

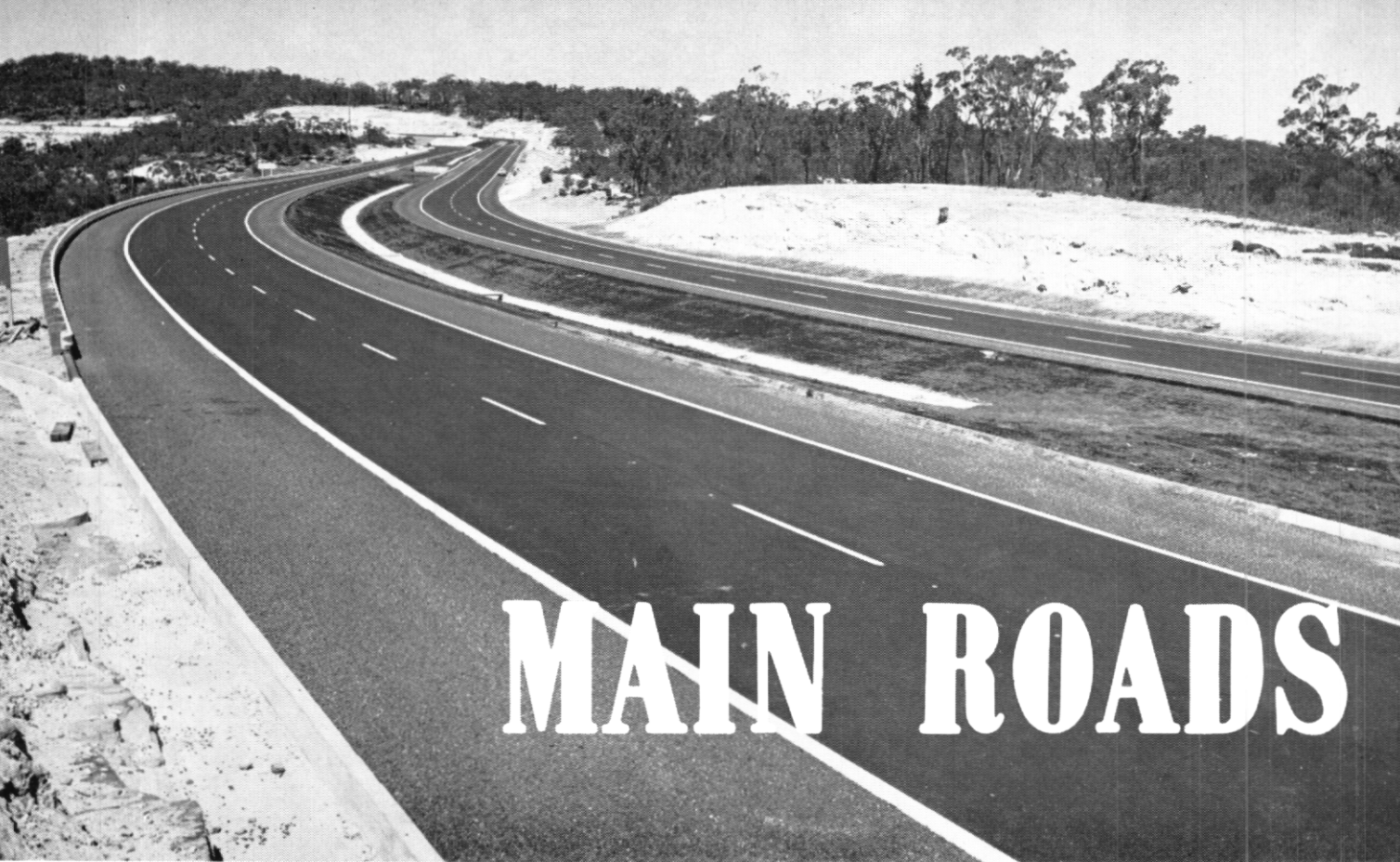
# MAIN ROADS

DECEMBER, 1965



JOURNAL OF THE DEPARTMENT OF MAIN ROADS • NEW SOUTH WALES





# MAIN ROADS

section of the Hawkesbury River to Mount White Toll Way    D E C E M B E R    1 9 6 5

Volume 31    Number 2

## Life is a matter of mind over motor

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Aerial view of Wilcannia, outpost on the Barrier Highway between Cobar and Broken Hill. (Note dust storm in background)

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DECEMBER 1965

JOURNAL OF THE  
DEPARTMENT OF MAIN ROADS  
NEW SOUTH WALES

*Issued quarterly by the  
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J. A. L. Shaw, D.S.O., B.E.*

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**The Hon. P. H. Morton, M.L.A.**

## *Minister for Highways*

The Hon. P. H. Morton, M.L.A., assumed the portfolio of Minister for Highways on 13th May, 1965, from the Hon. P. D. Hills, M.L.A.

Philip Henry Morton was born on 28th October, 1910, at Lismore, New South Wales. A successful commercial career preceded his entry into Local Government activity in 1945, when he became an Alderman of Mosman Municipal Council. He was elected Mayor of Mosman in 1946 and remained in this office until 1951.

Concurrently with this, he followed a family tradition in embarking upon a political career—three of his uncles having previously been in the Legislative Assembly. Mr Morton was elected to the Assembly in 1947 and was Leader of the Opposition from 1955 to 1959.

An aerial black and white photograph showing a large-scale road construction project. In the foreground, a multi-lane highway (the Sydney Harbour Bridge) runs horizontally across the frame. To its north, a new road (the Warringah Expressway) is under construction, featuring a large interchange and several curved sections. The surrounding area includes some industrial or undeveloped land with patches of vegetation and buildings. The title 'Review of Year's Work' is written in a large, white, cursive font in the upper right corner.

# Review of Year's Work

*An extract from  
the 40th Annual  
Report of the  
Commissioner for  
Main Roads,  
J. A. L. Shaw,  
D.S.O., B.E. on  
the work of the  
Department for  
the year ended  
30th June, 1965*

The area just north of the Sydney Harbour Bridge through which the first section of the Warringah Expressway is being constructed



**D**URING the past financial year, substantial progress has been made throughout the State by the Department of Main Roads and Municipal and Shire Councils, in the provision of improved roads and bridges.

A further 552 miles of Main Roads were bitumen surfaced during the year. This is the equivalent of a dustless surface from Sydney to Melbourne.

The total length of dustless surface on Main Roads is 11,292 miles, of which 3,059 miles, or 27 per cent, have been sealed in the last five years.

The total mileage of Main Roads is 22,311 of which over half has a dustless surface.

Major road works completed during the year included the following:—

- ☐ Four tunnels to carry public utilities under the first section of the Warringah Expressway from the northern end of Sydney Harbour Bridge to Miller Street, Cammeray.
- ☐ A length of the Southern Expressway from the southern end of Captain Cook Bridge to Taren Point Road.
- ☐ A six-lane divided carriageway in Taren Point Road between Toorak Avenue and The Kingsway, Miranda.
- ☐ A new road from Merton Street, Sutherland, to the Prince's Highway near Loftus Railway Station to provide an alternative to the "business route" through the town.

- ☐ Reconstruction and bitumen surfacing of the Prince's Highway south of Eden. There is now a dustless surface over the full length of the Highway from Sydney to the Victorian border, a distance of 335 miles.
- ☐ Reconstruction and bitumen surfacing of the Mitchell Highway between Nyngan and Bourke. There is now a dustless surface between Sydney and Bourke a distance of 487 miles.
- ☐ Reconstruction and bitumen surfacing of the Monaro Highway between Cooma and Nimmitabel a distance of 22½ miles.
- ☐ Reconstruction and bitumen surfacing of the Newell Highway between Narrabri and Moree.
- ☐ Reconstruction and bitumen surfacing of the Main Road between Hartley (near Mount Victoria) and Jenolan Caves.

Major road works in hand at the end of the year were:—

- ☐ Construction of approaches to the new bridge being built over Middle Harbour at East Roseville.
- ☐ Construction of three sections totalling 9.1 miles of the Sydney-Newcastle Expressway on the length between Hawkesbury River and Calga.
- ☐ Construction of the first section of the Warringah Expressway from the northern end of Sydney Harbour Bridge to Miller Street, Cammeray a distance of 1½ miles.

An elevator-grader at work on the Barrier Highway east of Broken Hill





The new six-lane divided carriageway of Taren Point Road, Sydney, looking south

- ☐ Rebuilding lengths of heavily trafficked State Highways, especially the Hume Highway, New England Highway and the Pacific Highway to provide stronger and wider carriageways.
- ☐ Reconstruction and bitumen surfacing of State Highways in the western area of the State.
- ☐ Duplication of the carriageway of the section of the north-south arterial road between North Wollongong and Ghost Creek to provide a four lane divided carriageway. This road provided an alternative to the "business route" through the principal shopping centre of Wollongong.
- ☐ Reconstruction and bitumen surfacing of the Main Road from Jindabyne to Mount Kosciuszko.
- ☐ Reconstruction and bitumen surfacing of the Grafton—Casino Trunk Road.
- ☐ Construction of a deviation of the Monaro and Snowy Mountains Highways immediately south of Nimmitabel with a length of 5.5 miles common to both Highways.
- ☐ Reconstruction and bitumen surfacing of the Bruxner Highway between Casino and Tenterfield.
- ☐ Construction of a deviation of the Pacific Highway at Maclean in approach to the bridge being built over the Clarence River.

In the County of Cumberland (Sydney Metropolitan Area), road works in progress were principally reconstruction and pavement widening to provide additional lanes for traffic, installation of median strips in six-lane carriageways and channelisation of intersections.

A large programme of bridge construction was in progress during the year and as a result, one hundred and forty-four new bridges and box culverts of bridge size were constructed on Main and Developmental Roads and at sites on unclassified roads where the Department was responsible for the construction of crossings.

In the last five years, 598 bridges have been constructed on Main and Developmental Roads. This averages out at about 120 per year or one every three days.

At the close of the year 72 bridges and culverts of bridge size were being built on Main and Developmental Roads.

