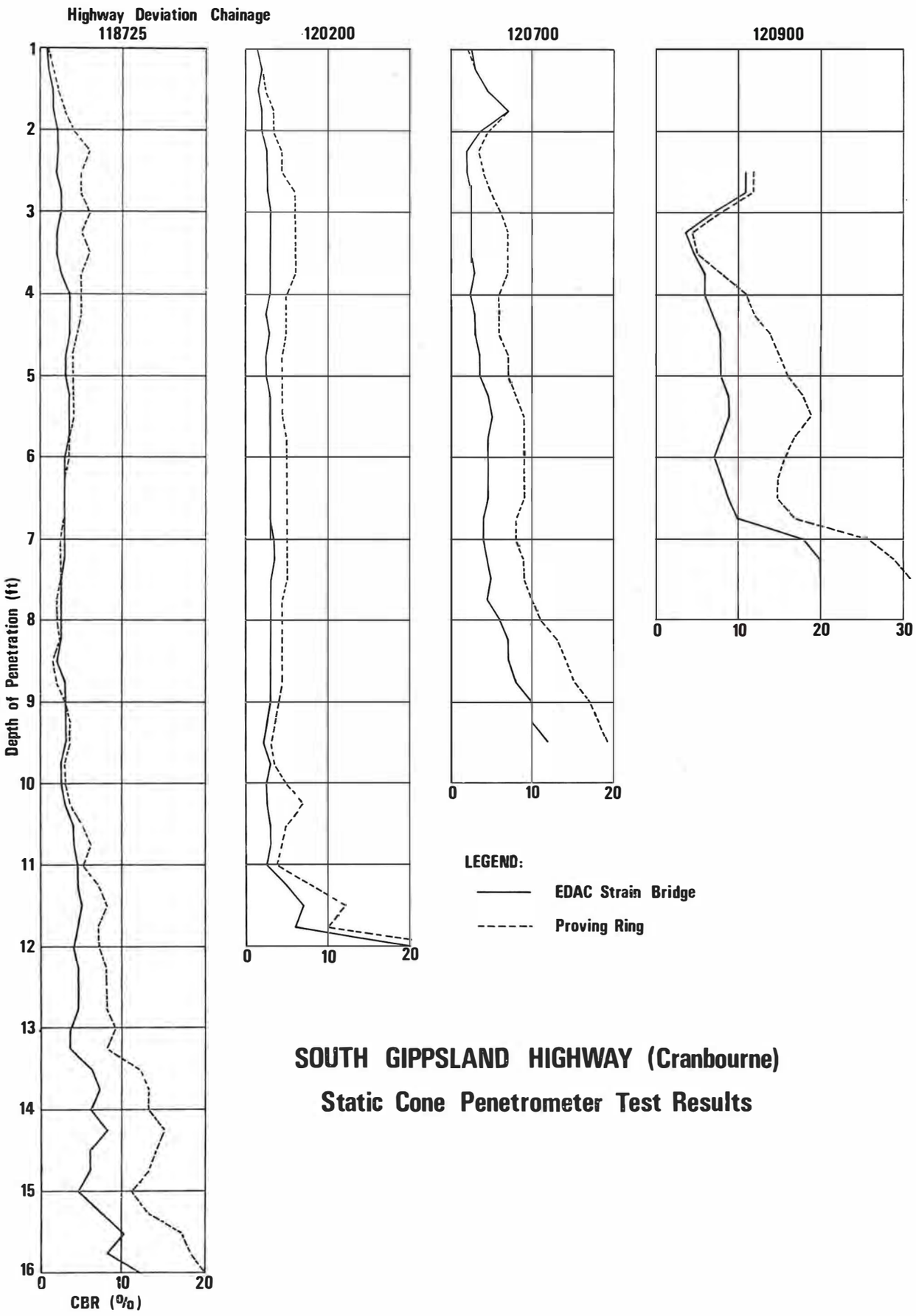


Fig 8—Static Cone Penetrometer Test Results

During field trials with the new cone the penetrometer was set up in the conventional manner using a proving ring to measure the force required to cause penetration, so that the side friction component could be determined. Some typical plots of CBR values indicated by the proving ring, and those obtained from the force measured at the cone, against depth of penetration are shown in Figure 8. It is apparent that when the depth of penetration reaches about 2 feet the value of CBR from the proving ring has increased to about $1\frac{1}{2}$ to 2 times the cone value and that this ratio remains fairly constant as the depth increases.

The new cone is a simple and robust device which enables an accurate assessment to be made of the strength of layers within soft soil deposits. It should find considerable application in investigation along proposed new alignments.

The Lacroix Deflectograph and the Measurement of Pavement Strength

When a road surface is showing signs of distress, i.e. cracking and loss of shape, a decision must be made whether to restore riding quality and extend the life of the pavement simply by applying a new surfacing layer of either asphalt or bitumen and stone seal, or to completely reconstruct the pavement at a much greater cost. For the correct decision to be made, a reliable assessment of the strength of the pavement structure is required. If the pavement is not sufficiently strong and a new surfacing layer is applied, the life of this surfacing would be quite short and so the money spent would be largely wasted. Conversely it would be very wasteful to completely reconstruct a strong pavement simply to correct surface faults.

The passage of a loaded vehicle along a flexible pavement produces a downward deflection which is almost proportional to the load carried by the wheels. In an adequate pavement the deflection is largely elastic, i.e. the pavement returns to its original level after the wheel has passed. However, heavier wheel loads cause a very small amount of permanent deformation which accumulates and eventually results in cracking of surface and loss of shape.

It is possible to relate the amount which a pavement deflects under a known heavy wheel load to the future performance of that pavement under known traffic conditions. Therefore it is also possible to make an assessment of the strength of the pavement by measuring the amount of deflection under such a load.

For some years the Country Roads Board has measured pavement deflections by means of a Benkelman Beam and a truck ballasted to produce a load of 18,000 lb on its dual tyred rear axle. The Benkelman Beam, which is named after its American developer, consists of a movable arm pivoted in a frame which can be seated on the pavement surface. To measure deflection the movable arm is placed, while the truck is stationary, between one pair of the dual wheels with its tip resting on the pavement at the spot where the deflection is to be measured. The other end of the arm is in contact with a dial indicator gauge attached to the frame. The gauge is capable of measuring movements as small as 0.001″.When the arm is in place the truck moves slowly forward until the dual wheels have passed the tip of the arm. The amount of deflection which has occurred in the pavement is indicated by the dial gauge. Measurements are taken at regular intervals, which range between 20′ and 500′ depending upon the length of road to be tested, in each of the traffic wheelpaths. This is a slow and tedious procedure involving up to six men, four of whom are on the road taking measurements and controlling traffic in a potentially hazardous situation.

The Board has recently purchased a Lacroix Deflectograph to replace the Benkelman Beam method of deflection measurement. The Deflectograph, which was developed in France and is now manufactured in Switzerland, is the only one of its kind in Australia, although others have been in operation in Great Britain, Europe and South Africa for some years.

Plate 12—The Deflectograph in the testing mode.

Plate 13—Electronic Recording Equipment.

The Deflectograph uses the same principle as the Benkelman Beam but the procedure has been completely automated. The measuring arms are fitted beneath the ballasted truck and are automatically placed between the rear wheels at predetermined intervals along the road (Plate 12). The deflection measurements are electrically transmitted to electronic recording equipment in the vehicle cab (Plate 13). Only two men, the driver and a testing officer, are required to operate the Deflectograph, and neither of them has to leave the vehicle while testing is in progress. This new machine will enable much greater lengths of road to be tested at a lower operating cost and with greater safety than would be possible with the Benkelman Beam process.

Proof Load Testing of Weldments

The Materials Research Division is often required to proof load test various types of weldment to determine if a particular weldment will perform adequately under maximum service load. Usually special loading apparatus must be constructed and load and deflection measuring devices attached.

One recent test involved one of two mooring plates for the floating dock, which replaces the old fixed dock upstream of the new Johnson Street bridge alignment over the Yarra River. The weldment consisted of 60 × 40 mm bars fillet welded to the edges of slots cut in a large 55 mm thick steel plate. A proof load of 135 kN was to be applied at each of four critical locations on the mooring plate.

The methods of applying the load to the plate by 300 kN jack, transfer beam and loading bolt is shown in Plate 14. The actual load applied was monitored by an 80 kN load cell. Deflection of the welded bars during loading was measured by two displacement transducers. X–Y recorders were used to obtain plots of load versus deflection for each load position.

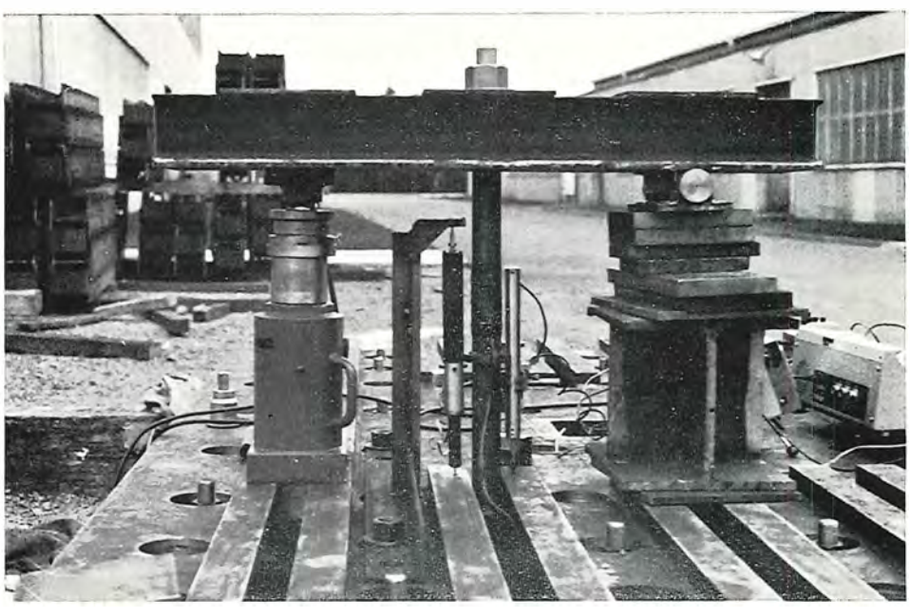


Plate 14—Method of applying proof load to welds of mooring plate.

On proof loading the weldment to 135 kN, bar deflections of 0.25 mm were measured at each location. The load-deflection plots indicated that the welds were stressed within the elastic range. A dye penetrant inspection of the welds made after proof loading did not revealany weld defects induced by the loading. The weldment was then considered satisfactory for service.

Prestressed Brick Lintel

A design for the proposed dynanometer building at the Syndal Depot included a proposal to span the entrance of a two door truck bay with a prestressed brick lintel.

Conventional steel or concrete lintels used in a brick building may cause cracking in the brickwork because of the differing temperature expansion characteristics of the materials. To overcome this problem it was proposed to use two lintels constructed from perforated bricks, laid vertically, with a prestressing tendon passing through the lower perforations.