Large bridges completed during the year included:—

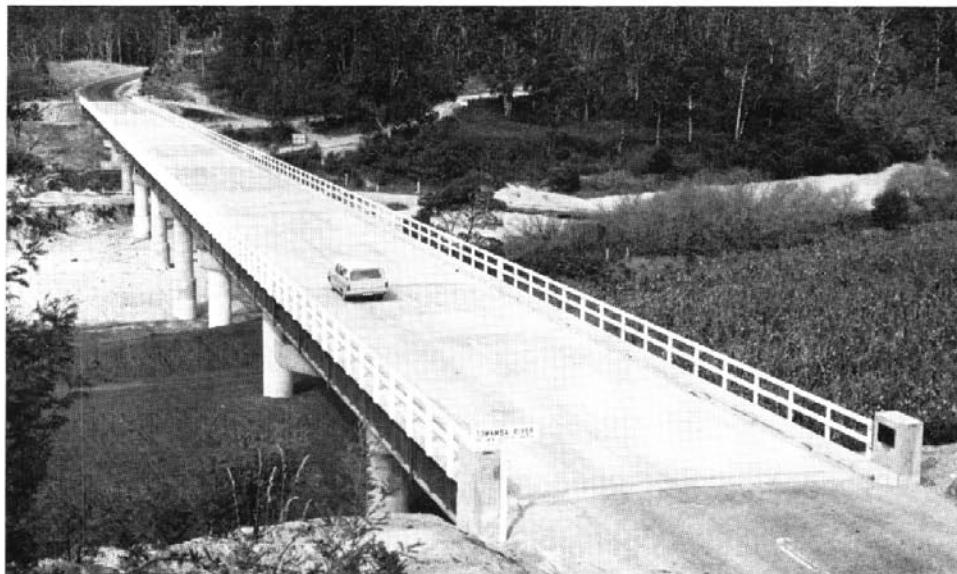
- ☐ Clyde River at Nelligen on the Canberra-Bateman's Bay Trunk Road—in replacement of a ferry.
- ☐ Parramatta River between Gladesville and Drummoyne on Victoria Road—in replacement of an old two-lane opening bridge.
- ☐ Darling River at Louth—to replace a ferry.
- ☐ George's River at Taren Point—Captain Cook Bridge—to replace a ferry.
- ☐ South Arm of the Hunter River at Tourle Street—a new facility.
- ☐ Jugiong Creek on the Hume Highway near Jugiong—to replace a single lane bridge. (Opened to traffic on 3rd July, 1965).
- ☐ Salt Pan Creek on Henry Lawson Drive—a new facility.
- ☐ Minnamurra River at Minnamurra on the Prince's Highway—to replace a single lane bridge.





Left: The new bridge over the Clyde River at Nelligen on the Canberra-Bateman's Bay Trunk Road

Right: Periodic flooding of the old low level bridge in the centre of the photograph led to its replacement by this new structure over the Towamba River at Kiah on the Princes Highway



Below: The new bridge over Salt Pan Creek is an important link in the Illawarra, South Western and Western Suburbs circumferential route





The bridge over the Darling River at Louth, during construction

- ☐ Yass River three miles east of Yass on the Hume Highway—to replace a timber bridge which was periodically submerged by floods.
- ☐ Murrumbidgee River at Jugiong—a new facility. (Opened to traffic on 3rd July, 1965).
- ☐ Towamba River at Kiah—to replace a structure which was periodically submerged by floods.
- ☐ Large bridges under construction at the end of the financial year were:—
- ☐ Clarence River at Harwood near Maclean on the Pacific Highway—to replace the last ferry on the Pacific Highway and on the Highway system of the State.
- ☐ Peel River at Tamworth on the New England Highway—to replace an old narrow bridge. (This bridge was subsequently opened to traffic on 14th August, 1965).
- ☐ Moruya River at Moruya on the Princes Highway—to replace a timber bridge subject to flooding.
- ☐ Orara River at Ramornie on the Gwydir Highway—to replace a narrow low-level bridge with approaches on poor alignment.
- ☐ Tarban Creek, part of the Gladesville—Huntley's Point complex of bridges and flyovers (North-Western Expressway).
- ☐ Hawthorne Canal, Haberfield—a new facility. (This bridge was subsequently opened to traffic on 23rd July, 1965).
- ☐ George's River at Milperra—to replace an old two-lane timber bridge.
- ☐ Middle Harbour at East Roseville—to replace a two-lane structure.
- ☐ Parramatta River at Aston Street, Camellia—a new facility.
- ☐ Wallagaraugh River at Timbillica on the Prince's Highway—to replace a timber bridge which is periodically submerged by floods.
- ☐ Nullica River near Eden on a two mile deviation of the Princes Highway being constructed to replace a length of narrow winding road.
- ☐ Williams River at Nelson's Plains—to replace a ferry.
- ☐ Great Ana-branch of Darling River at Bunneringee—two new bridges.



- ☐ Talbragar River at Troy—to replace an old narrow timber bridge.
- ☐ Bellinger River at Thora—to replace a low level bridge.
- ☐ Emigrant Creek near Ballina—to replace an old narrow truss bridge.
- ☐ Whalan Creek, 60 miles north of Moree—to replace an open crossing.
- ☐ Cudgegong River (Belinfante Bridge)—to replace an old narrow timber bridge which was extensively damaged when a large truck collided with the end of a truss.
- ☐ Murray River at Barmah—this bridge, to replace a ferry, is a work jointly arranged with the Country Roads Board, Victoria.

### BITUMEN SURFACE TREATMENT

The total length of bitumen or other dustless surface on the Main Roads System at 30th June, 1965, was 11,292 miles.

Bitumen or tar surface treatment was carried out during the year by Councils and the Department on a total of 1,337 miles of Main Roads. This work comprised:—

- (a) Initial surfacing of 552 miles of road pavement including 68 miles of new priming or light sealing with tar preparatory to bitumen sealing at a later date.
- (b) Resurfacing of 672 miles of existing bitumen-surfaced roads.
- (c) Restoration of the bitumen surface on 113 miles of road pavement after reconstruction following deterioration of an earlier similar surface.

### COUNTY OF CUMBERLAND PASSENGER TRANSPORT ADVISORY COMMITTEE

In March, 1965 it was announced that the State Government had set up a County of Cumberland Passenger Transport Advisory Committee.

The Commissioner for Main Roads is a member of the new Committee. The other members of the Committee are:—

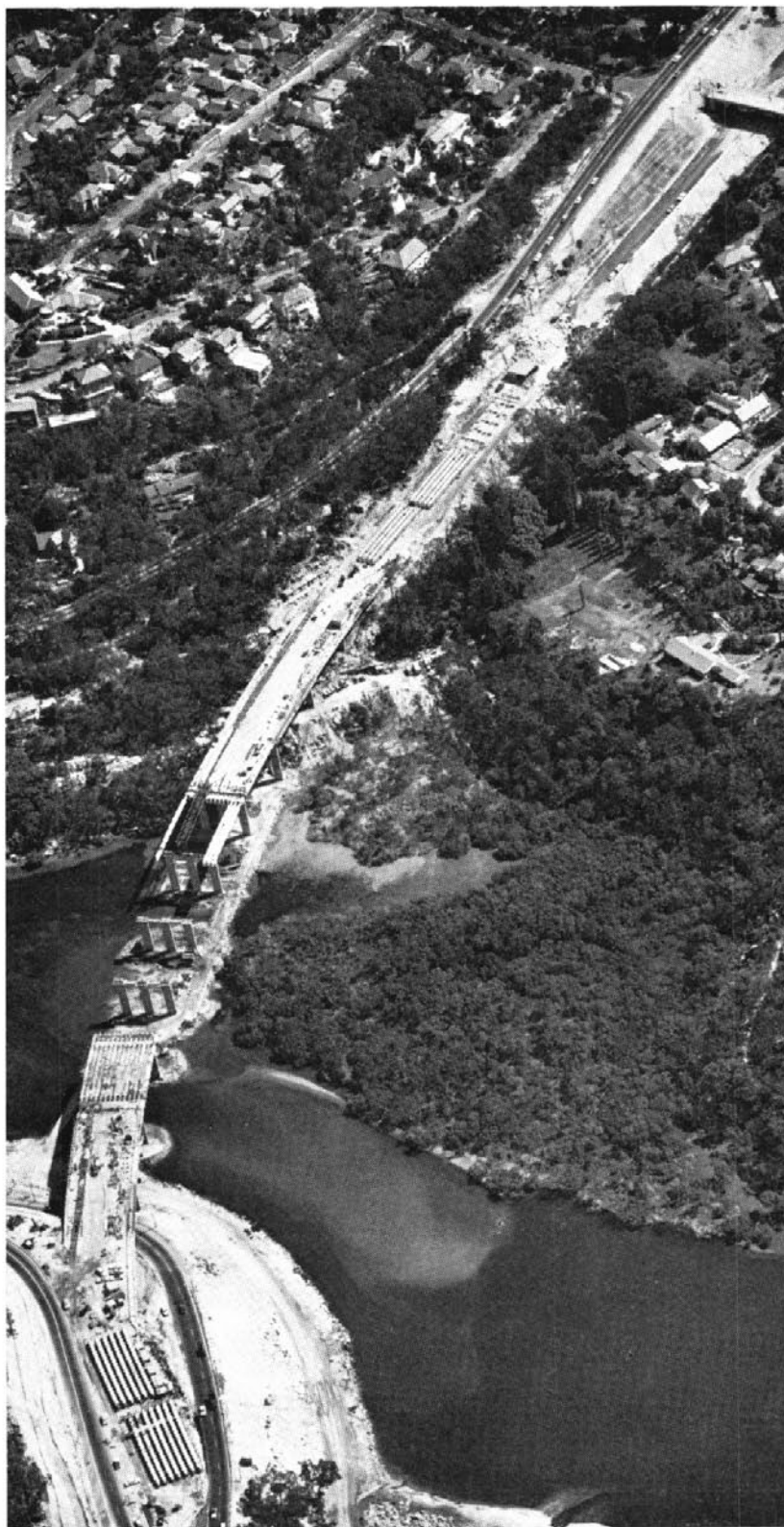
Commissioner for Railways (Chairman):  
Mr N. McCusker

Commissioner for Government Transport:  
Mr S. B. Berry

Commissioner for Motor Transport:  
Mr D. R. Coleman

Chairman of the State Planning Authority:  
Mr N. A. W. Ashton

Under Secretary of the Treasury:  
Mr E. J. Walder



The Roseville Bridge over Middle Harbour is built on a curved alignment to maintain the high standard of the approach

The Committee is a permanent consultative and advisory body set up for the purpose of making recommendations on all types of passenger movement in the County, both public and private, and to deal with such matters as land use, staggering of hours and co-ordination of existing and future services.

The Commissioner for Main Roads is also a member of the State Planning Authority and the Traffic Advisory Committee.

### **CAPTAIN COOK BRIDGE OVER THE GEORGE'S RIVER AT TAREN POINT**

The bridge over the George's River between Sans Souci and Taren Point was officially opened on 29th May, 1965, by His Excellency, Lieut.-General Sir Eric Woodward, K.C.M.G., K.C.V.O., C.B., C.B.E., D.S.O.

The new bridge is 1,662 feet long and 87 feet wide with six lanes for motor traffic and two footways. There are seven spans the end spans being 185 feet, the centre span 250 feet and the four intermediate spans each 235 feet.

Piles consisting of rolled steel lower sections and prestressed concrete upper sections were driven down to the sandstone which was encountered at depths of up to 216 feet below high water level.

Maximum clearance above mean water level under the centre span is 57 feet.

The Captain Cook Bridge has eliminated the Taren Point Ferry and has reduced considerably the number of vehicles crossing the river by the Prince's Highway bridge at Tom Ugly's Point, one mile upstream.

The Captain Cook Bridge and its immediate approaches are the first part to be constructed of the Southern Expressway between Sydney and the Wollongong—Port Kembla area.

Construction of the bridge was carried out by John Holland (Constructions) Pty Ltd, under contract with the Department of Main Roads.

The overall design of the bridge was prepared by the Department of Main Roads and embodied the most modern techniques of precast concrete construction. Some construction and design changes (principally affecting the foundations) were proposed by the contractor and were adopted.

The cost of the bridge was of the order of £1,600,000 and the cost of the approaches constructed by the Department by direct control was about £750,000.

### **NEW ROAD ROUTE**

A more direct route for traffic between the Balmain—Rozelle area and the Western Suburbs of Sydney became available on 23rd July, 1965.

The new route resulted from the construction of a bridge over Hawthorne Canal to connect Lilyfield Road (formerly Augustus Street), Leichhardt, and Dobroyd Parade, Haberfield.

Together with the road recently opened to traffic across Cintra Park and St Luke's Park to connect Queen's Road, Five Dock and Gipps Road, Concord, the new route via Hawthorne Canal provides an alternative to Parramatta Road for part of its length.

With a length of 2,915 feet, the new road bridge over the Clarence River at Harwood, now being built, will be the third longest bridge in New South Wales







Above left: New bitumen surface 100 miles south of Broken Hill on the Silver City Highway. Above right: Sportsman's Creek deviation sixteen miles north of Grafton on the Grafton-Casino Road. Below left: The reconstructed Monaro Highway, near Nimmitabel. Below right: Reconstructed section of the Mid-Western Highway thirteen miles east of Goolgowi

The bridge over Hawthorne Canal providing four traffic lanes is an eight-span concrete bridge 359 feet long and was built by contract for the Department of Main Roads at a cost of approximately £163,000. The approaches to the bridge were built by the Department at a cost of approximately £60,000.

Another new bridge over Johnston's Creek, Annandale built for the Department by the Sydney City Council, was also opened to traffic on 23rd July, 1965.

This latter bridge and associated road works connect Commercial Road, The Crescent and Crescent Road to Ross Street, Glebe, around the southern side of Harold Park. The bridge assists traffic movement to and from the Western Suburbs by providing an alternative route to Parramatta Road, and it also provides increased road capacity for traffic between Drummoyne and the City.

#### FOUR NEW BRIDGES IN SYDNEY METROPOLITAN AREA

Construction of four new major bridges in the Sydney Metropolitan area is nearing completion.

The bridges are over—

Tarban Creek at Hunter's Hill.

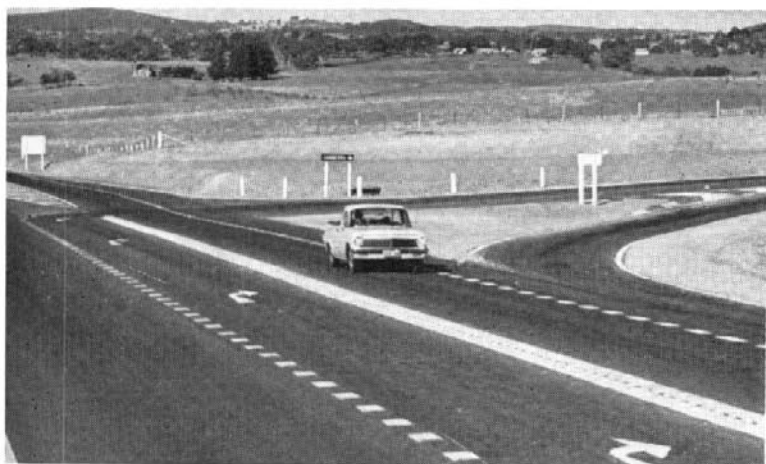
Middle Harbour at East Roseville.

George's River at Milperra.

Parramatta River at Aston Street, Camellia.

The bridge over Tarban Creek—750 feet long—is due for completion in December, 1965 and will provide for six lanes of traffic.

The new bridge over Middle Harbour at East Roseville—1,358 feet long—is due for completion in



March, 1966 and will provide for six lanes of traffic. It will replace a narrow two-lane bridge.

The new Milperra Bridge—280 feet in length—is due for completion in December, 1965. It will also replace a narrow two-lane bridge and will provide six lanes for traffic.

The Aston Street Bridge at Camellia—448 feet long—is expected to be ready for traffic in March, 1966. It will be an additional six-lane crossing of the Parramatta River and will be the eighth road crossing of the river and Sydney Harbour.

Each of the new bridges will be a valuable aid in the movement of traffic in the Sydney Metropolitan area.

- ☐ Tarban Creek Bridge will provide a direct connection between the new Gladesville and Fig Tree Bridges and will complete the first section of the North-Western Expressway between Drummoyne and Lane Cove.
- ☐ The Roseville Bridge will facilitate the movement of traffic to and from the rapidly growing Warringah area and Sydney's northern beaches.
- ☐ The Milperra Bridge will not only ease congestion, but will ultimately form part of a six-lane divided carriageway being provided progressively from the Bankstown area to the Liverpool area.
- ☐ The Aston Street Bridge will be part of a north-south alternative road around the City of Parramatta.

The cost of these four bridges, which are being built for the Department of Main Roads by contract, together with the cost of the approaches, will be of the order of £3,000,000.

#### IMPROVEMENT OF TRAFFIC FLOW BETWEEN THE CITY AND DOUBLE BAY

With the object of improving the flow of traffic between the City and Double Bay, and particularly through King's Cross the Department is proceeding with a scheme for the construction of a twin-bore tunnel under King's Cross from the eastern end of William Street to New South Head Road near McLachlan Avenue.

Top to bottom:

Nine Ways intersection at Broadmeadow, Newcastle

Junction of the Hume and Barton Highways near Yass

A channelised intersection on the southern approach to the Spit Bridge, Middle Harbour

Traffic channelisation at the link road between Botany Road and General Holmes Drive, Mascot



## METROPOLITAN EXPRESSWAYS

### Engagement of Consultants

In 1960 the firm of De Leuw, Cather and Company, consulting engineers, of Chicago and San Francisco, was engaged to advise on the layout of sections of the expressway system proposed by the Department for the inner Sydney Metropolitan area.

In reporting to the Department in November, 1961 the consultants advised that, while there should be some modification in detail of the Department's proposed system the expressway routes planned should be retained. They suggested, however that conditions might ultimately be improved as follows:—

By construction of a north-south expressway between Crow's Nest (Naremburn Area) and Tempe, involving a new bridge crossing of Sydney Harbour.

By construction of an east-west expressway from Woollahra, through Waterloo, to Five Dock with an extension north to Drummoyne.

In December, 1962 the consultants were asked to make more detailed investigations in regard to their suggestions.

The consultants' report on the proposed additional expressways was received at the end of December 1964, and their recommendations for the inclusion of the two additional routes in the expressway system are now receiving consideration.

### Western Distributor

The Department's consultants, De Leuw, Cather and Company, are also preparing a schematic lay-out of the Western Distributor from the southern end of the Sydney Harbour Bridge to the City Markets area.

It is proposed to put in hand the construction of the northern end of the Western Distributor from Sydney Harbour Bridge to Erskine Street City, following completion of the first section of the Warringah Expressway, immediately north of the Harbour Bridge in 1967.

The first section of the Western Distributor from the southern end of the Harbour Bridge to Erskine Street, City, will give direct access from the bridge to Day Street, City and so should reduce the volumes of traffic in York and Kent Streets. It will also give access to the length of the North-Western Expressway from Druiett Street, near Sussex Street to Bridge Road, near Wentworth Park, which is being currently designed for construction as soon as financially practicable.

### Southern Expressway

The first section of the Southern Expressway was opened to traffic on the 29th May, 1965. It comprises Captain Cook Bridge over the George's River between Rocky Point, Sans Souci and Taren Point and a short length of road from the southern end of the bridge to Taren Point Road near Toorak Avenue. This length includes an overpass across the expressway to link Woodlands Road with Taren Point Road.

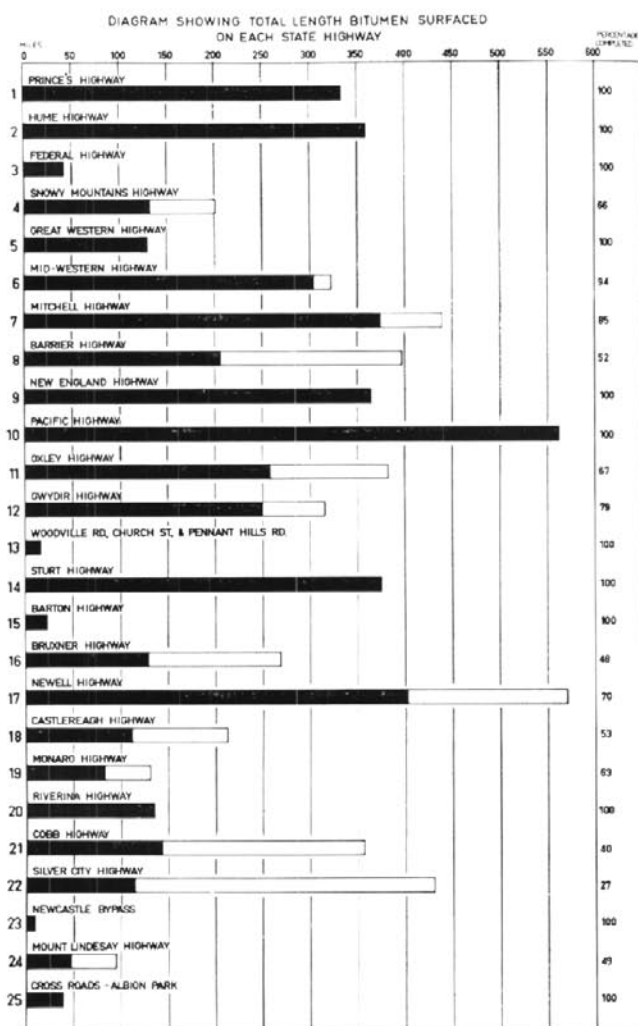
### WARRINGAH EXPRESSWAY

In April, 1965, the Department of Main Roads accepted a tender for the construction of the first section of the Warringah Expressway extending from the northern end of Sydney Harbour Bridge to Miller Street, Cammeray, a distance of 1½ miles.

The successful tenderer was the firm of Reed and Mallik and Stuart Bros. Pty Ltd (now Reed and Stuart Pty Ltd) which submitted a price of £4,986,181 10s. 3d. This was the lowest of three tenders received.

The work will include about 1½ million cubic yards of excavation, 300,000 square yards of road paving, construction of five overbridges and one pedestrian bridge, together with modifications of the northern approach of Sydney Harbour Bridge and the removal of the steel arch bridge which formerly carried the double tram tracks over Bradfield Highway.