A prestressed lintel of this type spanning 15 feet was constructed and tested in the MRD Laboratory (Plate 15). The elastic modulus of the brickwork was first determined from strain measurements on brickwork specimens. The lintel was then loaded and strains measured at the centre and one end of the beam. A four point loading system was used to apply vertical loads to the beam directly and to the beam with a 5 course wall of bricks laid onto it.

The test beam supported a load equivalent to more than double the design load with deflections that would be satisfactory.

Plate 15—Prestressed Brick Lintel under Test.

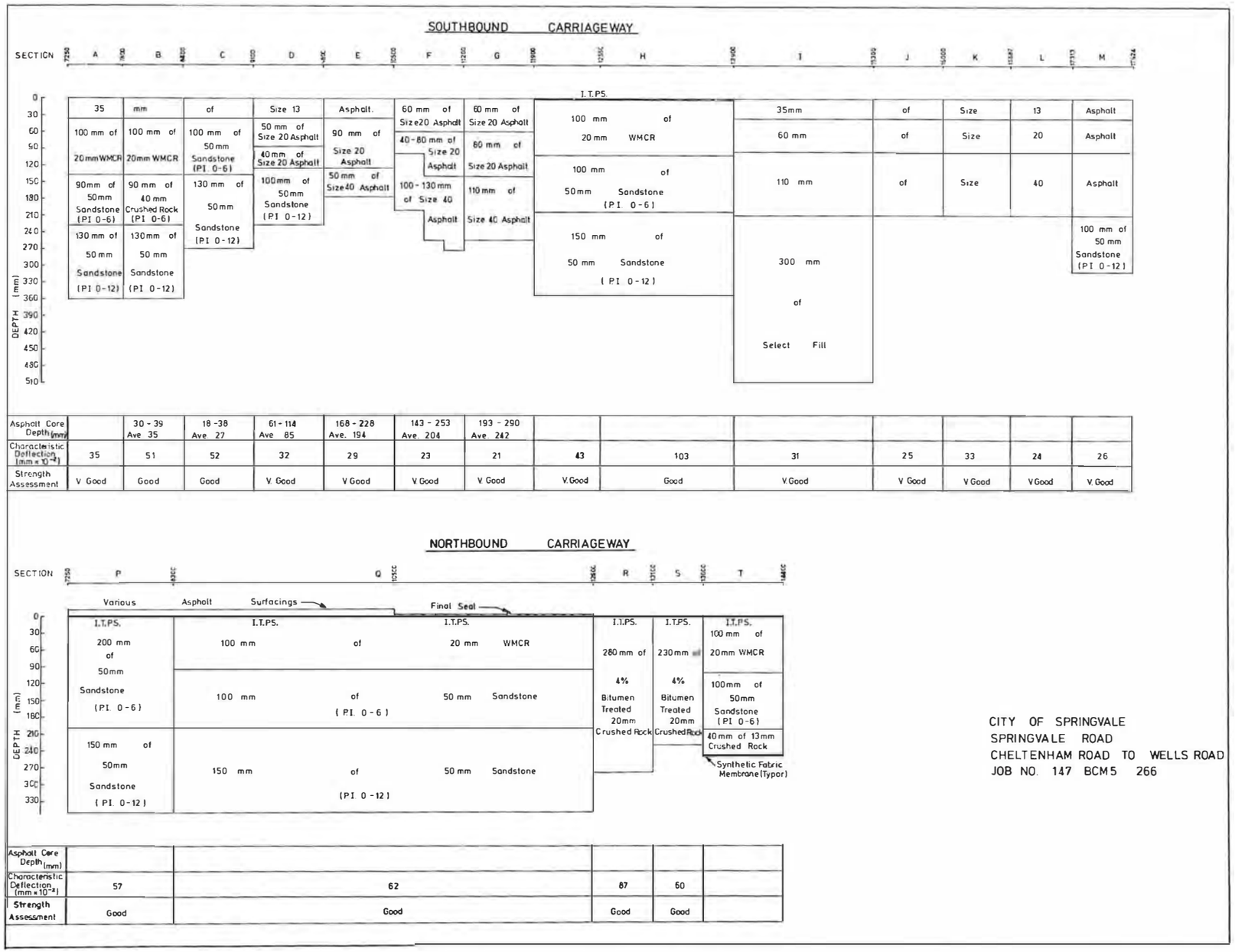
Plant Quality Control

The Plant Quality Control Section of the Materials Research continued the plant supervision of quarry products to Metropolitan and Dandenong Divisions, Eastern Freeway, Mulgrave Freeway & Hume Freeway (Wallan–Broadford) Projects, Metropolitan Municipalities and Sundry Debtor Works. The output of quarry products supervised during 1974/75 is shown tabulated below:

TABLE 6—OUTPUT OF QUARRY PRODUCTS SUPERVISED DURING 1974/75

Product	CRB Direct	CRB Funded	Sundry Debtors	TOTAL
Quarry Products Tonnes	515,582 (301,276 wet mixed crushed rock 214,306 dry crushed rock)	44,874	127,860	688,316
Asphalt Tonnes	160,305	66,114	254,370	480,789
Concrete Cubic Metres	28,311			28,311

Table 7—Springvale Road, Cheltenham Road to Wells Road.



Experimental Pavements—Springvale Road

In the duplication of Springvale Road between Cheltenham Road and Wells Road, Keysborough, a number of pavement types of different thickness were constructed and the performance of these pavements under traffic was determined. Major interest was directed to full depth and deep strength asphalt pavements, which because of their economy relating to conventional flexible construction, are of increasing interest. Other factors investigated included the use of marginal quality crushed rock stabilized with foam bitumen and the use of a fabric membrane as a possible means of reducing pavement thickness.

Pavement deflection testing was carried out, initially to obtain some indication of the structural adequacy of these pavements shortly after construction and, periodically to monitor their performance. Asphalt sections were cored to determine the standard of compaction and the as-constructed thicknesses.

Until this time the design of full depth and deep strength asphalt pavements was based on the Asphalt Institute Method of Equivalencies. The design procedure has now been revised to allow a reduction in pavement thickness without loss of pavement adequacy. Table 7 provides details of the various pavements and results of testing to date.

Road Roughness and Pavement Serviceability

The design and operation of devices used by the Board for measuring road roughness and pavement serviceability have been described in the Chief Engineer's reports of 1965/66, 1967/68 and 1970/71.

In 1971 a road rating study was conducted to determine the relationship between the pavement serviceability as judged by a rating panel at that time on a scale of 0 to 5 and roughness index as measured by a roughness meter. Research Memorandum No. 17 published in June, 1973, reported the relationships between present serviceability and the roughness index measured by the NAASRA Roughness Meter. It also reports relationships between the roughness indices measured by the NAASRA Roughness Meter and the modified Bureau of Public Roads (BPR) Roughometer. Further analysis of the data has established predicting equations for present serviceability for use with the modified BPR roughometer at speeds of 32 km/h and 64 km/h (20 mph and 40 mph). The higher test speed cannot be used on very rough roads and is impractical on roads with poor vertical or horizontal alignment, but is satisfactory for most State highways and major roads.

Electronic recording equipment for the modified BPR roughometer now automatically records roughness for direct input into the Board's computer. A keyboard is used to record identification codes, roadside features and other relevant information.

The Mulgrave Freeway has been tested on two occasions and the results analysed statistically to determine the significance of the measured changes in roughness. The freeway was surveyed with the roughometer in June, 1974, and again in March, 1975, all lanes being tested in both Section C and more recently constructed Section B.

Analysis of the results shows that the outbound carriageway is reasonably stable while the Melbourne bound carriageway showed a significant worsening in condition. The analysis also shows that Section C became significantly rougher; in Section B on the other hand one lane showed no significant change while the remaining three lanes did become significantly rougher.

Overall it was concluded that the effects of time, trafficking and weather had tended to produce a general worsening of the pavement surface roughness. This change in condition is expected to be more significant in the early life of the pavement during its initial trafficking. In addition the analysis shows that the general trend is towards a more consistent surface condition along the freeway.

Evolution of Asphalt Design Criteria

Following a long break during and after the Second World War, when no asphalt was used, the Board used asphalt surfacing on an important urban arterial road during 1955/56. The first asphalt designed and laid was stone filled sheet asphalt containing 28% by weight of 10 mm one sized aggregate, 8–9% by weight of lime filler and the remainder sand. This material proved to be unstable under traffic with plastic flow and corrugations rendering the material completely unsatisfactory. In an attempt to increase stability, the stone content was increased to 50% but the material was still unacceptable.

After some research, the mix design philosophy was changed in 1958 from the use of the gap graded, stone filled sheet asphalt to a continuously graded material and the Marshall method of mix design was adopted. These mixes approximated a maximum density grading and the emphasis was on stability and durability. Air voids were low, percentage of filler high, and bitumen content low and the mixes had high stability and high flow. This material which was used from 1958 to 1966, was easy to lay and when laid, was very stiff with high stability and limited flexibility. In service, the mixes retained a good surface macro-texture and therefore high skid resistance but tended to crack readily at areas of pavement weakness because of their limited flexibility.

In 1966 a new asphalt specification was issued, with the aim of increasing flexibility of the asphalt mixes and so overcome the cracking problems which were evident. This was achieved by using a slightly coarser, although still continuous grading and increasing the bitumen content by the order of one percent for any given size of asphalt. At this time the Board owned a mobile continuous mix asphalt plant and much developmental work was carried out in regional divisions, including the use of crusher fines in mixes, before the new specification was applied to asphalt laid in the metropolitan area. These mixes exhibited lower stability, slightly lower flow, had approximately the same air void content and low voids in mineral aggregate. The percentage of filler was lower and bitumen content higher than was previously used. In effect the asphalt was just as workable and more flexible but in service proved unsatisfactory, particularly under heavy traffic and if soft aggregate had been used. Problems of flushing, rutting and plastic deformation were experienced with resultant poor riding surfaces and lower skid resistance.

By 1970 it had become apparent that the asphalt mixes contained insufficient internal void space to accommodate post construction compaction by traffic. Since that time air voids and Voids in Mineral Aggregate have been substantially increased—to provide void space whilst the other properties have been little affected. Additional void space was provided by using an even coarser aggregate grading (corresponding to a grading with n = 0.6) whilst leaving the bitumen content the same. This has resulted in thicker bitumen films being present on aggregate particles and therefore the retention of flexibility, without the previous tendency to flushing and plastic deformation. The coarser grading has also had the effect of increasing surface macro-texture and therefore skid resistance.

Whilst this latter phase was evolving, difficulty was experienced in selecting a grading coarse enough to achieve the desired properties from the grading envelopes contained in the existing specification. This problem was overcome however with the issue of a new specification in 1974 which provides sufficient latitude in this regard and embodied requirements such that all currently desired properties may be achieved.