Plans and specifications for the work were prepared for the Department of Main Roads by one of its Engineering Consultants, Messrs De Leuw, Cather and Company of the United States of America.



All work on the expressway under the contract is scheduled for completion by December, 1967, but it is expected that traffic will be able to use a substantial part of the new route by August, 1967.

When completed the expressway will provide eight main lanes for traffic. The capacity of the immediate northern approach to Sydney Harbour Bridge will thereby be increased and local traffic will be able to join or leave the expressway without interruption to the main traffic flow. Where local streets are to cross the expressway, bridges will be built.

### SYDNEY-NEWCASTLE EXPRESSWAY

#### Work in Hand

Three sections of the Sydney-Newcastle Expressway are under construction between the Hawkesbury River and Calga.

The first section extends for 4.2 miles north from the Hawkesbury River and is being constructed for the Department of Main Roads by the Queensland firm of K. D. Morris and Sons Ltd. This section will be available for traffic on 15th December, 1965.

The second section a continuation of the first, extends over a length of 1.6 miles to Mt White. It is being constructed by the Department of Main Roads by direct control. It includes the construction of an interchange at Mt White which will be the first location north of the Hawkesbury River at which vehicles will be able to join or leave the expressway route. This section will also be available for traffic on 15th December, 1965.

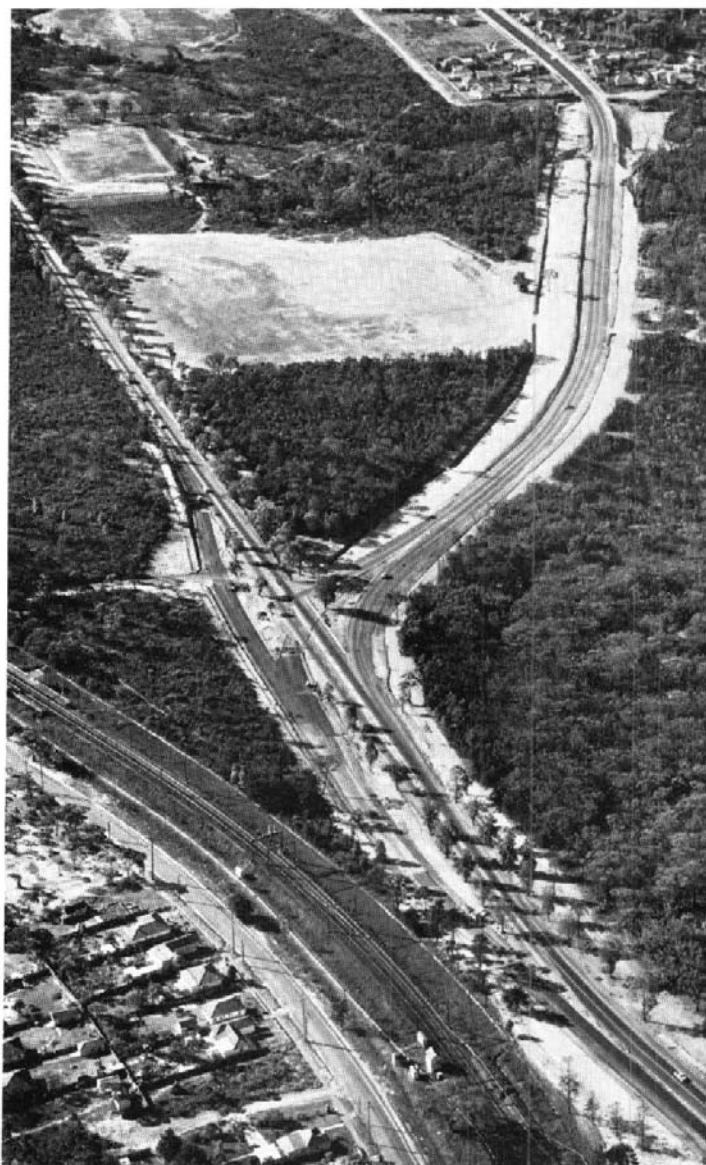
The third section extending from Mt White to Calga, a distance of 3.4 miles, is also being constructed directly by the Department. Completion of this section is scheduled for December, 1966. (Ultimately the route of the Sydney-Newcastle Expressway will not pass through Calga. From Mount White easterly it will follow a line south of the Pacific Highway as far as the vicinity of Kariong. This route is referred to on page 45.)

The cost of constructing the three sections is estimated to be £5.9M.

These three sections will link up with the new road route already in use between Calga and Ourimbah via Peat's Ridge and Somersby.

The Calga-Ourimbah route, 20 miles in length enables through traffic to by-pass the winding section of the Pacific Highway on each side of Mooney Creek and also to avoid closer settled areas between Gosford and Ourimbah. The route is not only of benefit to through traffic by saving about 20 minutes in travelling time but also reduces the volume of traffic on the Pacific Highway between Calga and Gosford with advantage to drivers travelling to Woy Woy, Gosford, Terrigal and other places in the area.

With completion of the length of the expressway between Hawkesbury River and Calga by December,



Work in progress on the intersection of the Sutherland By-Pass with Prince's Highway

1966, traffic will be able to travel in expressway conditions from the Hawkesbury River to Ourimbah a distance of about 30 miles.

After completion of the expressway between Hawkesbury River and Calga, the next major section of the expressway to be constructed will be south of the Hawkesbury River from Peat's Ferry Bridge towards Berowra.

In the meantime, widening of the Pacific Highway to provide a four-lane carriageway from Hornsby north towards Berowra is being carried out by the Department.

This widened length of the highway will serve through traffic until construction of the expressway from Berowra to Wahroonga has been completed.



### Future route from Mount White to Ourimbah

Following further examination, including the use of maps produced by aerial photography and particularly intensive investigations of the ground by low-altitude helicopter flights, a new route for the Mt White—Somersby section of the Sydney-Newcastle Expressway has been found.

The new route will involve the building of a bridge about 1,000 feet long over Mooney Creek downstream from the existing bridge on the Pacific Highway. It will follow up the valley of Piles Creek to a crossing of the Pacific Highway in the vicinity of Kariong and then in a general northerly direction to join the recently completed road of expressway standard between Somersby and Ourimbah. This route also has the advantage that from the vicinity of Kariong a high class main road connection to serve the Gosford-Woy Woy area can be readily established.

The new route between Mount White and Somersby will have better grading and alignment than the route previously thought likely, and will cost approximately £2M. less.

Because of the large expenditures involved in the current programme, it does not appear practicable at present to forecast commencement of work on the new route between Mt White and Somersby until the early 1970's by which time the expressway south of the Hawkesbury River should have been completed to a junction with the existing highway at a point between Mt Ku-ring-gai and Berowra. Pending construction of the length of the expressway from Mount White to Somersby via Kariong, the route to Somersby via Calga and Peat's Ridge will be available to traffic as mentioned earlier.

### MAIN ROADS AND SAFETY

The subject of road safety is of especial importance at the present time because of the disturbing impact of traffic accidents on the public conscience.

How accidents can be avoided on roads is a question being discussed everywhere by the public and being studied intensively and continuously by responsible authorities and organisations.

The main factors involved in the cause of road accidents are (i) the road user, i.e., the driver and the pedestrian, (ii) the vehicle and (iii) the road, while the passenger in many cases is a principle victim.

Other contributory factors are weather conditions, time of day, the volume and nature of traffic on the road the surroundings of the area, e.g., the presence of distractions such as advertising signs the behaviour of passengers in the vehicle and the public attitude towards road safety.

Since its inception, the Department of Main Roads has regarded road safety as one of its principal considerations.

In the construction and reconstruction of Main Roads the Department along with Municipal and Shire Councils has constantly endeavoured to provide "in built" safety.

On those Main Roads not being rebuilt local improvements have been and are being carried out to bring the roads to a consistent standard and thus assist traffic safety; these improvements include the widening of the road pavement; the improvement of visibility at curves and crests; and the construction of deviations to give better alignment; and the provision of new bridges to replace those too narrow for modern traffic.

One of the most important features calculated to improve conditions for traffic on Main Roads has been the provision of dustless surfaces. In the last ten years the activities of the Department and Councils have been directed vigorously towards the extension of dustless surfaces. In New South Wales, there are 22,311 miles of Main Roads of which 11,292 miles have now been provided with a dustless surface. Of this latter figure 50 per cent has been provided in the last ten years.

Work done in the construction, reconstruction and local improvement of Main Roads has been supplemented by the installation of safety furnishings.

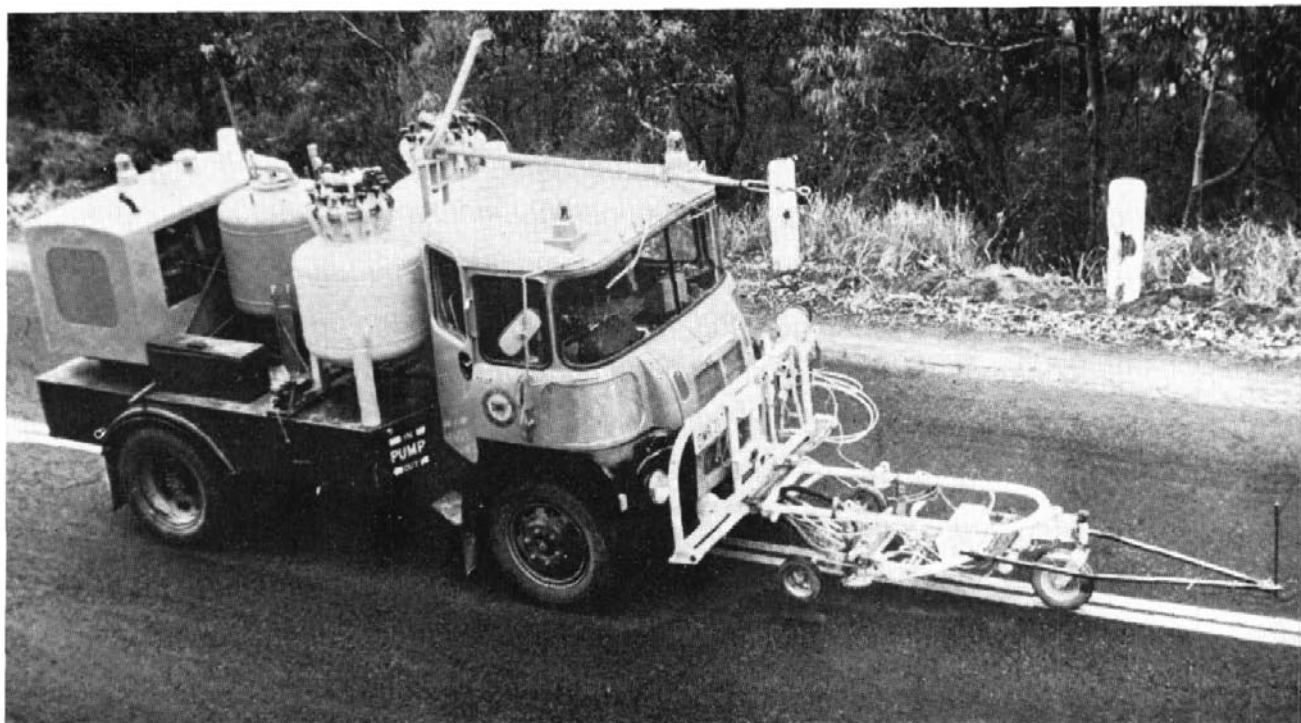
Some of these contributions towards road safety are:—

#### Traffic Line Marking

For many years past, the Department has been providing centre line marking on the Main Roads of the State. This has proved to be of the greatest value in promoting road safety; not only does it aid in the safe passing of vehicles but also, by use of the double line,

Bitumen pavements are being strengthened with asphaltic concrete surface layers where traffic is heavy





This line-marking equipment was designed, constructed and assembled on the vehicle at the Department's Central Workshops, Granville

it prohibits overtaking at points where visibility is inadequate for safe overtaking.

In recent years two important changes have been made by the Department in traffic line marking practice.

The first was the use of white paint instead of yellow for marking all broken traffic lines; the yellow colour was retained for all unbroken centre line marking.

The second change was the provision of reflective traffic line marking. This is accomplished by the application of very small glass beads to the paint used for the lines. These glass beads reflect the light from the headlamps of motor vehicles and give a marked improvement in night visibility of traffic lines. Unfortunately, they are not as effective in wet as in dry conditions.

### Edgelines

The Department is making experiments to determine the best form and method of delineating each edge of dustless surfaces by a white line.

The experiments are nearing completion and a policy for this type of marking is being formulated.

### Median Strips

In recent years the Department has been building median strips in heavily trafficked arterial roads to physically separate opposing streams of traffic thus making conditions safer for vehicle drivers and their

passengers. These medians have made a significant reduction in the number of "side-swiping" accidents and have increased the safe speed of vehicles.

### Protection fencing, guide posts and reflectors

Safety measures on Main Roads include the provision of protection fencing or guard railing on high embankments, especially where there are sharp curves, and the erection of guide posts along the outer edge of the shoulders of the road. These are of particular value in night driving but their value has been increased especially in wet or foggy weather, since the introduction of reflectors attached to the posts—red reflectors on those posts on the lefthand side of the road and white reflectors on those on the right.

### Climbing lanes

To allow for safer overtaking the Department has for many years been constructing an additional or third lane for traffic at locations where slower vehicles obstruct the free passage of faster moving traffic on busy two-lane roads.

This work is continuing.

### Channelised intersections

Construction of islands at intersections has been one of the major improvements on heavily trafficked Main Roads in recent years.

These islands have contributed considerably to the safer movement of vehicles at intersections.

### Reflectorised signs

All warning signs on Main Roads are now reflectorised.

These signs give greatly improved visibility at night so that the driver is now given much more noticeable warning of hazards than formerly.

### Advisory speed signs

The Department is progressively erecting advisory speed signs on State Highways and other Main Roads, in conjunction with the curve warning signs.

Following survey work, advisory speed signs have been erected on approximately 3,000 miles of Main Road. Main Roads on which signs have already been erected include the Prince's Highway, Pacific Highway, Hume Highway, Great Western Highway, New England Highway, Federal Highway, Mitchell Highway between Bathurst and Dubbo, Windsor-Singleton Road and Cowra-Albury Trunk Road (Olympic Way).

The advisory speed shown on the sign is the speed at which the driver and passenger do not experience discomfort when negotiating the curve; and it is regarded as the safe speed for the curve.

The speeds indicated have no regulatory significance and are of an informative nature only. Nevertheless

Manufacture of signs is one of the many activities at the Department's Central Workshops, Granville



the public is taking an increasing interest in them and their erection has met with public approbation.

A recent study of accidents on the Hume Highway between Camden and Berrima showed that the accident rate was significantly less after the erection of advisory speed signs.

### Accident investigation

The Department's standing instructions to its Divisional Engineers require an investigation of conditions at points on Main Roads where advice of an accident indicates that a road element may be involved.

In addition, as soon as it is learned that a fatal accident has occurred on a Highway the Divisional Engineer makes a personal investigation of the site so that the Department can be appraised of the conditions at the time of the happening in order that further consideration can be planned.

The purpose of these investigations is to ensure that engineering considerations are taken into account in relation to conditions at the site. Thus it can be determined whether a major road improvement should be recommended or whether the contributory cause is local in character and can be eliminated immediately, the object being to remove quickly from the Main Roads System any hitherto unknown factors which could contribute to accidents.

These "spot" investigations and subsequent improvement of road conditions, either by immediate alteration or improvement of physical conditions or by adequate signposting to warn traffic of hazards until it is practicable to eliminate them, are regarded by the Department as being of paramount importance in its endeavours to provide safe Main Roads.

Since the establishment of the Department significant improvements have been made in the condition of Main Roads to make them safer for traffic and many devices have been installed to promote the safe use of Main Roads.

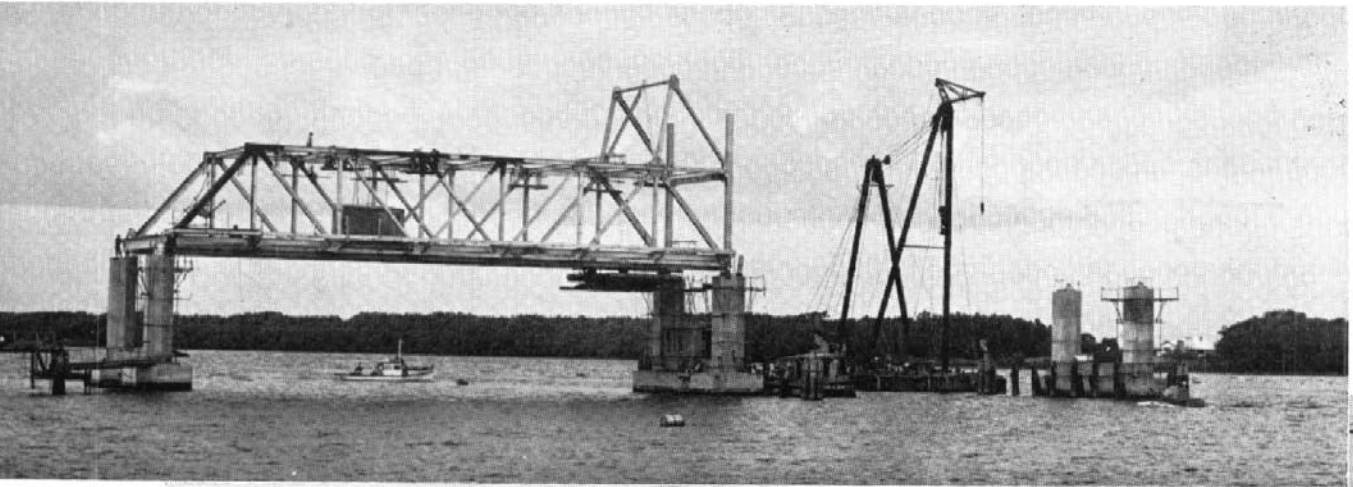
The Commissioner for Main Roads is a Member of the Australian Road Research Board which is actively engaged in carrying out and sponsoring research into road safety. The research so far being carried out and supported by the Board includes accident statistics; traffic injuries; inter-action between vehicle-driver-road system; road and vehicle lighting; vehicle windscreens; visual interference at traffic signals; arrangement of traffic signals; and visibility requirements of traffic signals.

Regardless of such improvements as have been carried out in the past, and will be undertaken in the future the co-operation of the individual road-user both driver and pedestrian, is necessary if the rate of road accidents is to be reduced.

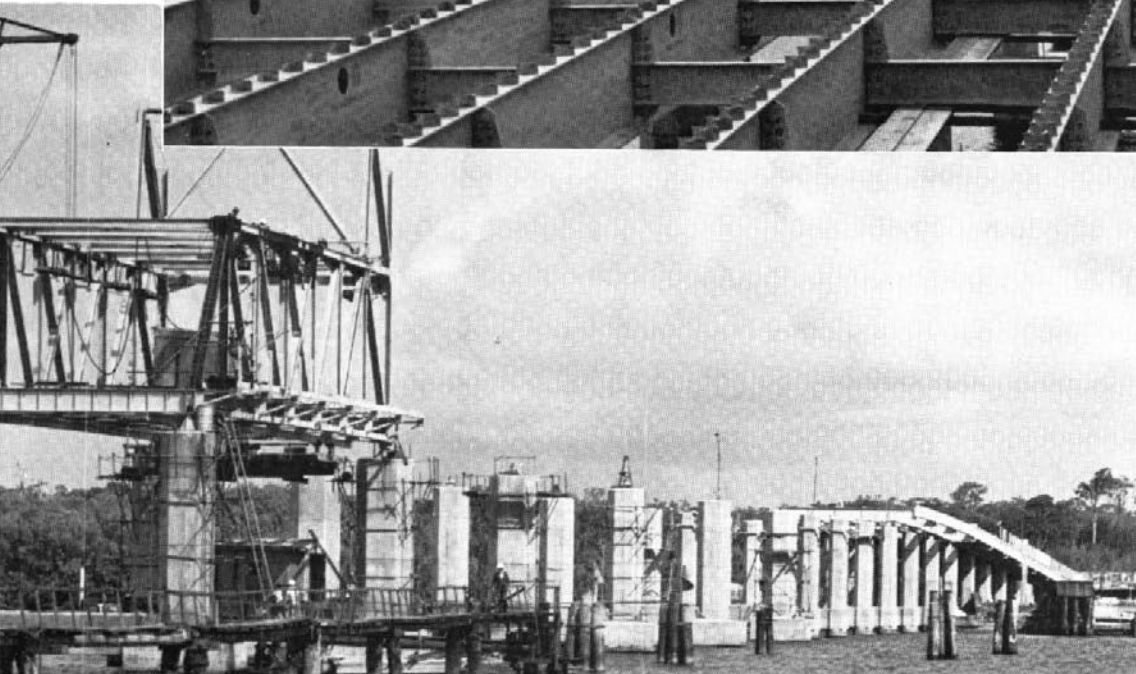
The Department in association with Municipal and Shire Councils, will continue as in the past to play its part in the common task, and to see that Main Roads are engineered for safety to the greatest practicable extent.



# Progress of Bridge at Ha



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ow various aspects of  
2,915 feet bridge. It  
there will be a footway  
. Shipping will pass  
cal lift span





BRIDGE OVER GEORGE'S RIVER AT MILPERRA, three lanes of which were opened to traffic in October, 1965. The full width of the six-lane bridge will be completed in February, 1966. It replaces a narrow two-lane bridge.