Asphalt that has been designed to meet the current criteria is immediately seen to advantage because the coarse aggregate grading is giving increased surface macro-texture and therefore improved skid resistance. The other advantages of good life and flexibility due to thicker bitumen film thickness and increased voids giving added protection against traffic compaction are factors that need service life to evaluate. Experience gained with asphalt laid since the adoption of the present criteria does however allow a confident prediction that these requirements are being met.

3. ASPHALT DIVISION

Extent of Work

Table 8 shows that 4,636 kilometres of all types of bituminous surfacing work was completed in 1974/75 compared with 4,734 kilometres in 1973/74.

In 1974/75 the length of sealed pavement on the Board's declared system was increased by 103 kilometres and the length on unclassified roads by 533 kilometres as shown in Table 9.

Reconstruction of existing sealed pavements and the restoration of the seal coat amounted to 490 kilometres of the declared system, 2.1 % of the sealed length compared with 2.1 % in 1973/74 and 2.4 % in 1972/73.

Retreatment on declared roads amounted to 1,373 kilometres, 5.8 % of the sealed length, compared with 6.6 % in 1973/74.

TABLE 8—BITUMINOUS SURFACING WORK COMPLETED

Category of Road and Plant Used	1973/74		1974/75	
	Kilometres		Kilometres	
Work on roads to which the Board contributed funds:				
(a) C.R.B. declared roads:				
(i) Board's plant	1,997		1,899	
(ii) Municipal plant	130		130	
(iii) Contractor's plant	386		387	
		2,513		2,416
(b) Unclassified roads:				
(i) Board's plant	1,672		1,610	
(ii) Municipal plant	206		178	
(iii) Contractor's plant	187		204	
		2,065		1,992
Sub-totals		4,578		4,408
Work done for other Authorities by the Board's plant (no Board contributions for these works)				
(i) Municipalities	135		212	
(ii) State Instrumentalities	21		15	
(iii) Commonwealth works	—		1	
		156		228
Totals		4,734		4,636

TABLE 9—BITUMINOUS SURFACING WORK ON VARIOUS ROAD CATEGORIES

(On roads to which the Board contributed funds during 1974/75)

Type of Work	State Highways	Freeways	Tourists' and Forest Roads	Main Roads	Total Board's Declared System	Un-classified Roads	Totals
	Kilometres	Kilometres	Kilometres	Kilometres	Kilometres	Kilometres	Kilometres
Initial Treatments:							
Extensions to sealed system							
(a) Sprayed work	0.90	38.51	10.88	46.57	96.86	527.21	624.07
(b) Plant mix work		6.48			6.48	5.38	11.86
Reconstruction of lengths of previously sealed pavements							
(a) Sprayed work	156.43	0.98	15.52	292.82	465.75	243.12	708.87
(b) Plant mix work	11.46			12.82	24.28	18.10	42.38
Widening of existing sealed pavements							
(a) Sprayed work	48.51	24.91		64.22	137.64	85.84	223.48
(b) Plant mix work	5.70	16.45		2.89	25.04	1.96	27.00
Duplication of existing sealed pavements							
(a) Sprayed work	27.77			3.23	31.00	1.80	32.80
(b) Plant mix work	6.67			6.96	13.63	6.00	19.63
Final seal							
(a) Sprayed work	121.10		13.30	91.86	226.26	128.25	354.51
(b) Plant mix work	6.03	6.49		3.02	15.54	6.44	21.98
Retreatments:							
(a) Sprayed work	518.55	32.07	43.34	737.84	1331.80	957.89	2289.69
(b) Plant mix work	19.42	6.30		15.17	40.89	10.40	51.29
Totals	922.54	132.19	83.04	12,77.40	24,15.17	19,92.39	44,07.56

Types of Work

Sprayed work (initial treatments and retreatments) was again the principal type of work, amounting to 96% of the total length of the work.

The plant mix work completed in 1974/75 was 176 kilometres, i.e. 4% of the total distance and 8.6% of the total area. The 1974/75 expenditure on plant mix works was equivalent to 28% of the total expenditure on bituminous surfacing. For the plant mix work a total of 319,000 tonnes was supplied and spread by contractors.

Costs of Work

The average unit costs for sprayed work done by the Board's 17 bituminous surfacing units are shown in Table 10. The average overall cost of all types of sprayed work was 48 cents per square metre compared with 35 cents in 1973/74, an increase of 37%. The average cost per tonne for asphalt supplied and placed was $17.35 compared with $15.04 in 1973/74.

TABLE 10—AVERAGE COSTS OF SPRAYED BITUMINOUS SURFACING DONE BY C R B PLANT

(On roads to which the Board contributed funds during 1974/75)
(Costs in cents per square metre)

ITEM	NATURE OF WORK															
Square Metres Costed	I.T.P. & S. Size 13		I.T.P. & S. Size 10		I.T.P. & S. Size 7 & Sand		Primerseals		I.T. Two-application Seal		I.T.S.O. & Reseals Size 13		I.T.S.O. & Reseals Size 10		I.T.S.O. & Reseals Size 7 & Sand	
	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%
Material	35.8	48.0	34.9	52.3	26.5	50.8	22.3	44.9	75.2	57.6	29.1	47.9	22.7	50.2	16.9	53.6
Stores	2.7	3.6	2.3	3.5	2.2	4.2	1.9	3.8	2.8	2.1	2.6	4.3	1.8	4.0	1.6	5.1
Plant hire	13.1	17.5	11.1	16.7	9.5	18.2	9.5	19.1	19.4	14.8	10.6	17.4	7.7	17.0	4.9	15.6
Labour	23.1	30.9	18.3	27.5	14.0	26.8	16.0	32.2	33.3	25.5	18.5	30.4	13.0	28.8	8.1	25.7
Totals	74.7	100.0	66.6	100.0	52.2	100.0	49.7	100.0	130.7	100.0	60.8	100.0	45.2	100.0	31.5	100.0

I.T.P. & S. Indicates "Initial Treatment Prime & Seal"
I.T.S.O. Indicates "Initial Treatment Seal Only"

Materials

(i) Aggregate

The total quantity of covering aggregate used was approximately 191,200 cubic metres on sprayed work done by the Board's plant and 49,600 cubic metres on sprayed work done by municipalities and contractors. Table 11 sets out the average prices of aggregates over the last five years and shows that the average price in 1974/75 was $2.05 per cubic metre higher than the average price in 1973/74.

(ii) Bitumen

The Board purchased 25,745 tonnes of bitumen by contract with four marketing companies at a cost of $2,317,105.

TABLE 11—AVERAGE PRICE OF AGGREGATE FOR BITUMINOUS SURFACING
(In roadside stacks)

Material	Prices per cubic metre				
	1970/71	1971/72	1972/73	1973/74	1974/75
	$	$	$	$	$
Screenings	6.64	6.74	7.01	7.39	9.31
Gravel	6.36	6.50	6.76	6.53	9.24
Sand	3.03	2.05	2.64	3.68	3.06
Scoria	4.32	4.46	5.10	4.49	5.38
Average price all aggregates	6.45	6.54	6.83	7.08	9.13

Change of Crude Oil Sources

During the late 1950's to the mid 1960's bitumen used by the C.R.B. was produced from blends of Middle East crude oils. From the mid 1960's to 1974 bitumen was produced from crude oil from Kuwait in the Middle East.

The recent world wide shortage of crude oil supplies resulted in bitumen supplied during the current financial year being produced from Kuwait and Safaniya crudes and from a blend of these two crude oils. There may be further changes of crude source during the coming year.

The new crude oils have test properties equal to or better than the Kuwait crude oil and their introduction has been preceded by field trials. Record sheets for each job now indicate the source of the crude oil from which the bitumen is produced. In the future this will enable a comparison to be made of seal life obtained from the bitumen produced from the various crude oil sources.

The Bass Strait crude oil is lacking in heavy ends and is therefore not suitable for the production of bitumen.

Experimental Seal on Ouyen Highway 11.9—18.25 M.P., East of Walpeup

On this highway trials were made of single application limestone aggregate seals in October, 1966.

The trials were designed to indicate a correct rate of application and fluxing of binder for single application seals using one sized limestone aggregate. In addition to this, with the objective of reducing or eliminating limestone aggregate breakdown, various types of precoating materials were tried. A total of 33 sections were involved.

This work has been inspected in detail every year and the conclusions reached have enabled the following practices to be adopted when using limestone aggregate.

(a) The percentage of voids to be filled was increased from 80% to 85% in the traffic range 150–250 vehicles per day, resulting in a higher binder content.

(b) All limestone aggregate is now precoated with tar.

(c) Standard fluxing tables are now used.

Only about 10% of the work needs to be resealed in 1975/76 giving a minimum seal life of 9 years. The limestone aggregate has performed very well, indicating that such aggregate can be used successfully for sealing roads carrying light to moderate traffic.

Primerseals

Primerseals are designed to hold pavements in good order between the time construction and surface preparation is completed and a permanent seal coat is applied. Primerseals can last for periods ranging from 3 months to 12 months. Under ideal conditions, however, primerseals may last for as long as 2 years or more. Initially primerseals were used for winter sealing, but because of problems with primed pavements, the use of primerseals has been extended over the full year.

In an endeavour to extend the effective life of primerseals before application of the final seals, several trials have been conducted using various types of primerbinders applied to pavements at varying rates of application. The pavements have been constructed with several different pavement materials.

The latest trial was carried out in May, 1975, on Eramosa Road in the Shire of Hastings where a cationic bitumen emulsion primerbinder was applied to a crushed rock pavement and covered by a Size 7 aggregate. This was compared with a proprietary cutback bitumen primerbinder applied at two different rates of application as detailed in the table below. No problems were experienced in applying the primerseals.

Section No.	Primerbinder			Size 7 Aggregate
	Type	Rate of Application	Residual Bitumen	Rate of Application
1	Cationic emulsion	1.35 l/m²	0.88 l/m²	1m³ to 88 m²
2	Proprietary cutback bitumen	1.30 l/m²	1.04 l/m²	1m³ to 88 m²
3	Proprietary cutback bitumen	1.59 1m/²	1.27 l/m²	1m³ to 88 m²

The cost of the emulsion primerseal with the primerbinder applied at an application rate of 1.35 l/m² is the same as the cost of the proprietary cutback bitumen primerseal with the primerbinder applied at 1.40 l/m².

The trial sections were inspected approximately 3 weeks later. A small amount of stone had been lost from the aggregate mat on the emulsion primerbinder section but it was considered that the sections were in good condition at this stage. It was noted that the primerbinder had not risen as high up the aggregate as on the cutback bitumen sections.

In using primerseals the following job requirements have been found to be important:

(a) The primerbinder should not be heated until required for use. Continued heating will rapidly increase the viscosity by evaporation of the volatile components.