## Standards Association of Australia

### Revised Glossary for Road Engineering Terms

**M**AJOR advances in the practice of road engineering, especially in traffic engineering, which have occurred in recent years, are reflected in the revised edition of Australian Standard A16, Glossary of Terms Used in Road Engineering. First published in 1938, the glossary is intended to serve as a reference and to promote uniformity of understanding among authorities, engineers, contractors, police, lecturers, students and others associated with road engineering design and road construction and use.

The new edition includes some 800 definitions and is based largely on proposals submitted by the National Association of Australian State Road Authorities. Many new terms are defined, obsolete terms replaced with up-to-date terms, and a new arrangement of material adopted. Previously the glossary was arranged in two parts with terms listed under classified headings, and alphabetically; in the revised edition terms are listed only in a classified list, and their reference numbers quoted in the alphabetical index.

The major change in the glossary is the expansion of the section dealing with traffic engineering which reflects the growing significance of this subject and its development as a specialised branch of engineering. In previous editions the section covering this subject included only eight definitions, but in the revised edition it embraces some 13 pages, being subdivided into traffic signs, signals and road furniture, and vehicle characteristics and behaviour. Other sections cover road types, classification, etc.; location, surveying, design and preparation of drawings, and setting out; road and drainage works (including earthworks and explosives, and pavement terms); and materials and properties (covering binding materials, aggregates and tests).

Copies of the new edition of AS A16 are now available from the various offices of the Standards Association for 18s. 0d. (\$1.80) a copy, plus a handling charge for mail orders.



# AN (ALMOST) PAINLESS CONVERSION



THE decimal system of numbers and numeration is recognised and practised throughout the world. The fundamental advantage of decimal currency is that the monetary system is placed on exactly the same basis as the usual numerical system.

This advantage shows itself principally in ease of calculation of amounts of money, and the results are apparent in savings of time and effort.

A secondary advantage is that the introduction of decimal currency will mean the availability of a wider range of monetary machines, as well as more flexibility in the use of machines, since they can be used for money or non-money calculations as required.

The introduction of the new system will cause some inconvenience, expenditure and additional work. These disadvantages, however, are expected to be short-lived, and there is no doubt that the long-term advantages will very much out-weigh the short-term difficulties.

## The Change-over

The principal problems connected with the change-over may be summarised as follows:—

- (i) Replacement and/or conversion of accounting machines for decimal currency operation.
- (ii) The review and re-ordering of stationery and financial records.
- (iii) The review of the legislation under which the Department operates, to identify the problems associated with monetary and other references likely to be affected by the conversion.
- (iv) Training of personnel.

Planning for the change-over was commenced early in 1964, and at that stage was devoted to finding the answer to the following questions:—

- ☐ What preparatory work can be undertaken before "C" day?
- ☐ If the Department were to change over before "C" day, what interim action would be needed?
- ☐ What changes in records and procedures would the arrival of "C" day bring?
- ☐ What action would be required on or immediately preceding the date of change-over?
- ☐ What measures must be taken to avoid unnecessary expense and to reduce risk of loss?

The answers to these questions provided the Department with a good start to an assessment of the whole problem. As a consequence, it has been possible to programme the preparatory work and minimise misunderstandings and inconvenience.

Some of the costs the Department will have to incur in connection with the change-over are:—

Cost of machine conversion where this is not wholly met by the Commonwealth Government.



Recently installed decimalised Data Processing machines

Printing and stationery costs in excess of normal requirements.

Additional labour costs in the converting of records.

Capital expenditure on new machines purchased in advance of normal requirements.

Loss on the retirement of some machines that are still serviceable but judged not worth the cost of conversion.

The careful planning mentioned above has played a large part in minimising these costs, particularly as regards the scheduling of stationery replacement.

#### Conversion of Machines

All machines scheduled for conversion have been registered in accordance with the requirements of the Decimal Currency Board.

The opportunity has, however, already been taken of replacing the Data Processing Section equipment with new decimal machines. The earlier equipment was due for renewal, and thus a considerable saving has already been effected.

The new equipment was installed ready for operation on 1st July, 1965, from which date the Department's internal monetary records have been produced in dollars and cents. This phase, extending over  $7\frac{1}{2}$  months, is

in lieu of simulated exercises, and has provided valuable staff training in decimal operation.

#### Training

It was apparent from the offset that effective staff training would be a vital factor in the smooth changeover.

To this end, in addition to the training phase referred to above, the Department has distributed among its staff general knowledge literature on decimal currency and tables of equivalents. Instructions have been issued relating to specific problems which may be expected for some time after C-day.

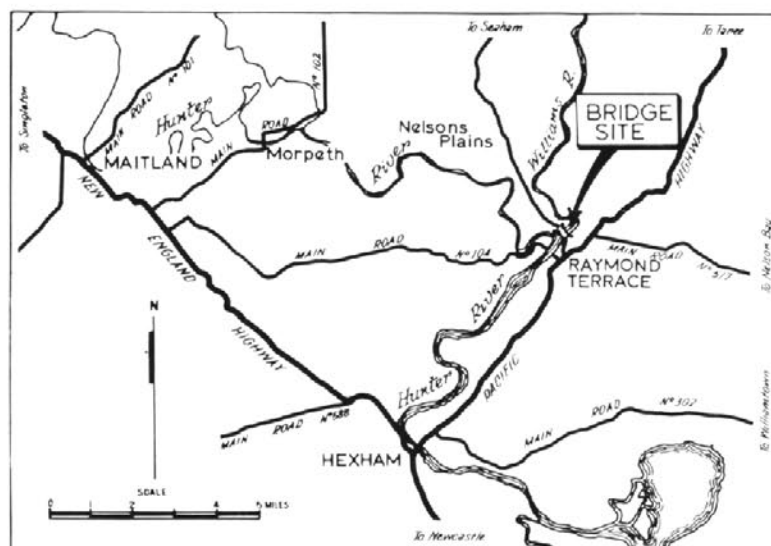
Apart from formal instruction, provision has been made for talks and informal discussion of changeover problems, and these have resulted in the anticipation of many minor, but troublesome, problems.

#### Conclusion

Although inconvenience and short-term difficulties may arise, the planning in advance and pre-conversion training is already bearing fruit.

It is really the conviction that decimal currency is the logical and easier system, and a determination to solve the minor problems expeditiously, that will ease the path to the smoother running ahead.

# THE FITZGERALD BRIDGE AT RAYMOND TERRACE



ON THE 16th October, 1965, a new bridge over the Williams River was officially opened by The Hon. P. H. Morton, M.L.A., Minister for Local Government and Minister for Highways.

This bridge, which provides a permanent link between Raymond Terrace and the Nelson's Plains area, replaces a ferry which has been operated at this site since at least 1830. It represents a vast improvement on conditions in the early days when passengers propelled themselves across the river by seizing a rope at one end of the ferry and walking to the other end, then returning

to the original end of the punt and repeating the performance.

The bridge was named after the late Mr R. L. Fitzgerald, who for twenty-one years, from 1941 to 1962, represented the Gloucester electorate in the Legislative Assembly of New South Wales, and who had been most active in pressing for the provision of this bridge.

Among the many local people who attended the opening ceremony was Mr H. Clague, who as a three-year-old baby, was carried over the bridge at Clarence

The ferry's last trip, on the day of the opening of the Fitzgerald Bridge







The Hon. P. H. Morton, M.L.A., and The Hon. M. A. Morris, M.L.A. Minister of Transport, reminisce with the crew of the ferry

Town when it was opened, and now, 85 years later, he was there to see the official opening of the second bridge to be built over the Williams River.

The new bridge and its approaches cost approximately £453,000, all of which was met by the Department. The bridge was built under contract by John Holland (Constructions) Pty Ltd, while the approaches were the work of the Department's own forces.

The bridge was designed by the firm of Macdonald, Wagner and Priddle, Consulting Engineers, who brought in Spencer, Hanson Partners (now Hanson, Todd & Partners), as architectural consultants.

Situated 140 feet downstream from the ferry crossing, the bridge has an overall length of 864 feet, a 24 feet carriageway, and a 6 feet wide footway for pedestrians.

An unusual feature of the design is the "V" shaped reinforced concrete piers, giving the bridge a striking appearance.

The deck is graded on a vertical curve to provide flood and navigational clearance at the centre, while bringing the deck at the abutments close to the level of the natural surface of the banks. This was necessary because higher approach embankments could not be built on the fine silty material of the river banks.

The design submitted by the Consulting Engineers and accepted by the Department has resulted in the erection of a structure with a very pleasing appearance on a vertical curve 864 feet long connecting to approach roads on a grading of 6 per cent. The bridge comprises 5 spans with lengths varying from 153 feet for the shore span to 188 feet for the centre span, and having a

clearance of 20 ft 6 in above mean high water spring tide at the centre of the structure.

The piers and abutments are founded on reinforced concrete bored piles. Steel casing of 24-in diameter was driven into the hard sandstone underlying a considerable depth of soft strata. After the soft material from the inside of the casing had been removed, holes of 24-in. diameter were drilled 10 feet into the sound sandstone and "Prepakt" concrete was placed in the piles with suitable reinforcement.

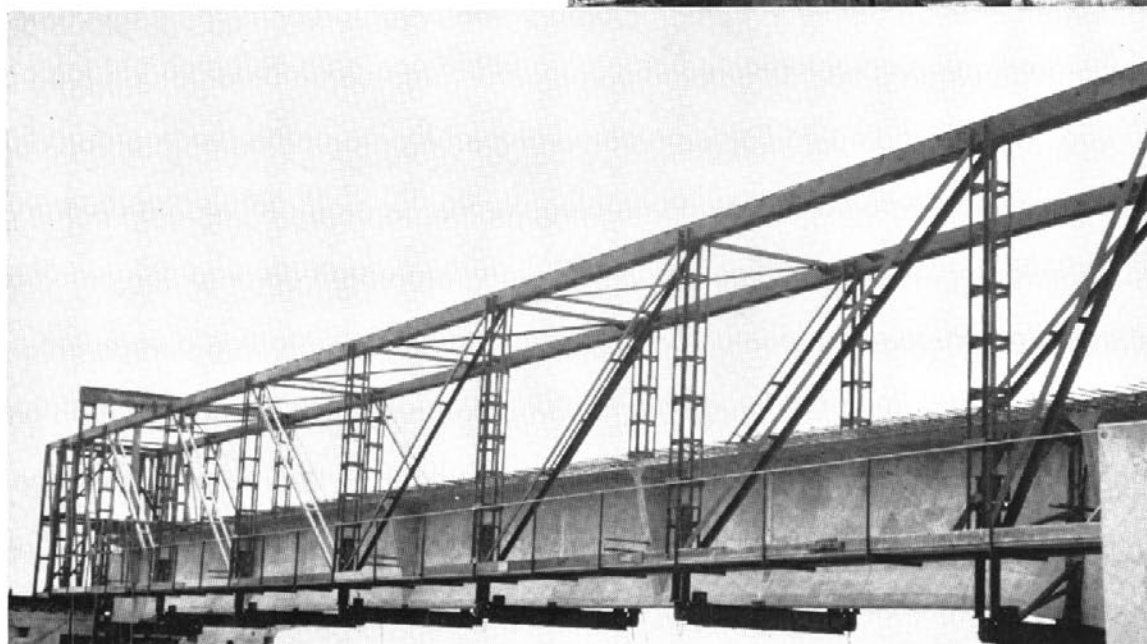
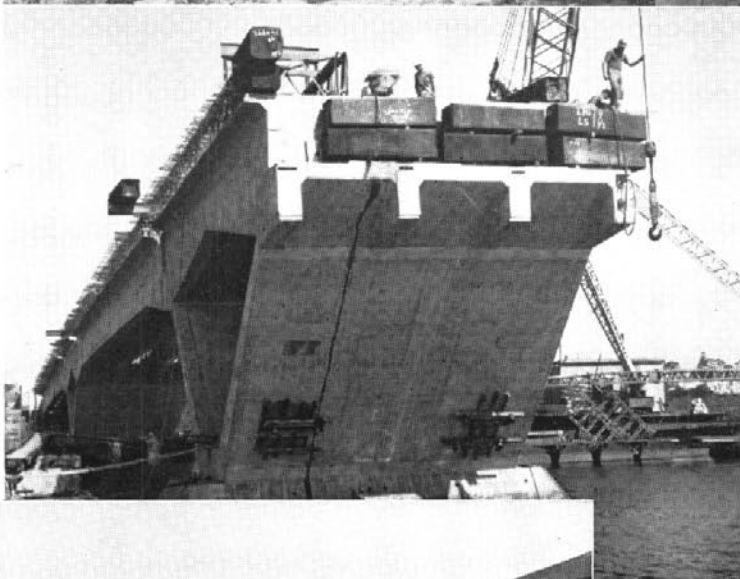
The maximum pile length is 152 feet and the maximum design load for the piles is 225 tons.

The piers above water level are "V" shaped with cast in situ concrete wings and cast in situ post-tensioned tie beams and deck on top of the wings. Reinforced concrete hinges have been provided between the wings and the tie beams.

Each of the five spans comprises four post-tensioned main girders 133 feet long and 7 feet 3 inches deep. The girders were cast in eight separate sections each weighing about 10 tons. The sections were cast at the site of a mixing plant about 2 miles from the bridge before being taken to the bridge site where they were assembled and stressed on a steel launching truss, specially designed for the purpose by the Contractor. The Birkenmaier, Brendistini, Ros, Vogt (B.B.R.V.) system of stressing was used for both the main girders and the tie beams. The main girders have 4 tendons each composed of 42 high-tensile steel wires of 0.276 inches in diameter which are stressed to 150 tons. To allow for losses the strands were stressed initially to 175 tons. Counterweights were used on the piers to reduce the out of balance loads during construction of the main girders.



These photographs illustrate stages in the bridge's construction





Aerial view of Broken Hill

### The Route of the Highway

**T**HE Barrier Highway, together with part of the Mitchell Highway, and the Great Western Highway, constitutes the principal means of east-west road communication through the centre of New South Wales.

Commencing at Nyngan on the Mitchell Highway, it extends westerly through sparsely settled wool-growing and grazing country to the copper mining centre of Cobar. West of Cobar the same type of country continues with occasional areas of low lying ground, and the vegetation becomes more stunted as lower rainfall areas are entered. At about 100 miles west of Cobar the Highway commences to skirt the flood plain of the Darling River, and a number of low areas which form shallow lakes after rain. At 157 miles the road crosses the flood plain of the Darling River, and of its major ana-branch, Talyawalka Creek.

The Highway crosses Talyawalka Creek by four long timber bridges, and the Darling River by a wrought iron vertical lift span bridge built in 1896, at Wilcannia (population 1,000) which is on the west bank at 165

miles from Cobar. This township, which was originally a major river port serving the opal fields at White Cliffs 53 miles to the north, diminished in importance when the east-west railway was constructed from Condobolin to Broken Hill via Menindee and river traffic declined.

West of Wilcannia the Highway traverses low ground and a number of streams which, following rain, carry water. The largest of these, Dolo Creek, is bridged by a timber structure built in 1934, but the remaining crossings where the ground becomes swampy in flood time, can cause inconvenience to traffic.

From Dolo Creek westward, the Highway follows a more or less direct line to Broken Hill through the Dolo Hills, the northern foothills of Scope's Range, and then across featureless plains to the foot of the Barrier Range at Stephen's Creek. The Highway ascends from this point to Broken Hill on the summit of the Barrier range, approximately 1,000 feet above sea level.

Broken Hill (population 31,000) is primarily a mining community, and owes its existence to large and rich deposits of lead, zinc, and silver ores, which have been worked continuously and extensively since 1885, and as



yet show no sign of exhaustion; although the present workings are at depths of 3,000 to 4,000 feet. The city is also the centre of a large wool growing area and is a railhead for the Adelaide market.

West of Broken Hill the Barrier Highway traverses undulating plateau country to a point 19 miles distant in the Thackaringa Hills, whence a descent of about 300 feet is made to the plains and the township of Cockburn on the South Australian border. From this point the South Australian Highway leads to Adelaide and Port Pirie.

### Reconstruction and Bitumen Surfacing

Prior to the commencement in 1953 of the current programme of pavement construction and bitumen surfacing, the only bitumen road surfaces were in the towns of Broken Hill and Cobar. Outside of these urban areas the road pavements were largely of the materials through which the road formation passes, with only very clayey or sandy sections stabilised with gravel or sand clay. Structures were few and most of the larger watercourses had gravelled causeways.

Reconstruction of the Barrier Highway is supervised by two of the Department's Divisional Engineers. The Central Northern Divisional Engineer at Bourke, and the Murray Darling Divisional Engineer at Broken Hill. The reconstruction is being carried out concurrently by these two Divisions, working at a number of places along the route.

The even terrain, particularly in the eastern section, has been a help to the road-makers, who have been able largely to follow the route of the existing road. The opportunity has been taken, however, to make local improvements such as the elimination of two railway crossings east of Cobar by adopting a new route south of the railway line. The one remaining level crossing, at Muriel Tank, will disappear with the construction of an overbridge over the railway line. Plans for this work are now being prepared.

Rainfall over the whole area varies, but is of the order of 10 to 12 inches per annum. Evaporation rates are as high as 60 inches per annum on the Barrier Range. Thus provision of water for road construction is a major problem and has been met by the use of ground tanks

owned by the Pastures Protection Board and by private owners. Tappings were made of the Menindee-Broken Hill water pipeline as far east as Stephen's Creek. More recently, it has been necessary to sink bores for water.

### Nyngan to the Cobar-Central Darling Shire Boundary

On the length from Nyngan to Cobar and west to the Cobar Shire boundary, 119 of the 173 miles of the Barrier Highway within the Central Northern Division have been reconstructed and bitumen surfaced; work is currently in progress on a further 21 miles.

Prior to 1955 the only bitumen surface on this 173 mile stretch was the  $1\frac{1}{2}$  miles in the town of Cobar. Not only that, there was hardly a culvert or structure along the whole length of the soil and gravel track. Now, wherever practicable, culverts have been provided. In some cases it has been necessary to use floodway sections to cater for maximum waterway needs.

Apart from water shortages, difficulty was encountered in obtaining suitable surface course material for pavement work. This was overcome in many cases by mixing two or three materials in suitable proportions.

The early part of the work was carried out on the road east of Cobar and the first  $7\frac{1}{2}$  miles west of Nyngan, and these stretches have a 26 feet wide formation and an 18 feet wide bitumen pavement.

The balance of the roadwork varies from 28 feet to 34 feet formation and an 18 feet to 22 feet sealed pavement. All further work is planned to a standard of 34 feet formation, 22 feet bitumen pavement width, and a design speed of 60 m.p.h.

Since March, 1962, when the Central Northern Divisional Office was opened at Bourke, all of this work of reconstruction and bitumen surfacing has been under the control of the Divisional Engineer at that centre. Bogan Shire Council carried out the work in that shire west of Nyngan, on the Department's behalf. The Department, with its own forces, carried out the work east and west of Cobar in the Shire of Cobar under the local supervision of the Department's Works Engineer stationed in Cobar.





Road works in progress about 80 miles east of Broken Hill. The bridge over Dolo Creek may be seen in the background on the photograph above

From the commencement of work in September, 1955 to the end of June, 1964, the cost of all these roadworks was £1,125,200.

The volume of traffic along this highway is not large, varying between 50 and 150 vehicles per day, but this is expected to grow with the development of Nyngan and Cobar. The re-opening of mining operations at Cobar and the consequent secondary activities arising from this should result in substantially increased traffic.

#### From the South Australian border to the Central Darling-Cobar Shire boundary

Reconstruction and bitumen surfacing of the Highway between Broken Hill and the South Australian border at Cockburn was commenced in 1951 and completed at the end of 1955. (This work was the subject of an article in the June, 1956 issue of *Main Roads*.)

Bitumen surfacing of stream crossings between Broken Hill and Wilcannia was commenced in November 1955, but work was suspended because of inability to recruit suitable labour. Work was re-commenced in September 1956, between 21.2 miles and 27.4 miles west of Wilcannia (Grassmere) and completed in July 1957, at a cost of £21,759.

Reconstruction of the pavement prior to bitumen surfacing began in December 1951, on the length from the Municipal Boundary at 2.37 miles east to the Royal Flying Doctor Service base at 5.2 miles east of Broken Hill. The work was carried out by Broken Hill City Council for the Department. The pavement base course was sand stabilised, but the bitumen surfacing was delayed for some considerable time, while tests were carried out to select suitable surface course pavement materials. Bitumen sealing was completed between April and May, 1953 at a cost of £10,842.

Between the Royal Flying Doctor Service base at 5.2 miles east of Broken Hill and Little Topar 50 miles east of Broken Hill, the highway was reconstructed and bitumen surfaced between July 1957 and April 1963, at a cost in the vicinity of £450,000.

A total of 12 box culverts were constructed by contract along the Highway to this point, the first being at 10.2 miles east of Broken Hill. Three timber bridges were replaced by the construction of these culverts, viz.: 25 Mile Creek, Marachi Creek at 28 miles and Acacia Creek at 41 miles east of Broken Hill. A causeway was also constructed at the latter site to provide additional waterway to carry the run-off during storm rains.