(b) Adhesion agent must be added (standard 0.5 per cent by volume) if the primerbinder is reheated at all, particularly when primersealing under adverse weather conditions. Adhesion agents are rendered ineffective by prolonged heating.

(c) Primerbinders may be applied with success to a damp surface but should never be applied to a dry dusty surface.

(d) Primer seals applied under adverse weather conditions are more likely to be successful if the cover aggregate is clean and has good adhesion properties.

(e) Damp aggregate may be used with success provided appropriate good working practices are adopted.

(f) Dusty aggregate may be used with success if treated with water or precoated lightly with diesel fuel oil or distillate prior to use.

(g) Rates of application of aggregate should be heavier than normal to avoid pick-up of the primerbinder and to ensure that the maximum amount of aggregate is incorporated into the primerbinder. Immediately after spreading and initial compaction with pneumatic tyred multi wheel rollers, the aggregate should be broom dragged to provide a uniform mat of aggregate. Under difficult circumstances, broom dragging and rolling should continue throughout the following day.

(h) Traffic control is most important, particularly on heavily trafficked roads. Traffic control should be directed at reducing the speed of vehicles and to ensuring that the width of the pavement is traversed.

(i) The primerseal should be kept under observation for at least one week in normal condition and if carried out in cool conditions it should be inspected during the first hot spell. Bleeding of the primerseal as the cutter evaporates should be remedied by gritting and brooming the surface. It is anticipated that emulsion primerbinders will not be subject to this problem.

(j) The final seal should not be applied before the primerbinder has oxidised completely and needs retreatment (usually 3 months minimum in hot weather and 5–6 months in cold weather) as the cutter in the primerbinder will cause the final seal to bleed.

(k) Recommended rates of application of primerbinder in litres/square metre are:

Aggregate size	Traffic — Vehicles per day– (12 hour count)		
	–250	250–2000	2000+
Sand, size 5, size 7	1.3	1.2	1.1
Size 10	1.4	1.3	1.2

The above rates apply to average conditions, and variations of up to 0.40 l/m² may be made for absorptive surfaces.

(l) Size 10 aggregate should be used where the traffic volume exceeds 2,000 vpd.

(m) Representative samples should be taken regularly from the sprayer and tested to ensure that the primerbinder has the specified qualities.

Full Depth and Deep Strength Asphalt Pavements

Full depth and deep strength asphalt pavements are being used on an increasing scale for the reconstruction and widening of heavily trafficked roads in and close to the Melbourne metropolitan area.

The cost of pavements constructed by this method is generally equal to or less than an equivalent granular flexible pavement. On large projects the cost of supply and placing of asphalt has been of the order of $14.60 per tonne.

The advantages of this method, as compared with conventional pavement construction, include:

(a) greater speed of construction, resulting in less inconvenience to the travelling public and lower overhead costs, Plate 16,
(b) because the subgrade or subbase is protected from the ingress of water at an early stage in construction, the work is less likely to be delayed by wet weather,
(c) being less than half the depth of an equivalent granular flexible pavement, excavation is reduced and the need to relocate underground services during construction is reduced,
(d) the subgrade beneath full depth asphalt pavements is generally of a lower moisture content than subgrades beneath conventional flexible pavements.

Details of some full depth asphalt work constructed in Geelong and Laverton areas are given in Table 12.

Plate 16—Placing full depth asphalt widening straight on to a prepared sub-grade on the Princes Highway West

Restoration or Removal of Asphalt Surfaces by Heater Planer

With increasing heavy traffic the need to treat asphalt surfaces which have become smooth and slick, or in extreme cases shoved and rutted, is becoming more common. Occasionally it is also necessary to remove the existing surface before placing the new asphalt surface to avoid raising the road levels or in the case of bridge decks, to avoid adding weight.

To assist in carrying out work of this nature the Board purchased a heater planer in June 1974. Since purchase the machine has been in almost constant use.

Approximately 75% of the work done involves "coking" the surface by burning the excess bitumen off the surface and exposing the larger aggregate particles, both on a sealed surface or an asphalt surface. The result is a marked improvement in surface texture and skid resistance (see Plates 17 and 18). When carried out on pavements which are otherwise sound no further treatment is likely for some years. Any retreatment of the surface is more likely to be successful as the excess surface bitumen has been removed reducing the likelihood of embedment of the stone in a surface reseal or flushing of the new surface in the case of an asphalt overlay or surface reseal.

Plate 17
Surface BEFORE "coking"
(Note surplus bitumen on surface)

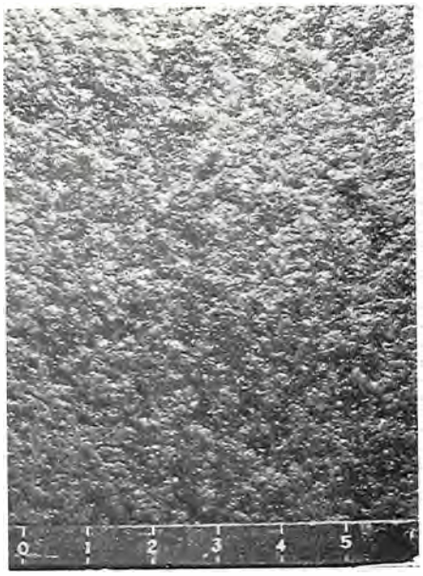


Plate 18
Surface AFTER "coking"
(Note: improved texture of surface)

Cold Mix for Maintenance Patching

Examination of cold bituminous premix materials for maintenance patching has been proceeding for several years. During 1974/75 a comprehensive study and report of Board practice was undertaken and from this a specification prepared setting out grading limits for dense graded and open graded mixes and specifying the composition and quantity of cutback bitumen binders for use under various seasonal conditions.

Rehabilitation of an Existing Concrete Pavement

The roadway in Malop Street, Geelong, comprised an old cracked concrete pavement with differential settlement between adjoining slabs (Plate 19). The resurfacing of this pavement with size 10 asphalt in April 1975 was used as an opportunity to test a special binder (EXAU 28/318M)—bitumen modified by blending with synthetic rubber, which is expected to have properties leading to less reflection cracking of the asphalt under these circumstances.

Plate 19—Malop Street—Geelong
Placing special asphalt mix over old concrete pavement

Resistance to reflection cracking will be compared with a short section of size 10 asphalt containing normal R90 grade bitumen binder and also compared with the section placed on the Princes Highway West at Norlane in 1974, being size 13 asphalt containing natural rubber.

This work was referred to in the 1973/74 Report.

In using this special binder, the practice recommended by the manufacturer was followed. This was to heat both binder and aggregate to higher than normal temperatures. However, from observations during the progress of the work and thereafter, it appears that the properties of the binder were detrimentally altered during the mixing process and ravelling of the pavement surface has occurred. Further trials using a greater binder film thickness combined with lower temperatures during the mixing process are required to evaluate this possibility.

Experimental Work on Asphalt Wearing Course Mixes

Further experimental work has been continued to evaluate the performance of three different types of asphalt wearing course including:
(a) open graded friction course mixes,
(b) gap graded mixes,
(c) continuously graded mixes.

(a) *Open Graded Asphalt Friction Course Mixes*

The development of open graded asphalt friction course mixes was referred to in the 1973/74 Report. Following the success of the initial trial sections, approximately 4,000 tonnes of this material, with 6% of R65 bitumen binder, was placed on the Tullamarine Freeway in May 1975, and its performance to date has been entirely satisfactory. It has been considered, however, that further aspects should be investigated, and with this in mind, trial sections of open graded asphalt friction course material were laid in Springvale Road, Keysborough, with various bitumen contents and grades of bitumen. Sections were placed with bitumen contents of 5%, 6% and 7%, and with bitumen grades of R200, R90 and R65, making nine sections in all.

The compacted depth of the asphalt surfacing was 20 mm. The aggregate grading used was as follows:—

Percentage Passing A S Sieves (by Mass)									
13.2	9.5	6.7	4.75	2.36	1.18	0.60	0.30	0.15	0.075
100	95	61	30	12	10	8	6	4	4.0

Plate 20 shows the textured surface achieved with one particular mix. The skid resistance of the trial sections and the surface appearance will be monitored to determine the performance of the sections under service conditions. On completion, the sideways force coefficient of the pavement surface was in the range of 68–70.

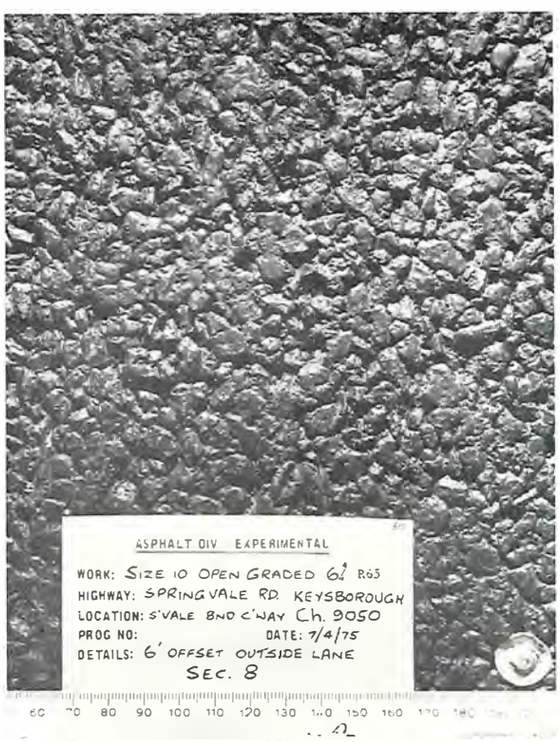


Plate 20—Size 10 Open Graded Friction Course Asphalt (6% of R65 Bitumen)

(b) *Gap Graded Mixes*

Gap graded asphalt essentially consists of large aggregate particles embedded in a sand/filler/bitumen mixture. Gap graded asphalt mixes generally have a higher filler content, slightly higher binder content, and require a harder grade of binder for stability. Because of the large proportion of sand in the mix, a fine surface texture results and, to provide adequate skid resistance, the usual practice is to roll additional coarse aggregate particles into the surface.

Under local conditions the gap graded asphalt is slightly more expensive than the continuously graded mixes; however, the experience in South Africa has been that the mixes are easier to manufacture and place, and that they have greater durability and flexibility than conventional graded mixes. Flexibility is particularly important when the material is used as a thin surfacing.

Four trial sections comprising mixes with two different gradings and with R65 (Plate 21) and R90 (Plate 22) grade bitumen binders were placed to assess durability and performance. The compacted depth of the asphalt surfacing was 35 mm.

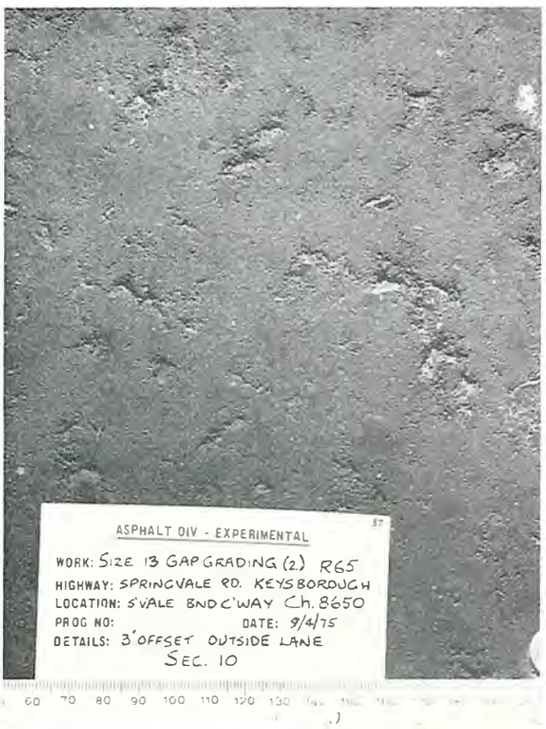


Plate 21—Size 13 Gap Grading (2) Asphalt (5.5% of R65 Bitumen) without aggregate rolled into surface

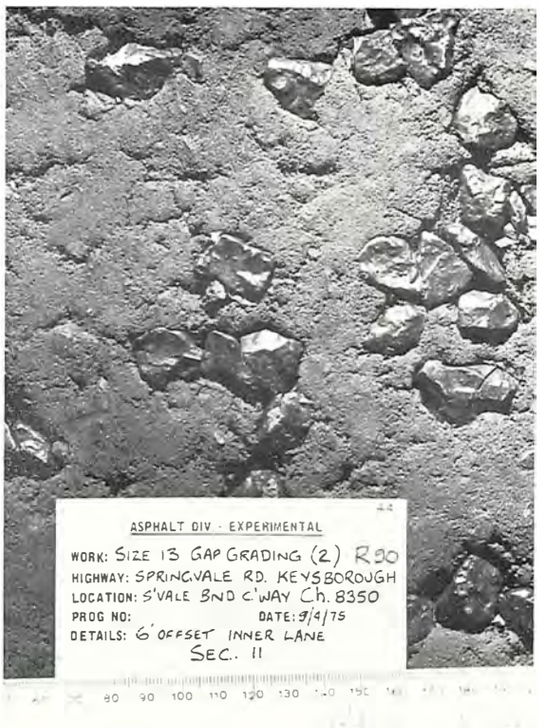


Plate 22—Size 13 Gap Grading (2) Asphalt (5.5% of R90 bitumen)with pre-coated aggregate rolled into the surface

The gradings used were as follows:

	Percentage passing A S Sieves (by Mass)											Bitumen Content %
	19.0	13.2	9.5	6.7	4.75	2.36	1.18	0.60	0.30	0.15	0.075	
1	100	92	75	56	53	47	44	37	26	16	10.8	5.5
2	99	84	75	64	61	56	53	46	32	18	11.9	5.5

Size 20 aggregate, precoated with hot R90 bitumen at a rate of 1% by weight was spread and rolled into surface of the asphalt at the rate of one tonne per 200 square metres.

The sideways force coefficients of the pavement surfaces on completion of the work were 78 for grading 1 and 56 for grading 2. There has been some loss of precoated aggregate from the west northerly section leading to a higher road noise from vehicles.

(c) *Continuously Graded Mixes*

In recent years, it has become apparent that the Board's standard asphalt mixes required modification to withstand the effect of heavy traffic.

TABLE 12—DETAILS OF FULL DEPTH ASPHALT PAVEMENT WORK IN GEELONG AND LAVERTON AREAS IN 1974/75

Job Description	Full Depth Asphalt Pavement Depth	Cost of Asphalt supplied & placed @ per tonne	Average Output per 8 hr day tonnes	Max. Output per 8 hr day tonnes	Total Asphalt used tonnes	Period of Work	Weather Conditions	Sub-grade CBR %	Av. Sub-grade Comp-action B.S. %	Asphalt Compact. % Lab. (on inter & base layer)
Princes Hwy. West Widening Melb C/w Lower Yarra F/W to Kororoit Ck O/pass 1 No. 3.66 m lane 2 No. 3.05 m should. Rural Road	Base 125 mm) Inter 100 mm) 275 Top 50 mm) mm	20 mm Base = $12.07 20 mm Inter = $12.07 13 mm Top = $12.22 (supply and delivery only)	518	918	21,240	2/4/74 to 31/5/74 (41 days)	Poor	4	95	98
Princes Hwy. West. Widening G'long C/w Lower Yarra F/W to Kororoit Ck O/pass 1 No. 3.66 m lane 2 No. 3.05 m should. Rural Road	Base 100 mm) Inter 75 mm) 225 Top 50 mm) mm	20 mm Base = $14.67 20 mm Inter = $14.67 20 mm Top = $14.67	819	1,191	13,111	4/2/75 to 22/2/75 (16 days)	Very good	4	95	101
Princes Hwy. West. Widening of both Melb & G'long C/ws between Laverton and Maltby By-pass 2 No. 3.05 m should. 2 No. 3.66 m lanes Rural Road	Base 100 mm) Inter 75 mm) 225 Top 50 mm) mm Reg. of existing pavement	20 mm Base = $15.20 20 mm Inter = $15.20 13 mm Top = $15.35 13 mm Reg. = $15.55	776	1,230	49,688	7/4/75 to 9/7/75 (64 days)	Fair	4.5 to 5.0	101	101
Reconstruction of Bellarine Highway Ryrie St. Geelong in front of hospital Urban Road	Base 100 mm) Inter 75 mm) 225 Top 50 mm) mm	20 mm Base = $17.45 20 mm Inter = $17.45 13 mm Top = $18.05	208	335	2,709	17/3/75 to 22/4/75 (13 days)	Poor	3.7	—	—
Reconstruction of Hamilton Highway Aberdeen St, G'long Urban Road	Base 100 mm) Inter 62 mm) 200 Top 38 mm) mm	20 mm Base = $17.46 20 mm Inter = $17.46 13 mm Top = $18.05	258	456	5,680	7/5/75 to 23/6/75 (22 days)	Poor	4.5	—	—

Mixes designed with 3%–4% air voids during the late '60s and early '70s were found to undergo further compaction by the action of heavy traffic. This caused bitumen to flush to the surface and allowed mixes to become unstable resulting in shoving and rutting at intersections. During 1974/75 all standard surface course mixes were redesigned to provide 6% air voids with a coarser aggregate grading. The air voids provided in the new mixes allow for expansion of the binder in hot weather and for compaction under traffic, yet the mix is sufficiently dense to be waterproof and durable.

For particularly heavy traffic situations, consideration is being given to slightly coarser mixes with 8%–9% air voids and to the use of R65 grade bitumen instead of R90 grade.

Mixes used in test sections in Springvale Road, Keysborough, include size 10 asphalt with 8% air voids (Plate 23) and standard size 13 asphalt with 6% air voids, but with R65 bitumen binder. A section of standard size 13 mix with 6% air voids and R90 grade bitumen binder is included as a control section for comparison with the other sections (Plate 24). The compacted depth of the asphalt surfacing was 35 mm.

Gradings used were as follows:

	Percentage passing A S Sieves (by Mass)											Bitumen Content %
	19.0	13.2	9.5	6.7	4.75	2.36	1.18	0.60	0.30	0.15	0.075	
Size 13 Normal Grading	100	90	83	68	55	35	27	21	14	8	5.5	4.9
Size 10 Coarse Grading		100	97	71	62	41	28	22	14	8	6.0	5.1

The sideways force coefficient values for both surfaces on completion of the work were 75, and the surfaces have a good texture. There is every indication that these modified mixes will perform better than previous standard dense graded asphalt mixes under heavy traffic conditions.

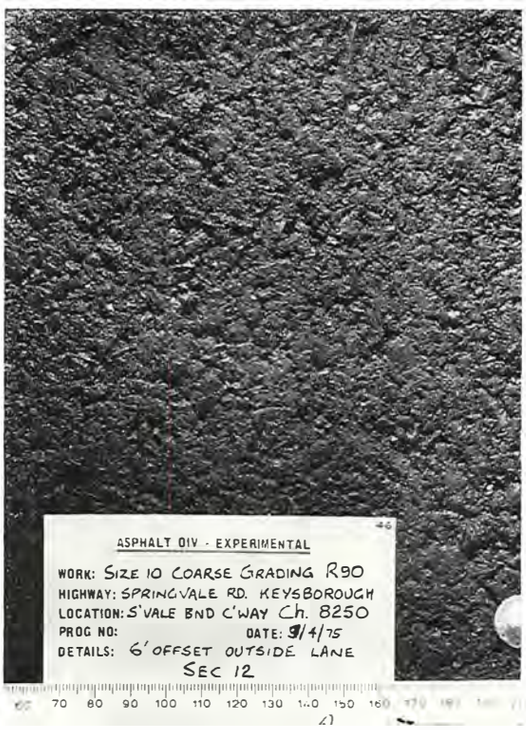


Plate 23—Size 10 Coarse Grading Asphalt (5.1% of R90 bitumen)

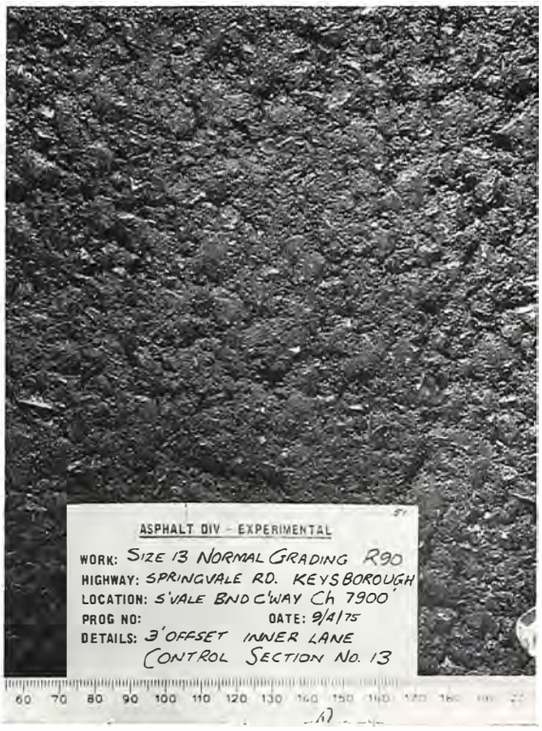


Plate 24—Size 13 Normal Grading Asphalt (4.9% of R90 bitumen)

CURRENT MISCELLANEOUS EXPERIMENTAL WORK

The following is a list of current experimental work being carried out by the Asphalt Division in conjunction with the various regional divisions. Changes in Board practice have resulted from the observations of the experimental sections.

Road and Location	Nature and reason for work	Date work done	Conclusions to date
Beaufort–Carngham Road	Adhesion trials using quartz aggregate.	November, 1969	The experimental sections in which the quartz aggregate was precoated with petroleum tar and adhesion agent added to the binder had much less breakdown and stripping than the sections of untreated quartz aggregate.
Bogong High Plains Road	Evaluation of two application seals using softer bitumen binders to overcome brittle failure of the seal in snow conditions.	March, 1975	All sections are in good condition at this stage but have not experienced a winter period.
Hume Highway north of Violet Town	Evaluation of low "vispen" class R90 bitumens used in a Size 13 reseal (ARRB Road Trials).	February, 1974	No visual difference, but close up photographs of the surface indicate a definite flushing of the low Vispen bitumens.
Hume Highway north of Violet Town	Evaluation of class R90 bitumen produced from light Arabian crude oil used in a Size 13 reseal.	March, 1974	No visual difference, but close up photographs of the surface indicate a definite flushing of the bitumens with a low Vispen.
Hume Freeway (Wallan–Broadford Section)	Evaluation of the performance of a proprietary primerbinder used for a Size 7 primerseal.	October, 1973	In very good condition after 18 months of light traffic.
Northern Highway north of Elmore	Evaluation of low "vispen" class R90 bitumens used in a Size 10 reseal. (ARRB Road Trials).	March, 1973	All sections are in good condition and it is not possible to visually discern any difference in the binders at this stage.
Burwood Highway Vermont South	Size 10 asphalt resheet using various bitumens. Investigation of relationship between the "long term" performance of paving bitumens in asphalt surfacings and the ARRB laboratory testing proposed for predicting performance.	March, 1973	No visual deterioration at this stage. All sections have a good textured surface (skid resistance value about 55) and are in good condition.

Road and Location	Nature and reason for work	Date work done	Conclusions to date
Maroondah Highway Blackburn	Skid resistant evaluation of Size 10 reseals using scoria, basalt and toscanite aggregates.	March, 1971	Some breakdown of the scoria aggregate, but both the scoria and newer basalt seals provide very good skid resistance (68–78 in January, 1974) after the passage of approximately 7.5 million vehicles subjected to stop/go/turning conditions. The toscanite aggregate has polished and has a lower skid resistance (51–55 in January, 1974). All sections of seal should last at least 7 years prior to resurfacing.
Maroondah Highway Blackburn	Determination of the performance of open graded asphalt using class R90 and class R200 bitumens.	March, 1972	The use of an open aggregate grading and a viscous binder produces an asphalt having a satisfactory surface texture which does not close up under the action of traffic, therefore providing a better skid resistance. The findings of this experiment have been incorporated into the Board's asphalt mix design practice.
Springvale Road Keysborough	Evaluation of the performance of various depth, full depth and deep strength asphalt pavements on a sandy-clay subgrade.	October, 1973	The work has proved that a strong economical full depth pavement can be constructed directly on a poor sandy clay subgrade. All pavement types are performing well at this stage, including the 7″ full depth asphalt pavement. Deflection testing has shown the full depth asphalt pavements to have the greater stiffness, followed by deep strength asphalt pavement and the conventional flexible pavement in that order. Testing will continue at regular intervals in the future.
Springvale Road Keysborough	Evaluation of the performance of various depth, full depth and deep strength asphalt pavements on a heavy clay subgrade.	March, 1975	The work has proved that a strong economical full depth pavement can be laid on a heavy clay subgrade. All sections are in good condition at this early stage. Testing will continue at regular intervals in the future to assess the various depth of asphalt.
Princes Highway East east of Beaconsfield	Evaluation of the effects of placing an asphalt wearing course over a "lively" primerseal.	April, 1973	Asphalt still in good condition although there are isolated areas with excess bitumen on the surface.
Frankston–Dandenong Road City of Frankston	Comparison of the performance of asphalts using bitumens produced from Basrah and Kuwait crude oils.	October, 1968	Viscosity results indicate that the Kuwait crude bitumen has oxidised more rapidy than the Basrah crude bitumen and for this reason has a better skid resistance (55 to 44 respectively). Provided lack of skid resistance does not become a problem the asphalt produced from the Basrah crude bitumen should last longer due to the slower rate of hardening or oxidation of the bitumen.
Warburton Highway Launching Place	Evaluation of the performance of a bitumen produced from Qatar-Marine crude oil when used in a Size 10 reseal.	February, 1974	All sections in good condition and no visual difference between the Qatar–Marine crude bitumen (Vispen 34000) and the Kuwait crude bitumen (Vispen 40000+) at this early stage.
Eramosa Road Shire of Hastings	Determination of the life and performance of a Size 7, cationic emulsion primerseal.	May, 1975	Both the proprietary cutback primersea and the cationic emulsion primerseal in good condition at this stage. Refer page 101 "Primerseals".
Princes Highway West Norlane	Evaluation of the performance of a rubberised (natural rubber) asphalt in relation to reflection cracks from a concrete pavement.	July, 1974	Additional cost of incorporating rubber in the mix was $2.65 per tonne. Unmixed rubber evident in two small areas of the road surface indicating incomplete mixing of the rubber in the bitumen binder during the pugmill mixing. No reflection cracking evident in either the normal or rubberised asphalt at this early stage.
Princes Highway West Winchelsea	Evaluation of the performance of a bitumen produced from Basrah crude oil when used in a Size 10 and 13 reseal.	February, 1969	No visual difference in the reseals using the Basrah or Kuwait bitumen binder, but testing indicates that the Basrah bitumen is hardening at a slightly slower rate than the Kuwait bitumen.

Road and Location	Nature and reason for work	Date work done	Conclusions to date
Western Highway east of Pimpinio	Aggregate adhesion and precoating trials using various types of precoating materials on quartz porphyry aggregate.	May, 1974	All sections with adhesion agent are performing better than sections without adhesion agent. When conditions require the use of adhesion agent, it has been found to be more effective mixed in the binder than when mixed in the aggregate treatment oil. The sections pre-coated with tar are performing best at this early stage.
Calder Highway north of Sea Lake	Evaluation of binders incorporating anti oxidants in an ITP and Size 13 seal. (ARRB Road Trials.)	October, 1969	Viscosity measurements of the bitumen give no indication of any reduction in amount of hardening of the bitumen binder due to the addition of zinc diethyl dithiocarbamate anti oxidant. There is no difference in the various sections of the seal which are all in good condition.
Town Street, Red Cliffs Shire of Mildura	Aggregate precoating trials using various types of precoating materials on limestone aggregate.	May, 1975	No firm conclusions at this stage.
Princes Highway West Lynches Bridge and Tullamarine Freeway	Evaluation of Size 10 open graded friction course asphalt.	April, 1974	Performing very well with average skid resistance around 75 and the textured surface results in less water spray, reduced traffic noise, reduced light glare and better line-marking definition. 4,000 tonnes of this mix has been laid on the Tullamarine Freeway in April/May 1975.
North Road City of Caulfield	Evaluation of Class R90 bitumen produced from light Arabian crude oil used in a Size 10 reseal.	April, 1974	Reseal in good condition with no visual difference from the normal Kuwait bitumen reseal at this stage.
North Road City of Moorabbin	Evaluation of the performance of an artificial aggregate, Calcined Pyrophyllite used on a Size 10 reseal.	April, 1974	All sections in good condition. Some breakdown of the artificial calcined pyrophyllite aggregate which has good reflective properties. The scoria/ calcined pyrophyllite mix has the best skid resistance properties at this stage.
Epping Road Shire of Whittlesea	An ITP and Size 13 reseal using various bitumens. Investigation of the relationship between the "long-term" performance of paving bitumens in asphalt surfacings and the ARRB laboratory testing proposed for predicting performance. (AARB Road Trials.)	March, 1973	All binders are in very good condition with no apparent visual difference at this stage.
Hamilton Highway east of Berrybank	Evaluate the performance of a bitumen, produced from Qatar–Marine crude oil, when used in a Size 13 reseal.	February, 1974	The reseal is in very good condition at this stage.
Woolsthorpe-Heywood Road Shire of Minhamite	Evaluation of the performance of various primerbinders applied at various rates of application on various types of pavement and covered with different types of Size 7 aggregate.	December, 1973	The first 6 sections were given a Size 7 scoria final seal in February, 1975, (14 months after the initial primerseal.) The modified primerbinders are performing better in remaining six sections. The borderline volcanic tuff pavement material and low application rates of primerbinder are thought to be factors in the shorter life of the first six sections.
Kangarton–Glengleeson Road Shire of Minhamite	Evaluation of the performance of various primerbinders applied at various rates of application on various types of pavement and covered with different types of Size 7 aggregate.	December, 1974	All primerseals generally in good condition after 8 months with some indication that the modified primer-binders are performing best at this stage. Pavement material is a scoria/gravel mix.
Hensley Park Road Shire of Dundas	Evaluation of the performance of various primerbinders applied at various rates of application on various types of pavement and covered with different types of Size 7 aggregate.	January, 1974	All sections are in excellent condition after 20 months. Pavement material is a good silty surface gravel.

EQUIPMENT

(a) *Aggregate Precoating*

In the past aggregate precoating has been carried out at the loading spirals of the aggregate loader using a hand held spraying lance (Plate 25).

To provide a more efficient process for aggregate precoating and reduce the labour required at the loading site a mechanical method of precoating aggregate has been developed.

The precoating system comprises spraying head, control valves, gauges, pump, pipework and filters (Plate 26).

The spraying head consists of 3 spraying nozzles fitted to diaphragm check valves and is located at the inlet end of the trommel screen on the aggregate loader.

The control valves are located on the operators platform and the system gives the operator full control over the amount of precoating material sprayed on the aggregate.

This system has been successfully tried over the last 12 months and will be fitted to all Board owned aggregate loaders in the future.

Plate 25—Old method of precoating using hand held spraying lance.

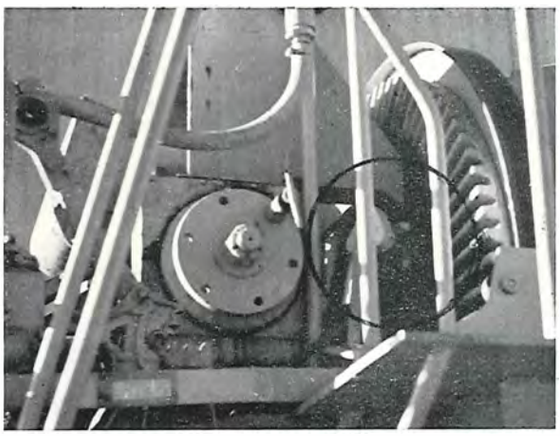


Plate 26—New method of precoating using 3 spraying nozzles at inlet to trommel screen.

(b) *Bitumen Sprayers*

Two of the new C.R.B. designed 4,500 litre capacity bitumen sprayers have been successfully operating in the field during the 1974/75 bituminous surfacing season. Increased outputs have resulted from the bituminous surfacing units using them.

Apart from the increased tank capacity,the major differences from the older 3,600 litre capacity bitumen sprayers are:—

A more powerful prime-mover (GM diesel).

A compact and readily interchangeable pump and valve assembly.

A Lister diesel auxiliary engine has been provided.

The hydrostatic transmission has been provided to the bitumen pump.

Operator comfort has been improved by locating the operator toward the front of the sprayer away from fumes.

It is anticipated that six new sprayers will be brought into operation during 1975/76.

(c) *Aggregate Spreaders*

Two proto-type rotating belt spreaders capable of spreading aggregate to a width of 3.7 metres (12 feet) have been operating in the field during the 1974/75 B.S. season. These aggregate spreaders have been found to be most useful on 3.7 metre (12 feet) wide seals where the cover aggregate can be spread in one pass, compared with two passes when a 3.0 metre (10 feet) belt spreader and a box spreader are used.

4. MAJOR PROJECTS DIVISION

Construction of Concrete Barrier Safety Wall by Slipforming

3,100 metres (10,000 lineal feet) of concrete median barrier wall were constructed on a section of the Princes Freeway (Geelong Road) near Laverton in 1975.

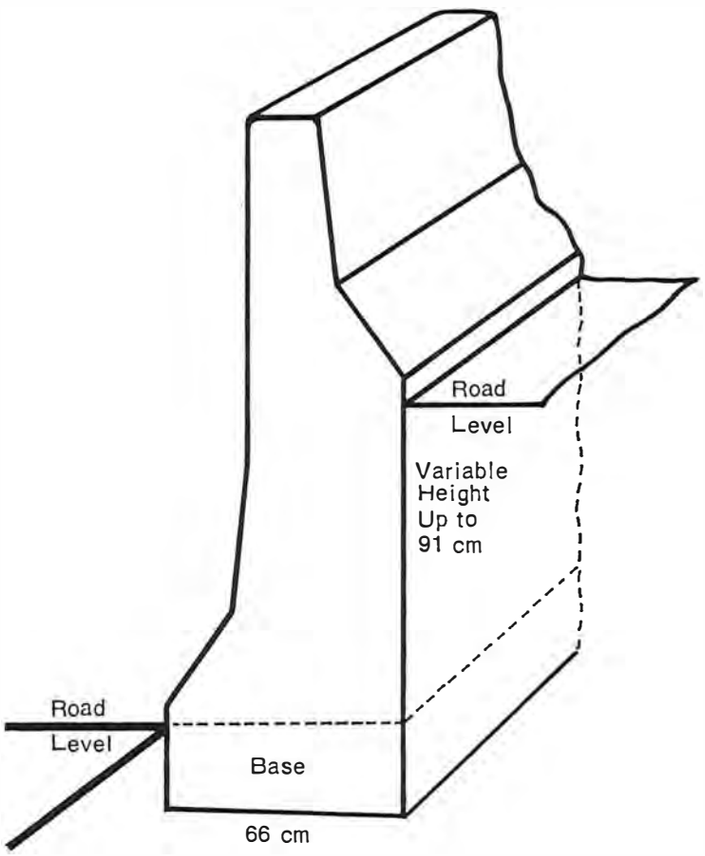


Figure 9—Profile of modified New Jersey type barrier wall designed for use where levels of roadway on each side of barrier wall are at different heights.

The barrier wall was of the modified New Jersey type profile as illustrated in Figure 9. This wall was formed by extrusion from a slipform paver machine especially obtained for the purpose.

The height of the wall, excluding the base, varied from 81 cm (32 inches) to 160 cm (63 inches).

The variable height of the wall was required because of the difference in level of the carriageways on each side of the median. This difference in level was a maximum of 79 cm (31 inches) in the case of one curve, and up to a maximum of 53 cm (21 inches) between straight sections of the adjoining carriageways.

The machine is capable of extruding a wall of uniform height up to a maximum of 173 cm (68 inches).

The machine, costing approximately $100,000, is fitted with electronic sensing units, which, by following a pre-set string line, automatically control the elevation of the machine above the ground and its direction, to produce the barrier wall in the required position and to the required height.

Pre-mixed concrete is fed into the hopper on the front of the machine and then conveyed via a screw conveyor into the form or screed, which is mounted under the body of the machine. The concrete is vibrated internally by air vibrators and externally by hydraulically-driven form vibrators, and when the machine is moved forward under the control of an operator, the concrete is extruded at the rear of the machine in the shape of the wall.

The sensor units, which are shown in Plate 27 being mounted on the left side of the machine, control the left side of the form, which extrudes the lower level of the barrier wall with the variable height surface above the profile being vertical.

The right side of the form is independently adjusted by a hydraulic control valve to raise or lower the profile form on this side to extrude the variable height difference as a vertical face below the 81 cm wall profile.

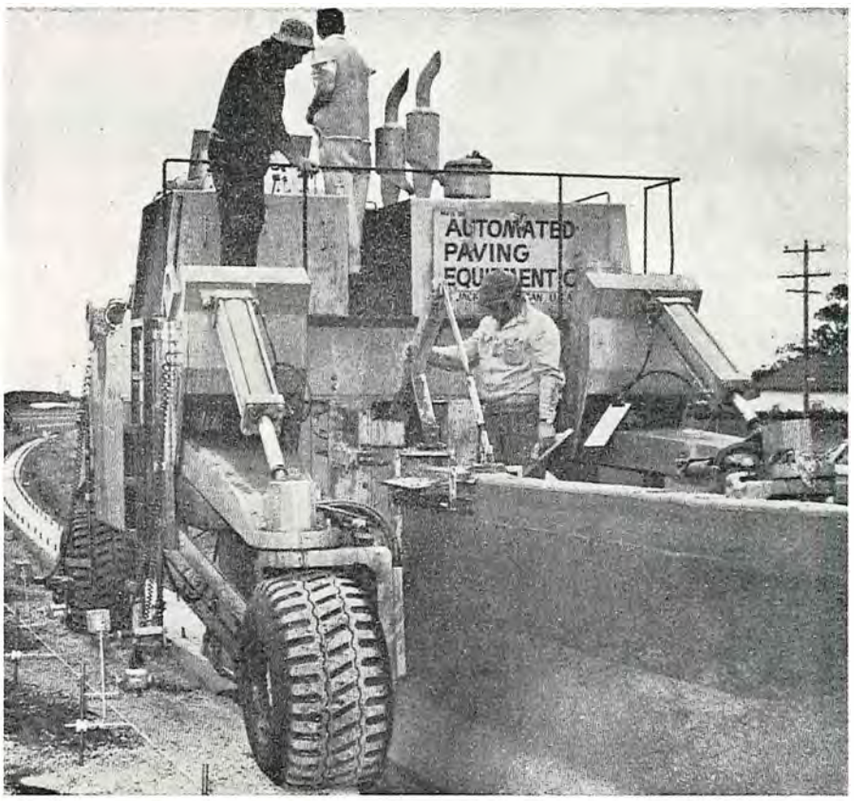


Plate 27—Showing extrusion in progress.
Note sensor units against string line on left of machine

Where the height difference changes from one side of the machine to the other, it is necessary to turn the machine around to enable the left side always to be the lower profile. Any resulting gap in a continuous wall has to be formed and cast manually (gap length 11 metres (36 feet)).

Various trials have been carried out to ascertain the most suitable concrete mix for the work, using standard mixes of the structural, pump and paving types with variation in the cement and sand content. The mix found most suited for the work is a conventional 14 mm structural mix with additional cement (340 kilograms of cement per cubic metre total) using water reducing and air entraining agents.

On the higher wall a pumping aid was added to the mix to "jellify" the water and increase stability, following several failures with the 1 in 9½ slope face.

The specified slump of the concrete mix was 15 mm, and it was found possible to control the water content, such that the slump of the concrete ranged from 5 to 10 mm. When slumps of 13 to 15 mm were encountered, the concrete bulged after extrusion, resulting in poor wall shape and requiring manual correction.

The barrier wall was extruded onto a separate concrete base to limit the height of extrusion of the high wall, and no reinforcement was used in the wall.

The following outputs of barrier wall construction were obtained:

1. Total length of wall constructed	3,100 metres (10,000 ft)
2. Total quantity of concrete used in wall	1,526 cubic metres
3. Maximum daily length of wall constructed with a height up to 100 cm (40″)	210 metres (660 ft)
4. Maximum daily length of wall constructed with a height of 160 cm (63″)	67 metres (220 ft)
5. Average daily length of extruded wall completed	82 metres (270 ft)
6. Maximum quantity of concrete used in one day	70.4 cubic metres
7. Average daily quantity of concrete used	41.2 cubic metres

The machine is also capable of extruding bridge parapet rails, kerbing and channel and low retaining walls and channel lining.

The various requirements for these shapes are met by the use of different screeds.

Plate 28—View showing new work in progress on Princes Freeway at Laverton.

Price Variation Clauses in Board's Contracts

Because of the effects of inflation on the cost structure in the road and bridge construction industry, the Board during this year introduced price adjustment clauses into all road and bridge construction contracts. The price adjustment formula takes the following form:—

$$A = V \left[0.35 \frac{Ln - Lo}{Lo} + 0.45 \frac{Mn - Mo}{Mo} \right]$$

Where:

A = amount of adjustment

V = value of claim for work executed

*Ln, o = Labour Index: the Hourly Wage Rate for adult males in the Building and Construction Industry Group, Victoria, as published for each month by the Australian Bureau of Statistics.

*Mn, o = Materials Index: the Wholesale Price Index of Materials Used in Building Other Than Housebuilding—Special Purposes Index Group for Melbourne as published for each month by the Australian Bureau of Statistics.

*n, o = Subscripts indicate the indices for the months preceding the date of measurement of works executed and the closing of tenders, respectively.

The Board has also introduced price adjustment clauses in material supply contracts.

Existing Board's contracts having a major portion of work outstanding were renegotiated or amended by the inclusion of price adjustment clauses. Approximately 40 contracts were so adjusted.

It has not been possible to determine with exactness the effects of inflation on any particular aspect of road and bridge construction costs. The price adjustment formulae reflect the general changes in cost in closely related fields and will in time reflect all such changes, but they do not immediately reflect the effect of changes in workers' compensation insurance premiums, special on-site loadings and allowances, and the sudden changes in price of some construction materials.

Contractors are expected, from their specialized knowledge and experience, to make allowance for all on-site conditions and for the costs of plant operation, etc.

In 1974/75 the number of lost time injuries increased by 65 (net) over the previous year. Details of the increases and decreases are shown in Table 13.

TABLE 13—INJURIES TO BOARD'S EMPLOYEES

Type of Injury	1973/1974	1974/1975	Changes from 1973/74	
			Decrease	Increase
Back strain	55	83	—	28
Burns and scalds	26	18	8	—
Burns to eyes	13	5	8	—
Fatal injuries	0	1	—	1
Foreign body in eyes	23	36	—	13
Fractures	28	18	10	—
Head injuries	22	17	5	—
Lacerations and wounds	55	63	—	8
Miscellaneous	30	52	—	22
Multiple injuries	0	0	—	—
Occupational diseases	17	11	6	—
Sprains and strains	46	76	—	30
TOTALS	315	380	37	102

Table 14 shows the trend in accident frequency rate and the days lost per million man-hours worked. Fatal accidents are assessed in accordance with Australian Standards CZ6—1966 as being equivalent to 6,000 days lost.

TABLE 14—ACCIDENT FREQUENCY RATE AND DAYS LOST PER MILLION MAN-HOURS

	1974/75	1973/74	1972/73	1971/72	1970/71	1969/70	1968/69	1967/68
Total man-hours worked (mill.)	9.06	8.75	9.05	9.08	8.97	8.76	8.42	8.42
Lost time accidents	380	315	355	314	294	369	375	385
Accident frequency rate per million man-hours	42	36	39	35	33	42	45	46
Days lost (non-inclusive of fatalities)	2,222	1,998	2,051	2,113	1,794	2,058	4,113	2.328
Resultant days lost per million man-hours	245	228	226	233	199	235	491	277
Number of fatalities	1	—	—	—	1	—	3	2
Days lost (inclusive of fatalities)	8,222	1,998	2,051	2,113	7,794	2,058	22,113	14,318
Resultant days lost per million man-hours	208	228	226	233	869	235	2,563	1,714

The number of lost-time injuries to Board's employees increased in 1974/75 by 20.6% and the accident frequency rate per million man-hours increased by 16.7% as against an increase of 3% in man-hours worked.

PUBLICATIONS

In connection with the Board's engineering work, the following papers by Board's officers were presented or published during 1974/1975.

Paper	Author
Experimental Behaviour of Circular Concrete Hinges Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	S. Plesiotis, B.E.(Civil), M. Eng. Sc., M.I.E. (Aust.) and G. D. Base, B.Sc. (Eng.), Ph.D. (Lond.), M.I.C.E., M.I.Struct. E., Senior Lecturer, Department of Civil Engineering, University of Melbourne and L. C. Schmidt, B.C.E., M. Eng.Sc., Ph.D., M.ASCE, M.I.E. (Aust.), Reader, Department of Civil Engineering, University of Melbourne
Design of Eastern Freeway Structures Presented at the Structural Branch Institution of Engineers, Australia, Victoria Division, September 1974.	H. B. Day, B.C.E. and S. Mokos, C.E. (Budapest) Grad. I.E. (Aust.) and B.A. Hensley, Dip. C.E., M.I.E. (Aust.), and D. I. Payne, Dip. C.E., M.I.E. (Aust.) and H. C. Richards, Dip. C.E., M.I.E. (Aust.), Chairman, Hardcastle & Richards Pty. Ltd., Consulting Engineers
Prediction of Temperatures in Box Girder Bridges Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	A. G. Lanigan, B.E., Ph.D. and A. H. Bryant, B.E., Ph.D., Senior Lecturer, Department of Civil Engineering, University of Auckland and I. G. Buckle, B.E., Ph.D., Senior Lecturer, Department of Civil Engineering, University of Auckland
Quality Control at West Gate Bridge Presented at the Fourth Annual Conference AINDT at Melbourne, August 1974.	R. S. Gilmour, B.Sc.(Hons), A.R.C.S.T., M.I.E. (Aust.), F.A.W.I. T. Sweeney, West Gate Bridge Authority
Searching for Road Construction Materials Published in Highway Engineering in Australia, May-June 1975.	D. T. Currie, B.C.E., Ph.D., M.I.E. (Aust.) A. G. Muir, B.Sc.
The Stabilization of a Large Moving Rock Slide with Cable-Anchors Presented at the Annual Conference, Institute of Engineers, Hobart, February 1975.	A. G. Muir, B.Sc. A. F. Williams, B.E., M.Eng.Sc. M.I.E. (Aust.)
The Construction of a One-Tenth Scale Model of a Prestressed Concrete Bridge Presented at the Seventh Australian Road Research Board Conference, August 1974.	R. S. Gilmour, B.Sc.(Hons), A.R.C.S.T., M.I.E. (Aust.), F.A.W.I. L. K. Watson, Dip. C.E., Grad., I.E., (Aust.)
The Specification of Acceptance Standards for Ultrasonic Inspection Presented at AWRA-AINDT Symposium, University of NSW, June 1975.	R. S. Gilmour, B.Sc.(Hons), A.R.C.S.T., M.I.E. (Aust.), F.A.W.I.
The Corrosion of Galvanised Steel Culverts Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	W. P. Gadsby, B.Sc., A.R.A.C.I.
Photometric Testing of Retro-Reflective Materials used for Highway Signing and Delineation Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	R. N. Field, G. W. Knox, A.M.T.C. (Mech. Eng.), M.I.E. (Aust.)
The Effects of Seasonal Climatic Variations on Pavement Deflections Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	A. Ratnarajah, B.Sc. W.T. Delaney, B.Sc.(Hons), Ph.D., Scientific Officer, ARRB
Settlement Measurement in Pile Loading Test Presented at the Victorian Group, Australian Geomechanics Society, Symposium Observations of Foundation Behaviour, October 1973.	H. R. Ellis, B.E., M.I.E. (Aust.)
An Assessment of A Nuclear Hydrodensimeter Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	R. J. Chalmers, B.E.(Civil), Grad. I.E. (Aust.)

Report on Rock Weathering Classification Presented to the Victorian Group, Australian Geomechanics Society, July 1974.	A. G. Muir, B.Sc. C. Beggs, Melbourne & Metropolitan Board of Works J. Neilson, Mines Department. W. Peck, Golder Moss & Assoc.
Evaluation of a Fine-Grained Sedimentary Rock Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	D. T. Currie, B.C.E., Ph.D., M.I.E. (Aust.) O. G. Ingles, B.A., M.Sc., F.R.I.C., C.Eng., A.M.Inst.F., Professor Department of Civil Engineering (Materials) University of NSW: Formerly Principal Research Scientist, CSIRO, Division of Applied Geomechanics, Victoria. A. F. Williams, B.E., M.Eng.Sc. (Melb.), M.I.E. (Aust.) C. M. Barton, B.Sc., Ph.D., F.G.S., M.Geol.Soc. (Aust.), Senior Research Scientist, CSIRO, Division of Applied Geomechanics, Victoria
Community Consultation in Road Planning Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	K. Bush, B.Com. I. R. Thompson, B.A. R. S. Matthews, B.Surv., Dip. R.&T.C., C.T.P.&C., M.R.A.P.I., M.I.S. (Aust.)
The Intervening Opportunities Trip Distribution Model, and Investigation of Ranking and Stratification Procedures Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	I. G. Thomas K. W. Ogden, Lecturer in Transport Dept. of Civil Engineering, Monash University
Road Surface and Skid Resistance Testing Vehicle Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	J. D. Bethune, Dip.C.E., C.E., M.I.E. (Aust.) K. Read
Planning with Regard to the Roadside Environment Presented at the Forum on Roadsides and conservation, Burnley Horticultural College, November 1974.	S. C. B. Erikson, B.Sc. (Eng.), M.Eng.Sc., M.I.E. (Aust.), M.(S.A.) I.C.E., R. S. Matthews, B. Surv., Dip. R.&T.C., C.T.P.&C., M.R.A.P.I., M.I.S. (Aust.)
Computer Aided Measurement of Earthworks Quantities Civil Engineering Transactions I.E. Aust., Vol. CE. 17 No. 1, 1975.	R. E. Saunders, B.E.
Current Overseas Practice on the Provision of Service Centres on Freeways Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	R. T. Underwood, M.E., B.C.E., Dip. T.&R.P., C.H.T. (Yale), C.E., F.I.T.E., M.R.A.P.I., F.Inst.H.E., M.I.E. (Aust.)
Types of Asphalt Mixes, Mix Design and Quality Control Presented at the Seminar on Hot Mix Asphalt, Bendigo Institute of Technology, May 1975.	J. J. Rebbechi, Dip.C.E., C.E., M.I.E. (Aust.)
Effects of Design Alternatives on Quality of Service at Signalized Diamond Interchanges Presented at the 54th Annual Meeting of Transportation Research Board, Washington D.C. January 1975.	C. J. Messer, Assoc. Research Engineer, Texas Transport Inst., Texas, A & M University D. J. Berry, M.E., B.E.(Civil), C.E., C.T.P.&C., M.E.I. (Aust.), A.M.I.T.E.
Economy of Highway Median Barriers Published in Traffic Engineering, March 1975.	D. J. Berry, M.E., B.E.(Civil), C.E., C.T.P.&.C., M.E.I. (Aust.), A.M.I.T.E. D. J. Woods, Professor of Civil Engineering, Texas Transportation Institute, Texas, A & M University
Design and Analysis of Roundabouts Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	C. B. Horman, B.E.(Civil), Dip. T.&R.P., Grad. I.E. (Aust.) H. H. Turnbull, B.E.(Civil)
Gap Acceptance and Merging Presented at the Seventh Australian Road Research Board Conference, Adelaide, August 1974.	N. Szwed, B.E.(Civil), M.Eng.Sci., M.I.E. (Aust.) N. M. H. Smith, B.E.E., Ph.D., Senior Lecturer Department of Statistics, University of Melbourne
Economics of Road Vehicle Limits Study Published in Highway Engineering in Australia Vol. 7 No. 2 March/April 1975 p. 9–12.	T. H. Russell, M.Eng.Sci., B.C.E., Dip.C.E., C.E., F.I.E. (Aust.) A. T. Fry, B.E.(Civil), M.Eng.Sci. (Transportation), M.I.E. (Aust.), A.M.I.T.E.

Other publications:

Engineering Note No. 108	Asphalt with improved skid resistance.
Engineering Note No. 109	Skid resistance of road surfaces
Technical Bulletin No. 28	Horizontal Drains by H. R. Ellis, B.E., M.I.E. (Aust.)
Technical Report No. 59	Materials for filling indentations in wood by C. J. Parfitt
Technical Report No. 60	The erection of ARMCO multi-plate culverts by L. N. Clay
Research Memorandum No. 19	Concrete Shrinkage Investigation, by R. J. Chalmers, B.E.(Civil).
Research Memorandum No. 20	Settlements and Capacities of Driven R.C. Piles in clay, by H. R. Ellis, B.E., M.I.E. (Aust.)
Research Memorandum No. 21	An evaluation of the Performance of Sandstone and Limestone Road Bases in Horsham Division, by A. Ratnarajah, B.Sc.

STAFF

At the 30th June, 1975 the total staff of the Engineer in Chief's Branch was 1,369.

During 1974/75 Mr. G. M. Langham retired as Chief Mechanical Engineer after 35½ years service with the Board.

I wish to thank all the staff of the Branch for their hard work and loyal service to the Board.

K. G. MOODY,

ENGINEER IN CHIEF

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