Construction of a deviation in the Dolo Hills between 73 miles and 87 miles east of Broken Hill, to avoid a low section of the old road where traffic was held up during storm rains, was completed in October 1965. A start has been made on construction work to close the gap between the eastern end of the sealed road at 50 miles from Broken Hill at Little Topar and the Dolo Hills deviation at 73 miles east of Broken Hill. It is expected that 15 miles of this length will be sealed during 1966.

Work has also commenced extending westerly from Wilcannia, and it is expected that during 1966 bitumen surfacing will be completed to a point 17 miles west of Wilcannia.

East of Wilcannia sealing has recently been completed between  $8\frac{1}{2}$  miles and 13 miles.

Aggregate for the sealed pavement had to be obtained from a crushing plant operated by a private company in Broken Hill and bitumen had to be drawn from a Sydney refinery by rail and more recently from Adelaide and Melbourne refineries by road haulage.

Because of the remoteness of most roadworks on the Barrier Highway, the Department has found it difficult to obtain suitable labour, particularly plant operators. The availability of skilled men is also affected by the prevailing rates of pay at the Broken Hill Mines.

The volume of through traffic on the Cobar-Wilcannia section of the Barrier Highway is at present of the order of 30 vehicles per day. It is increasing with the progressive improvement of the Highway surface. As Wilcannia obtains most of its supplies by road from Broken Hill, traffic volumes on this section of the Highway are greater.

Traffic generally on the Barrier Highway can be expected to increase substantially following the completion of bitumen surfacing particularly as a result of tourist traffic, and also because of the number of heavy vehicles making their way from Western Australia and South Australia to Queensland.



The Barrier Highway as it approaches Broken Hill





## THE WARATAH PAGEANT

Gorgeous girls, pink and blue dresses, and blue and white parasols. What could be more eye-catching?

For those who bothered to look further, the Department's float in the Tenth Annual Waratah Spring Festival Pageant, also carried a "Highway Progress" theme, the old way and the new, country lanes and Expressways.

## Trade Fairs

COMMERCE and private enterprise have much to show bodies such as the Department of Main Roads, both in technical know-how and the economy of operation that competition enforces.

At the same time the value of the business available with the Department is of such dimensions as to encourage the private contractor to exert his best effort to secure orders or contracts with the Department.

It is relevant to mention here that major road works in hand and scheduled for early commencement in New South Wales will cost £38 million, not including the £8 million for major bridge works; that £40 million was spent in 1964-65 on construction, maintenance and associated works; and that during this same period Contractors to the Department received £11 million, including hire of plant and lorries.

Now this is big money, which must be spent to provide the public, including commerce, with the highway facilities so badly needed.

The Department's Stands at the Sydney Trade Fair in October 1965, and at the South Coast Industries Fair at Wollongong in November 1965, were designed to show the opportunities for business that the Department offers, be it the supply of stores or the construction of major highways.

## Critical Path Method Simply Explained

THE September 1965, issue of *Main Roads* included an article on Critical Path Method in Civil Engineering.

In a recent issue of its Digest Series, the United Kingdom Building Research Station has set out the simple 'facts of life' concerning Critical Path Methods for the planning and control of building work in such a manner as to show how they can be applied easily to smaller projects which do not require electrical computers for analysis.

The Digest sets out the basic principles of Critical Path Method:

- What it is.
- What it does.
- and How it is used.

These points are illustrated by their application to an actual project. A convenient list of references for further reading is included.

Building Research Station Digest No. 53 is available in Australia from the Building Research Liaison Service, Department of Works, at 44 Burwood Road, Hawthorn, Victoria, and at Room 14, 11th Floor, the Commonwealth Centre, Elizabeth Street, Sydney, N.S.W. (Price 8d. each, including postage.)

# Recent Changes In Standard Forms And Drawings

THE more important standard specifications, technical instructions and drawings published by the Department of Main Roads, N.S.W., are brought up to date and listed in the inner back cover of each issue of *Main Roads*. In addition to minor amendments, the principal changes introduced in the December issue are as follows:—

- (1) *Instructions for Design of Two-Lane Rural Roads* (M.R. Form No. 355, revised August 1964).

These instructions include most of the design material formerly in M.R. Forms Nos. 355A and 355B, which have been discontinued. Amendments have been made to deflection angles and arc lengths on curves, pavement crossfalls, minimum permissible grades, and vertical curves.

Separate tables are available for horizontal curve transitions for design speeds up to 60 m.p.h., and are numbered 689 to 693 inclusive.

- (2) *Reinforced Concrete Box Culverts* (M.R. Drawings A5791-8).

In April 1964, new drawings were issued for cast-in situ box culverts of one, two, three and four cells, spans 4 feet to 8 feet, with heights of opening 2 feet and 3 feet. Older drawings A1012, A1013, A1021, A1022, A1031 and A1032, which made provision for heights of opening down to 6 inches, have been withdrawn, as shallow culverts are difficult to construct, and such requirements can usually be met by precast reinforced concrete box culverts.

- (3) *Specification for Supply and Delivery of Precast Reinforced Concrete Box Culverts* (M.R. Form No. 138A, Amended March, 1965).

This specification supersedes M.R. Form No. 138, which dealt with the manufacture of small precast culverts. Provision is now made for culverts up to 10 feet span and 10 feet height of opening.

A companion specification, to provide instructions for the erection of precast culverts (including wing walls), will be issued later.

- (4) *Specification for Supply and Delivery of Precast Reinforced Cement Concrete Pipes* (M.R. Form No. 303).

This specification has been withdrawn. Australian Standard A35-1957 may be used to control the quality and strength of pipes of classes S, X, Y and Z.

- (5) *Specification for Manufacture of Elastomeric Bearings for Bridge Units and Girders* (M.R. Form No. 562, issued December, 1964).

This specification supplies data for the manufacture and testing of natural rubber or synthetic rubber bearings used in prestressed concrete bridges.

- (6) *Specification for Sealing and Resealing with Bitumen*, M.R. Form No. 93, revised October 1965).

In October, 1964 this specification was re-written to incorporate a more comprehensive table of heating and spraying temperatures, a suitable procedure for measuring road temperatures, instructions and chart for cutting back R.90 bitumen with power kerosene, provision for the use of cutback bitumen prepared in a refinery or central supply depot, the use of primer-seals, instructions for pre-coating aggregate, and provision for all job details to be shown in a table at the rear of the form so as to avoid making entries or erasures in the body of the specification.

This form was re-issued in October 1965, with several additional small changes.

- (7) *Specification for Erection of Guardrail Protection Fencing* (M.R. Form No. 680, issued September, 1965).

The Department has adopted corrugated steel guard-rail protection fencing for use on roads carrying dense traffic, especially at points where serious accidents could occur if vehicles leave the road. Posts are 7 inches x 5 inches, spaced at 6 feet 3 inches centres, and the rail is blocked out from the posts to reduce the risk of vehicle axles catching against posts. Provision is made for reflectors to protrude above the posts. The details of the construction are shown in M.R. Drawings A5829 and A5595.

Chain wire protection fencing will continue to be used on roads on which the more costly guardrail is not warranted.

- (8) *Specification for Roadmarking Paint* (M.R. Form No. 671, issued May, 1964).

Roadmarking paint is specified on the basis of performance rather than composition or formulation. Tests are prescribed for drying time, spraying characteristics, adhesion, retention of glass beads (for reflectance), and other properties. The durability of paints can only be determined satisfactorily by field tests, in which transverse stripes are placed on a road carrying very heavy traffic, and kept under observation for several months.

- (9) *Instructions for Sampling Bituminous Materials* (M.R. Form No. 626, issued May, 1964).

These instructions are intended to promote uniform and reliable sampling, as faulty sampling may give misleading test results.

(10) *Drawings for Motor Grids, 12 feet wide, A5769; 24 feet wide, A5770.*

New standards for motor grids were issued in November 1964, replacing the earlier drawing (A3691) dated January 1952.

(11) *Specification for Supply and Delivery of Guide, Fender and Protection Fence Posts (M.R. Form No. 252, revised September, 1965).*

The Department has adopted sawn timber for guide, fender and protection fence posts in lieu of the round timber previously used. Guide and fender posts are now 5 inches x 5 inches, and protection fence posts 7 inches x 5 inches, except for end and strainer posts, which are 8 inches x 8 inches.

(12) *Specification for Erection of Guide Posts (M.R. Form No. 253, revised September 1965).*

This specification has been amended to provide for the use of sawn timber, premixing of creosote with earth backfilling in the post holes, and red reflectors to be 3 inches x 3 inches.

(13) *Book on Sprayed Bituminous Surfacing.*

The National Association of Australian State Road Authorities has issued a small book, "Principles and Practice of Bituminous Surfacing, Volume I, Sprayed Work", which provides detailed information relating to Australian methods of designing seal coats, also the manner in which the work is performed.

## SYDNEY HARBOUR BRIDGE ACCOUNT

Receipts and Payments for the period from 1st July, 1965, to 30th September, 1965

Receipts		Payments	
	£		£
Road Tolls .. .. .	484,938	Cost of collecting road tolls .. .. .	45,701
Contributions—		Maintenance and minor improvement .. .. .	62,216
Railway passengers .. .. .	35,195	Interest, exchange and management expenses on	
Omnibus passengers .. .. .	4,284	State Loans .. .. .	148,510
Rent from properties .. .. .	26,500	Alterations to Structures .. .. .	428
Miscellaneous .. .. .	71	Administrative expenses and Miscellaneous charges	6,154
Loan Borrowings for the Warringah Expressway		Provision of traffic facilities .. .. .	6,310
approach .. .. .	400,000	Interest and provision for repayment—Loan	
		Borrowings under Section 7 of Sydney Harbour	
		Bridge Administration Act .. .. .	2,748
		Transfers to Expressways Fund .. .. .	670,000
	£950,988		£942,067

## MAIN ROADS FUND

Receipts and Payments for the period from 1st July, 1965 to 30th September, 1965

	County of Cumberland Main Roads Fund	Country Main Roads Fund
	£	£
<b>RECEIPTS—</b>		
Motor Vehicle Taxation (State) .. .. .	779,683	3,118,733
Charges on heavy commercial goods vehicles under Road Maintenance (Contri- bution) Act, 1958 (State) .. .. .	285,561	1,142,243
Commonwealth Aid Roads Act, 1964 .. .. .	580,882	2,323,528
From Councils under Section II of Main Roads Act and/or for cost of works .. .. .	1,063,169	32,500
Other .. .. .	72,660	89,330
<b>Total Receipts .. .. .</b>	<b>£ 2,781,955</b>	<b>6,706,334</b>
<b>PAYMENTS—</b>		
Maintenance and minor improvement of roads and bridges .. .. .	357,920	1,919,175
Construction and reconstruction of roads and bridges .. .. .	1,106,377	2,712,390
Land Acquisitions .. .. .	216,016	46,611
Administrative Expenses .. .. .	150,503	304,051
Loan charges, payment of interest, exchange, management and flotation expenses .. .. .	60,936	160,040
*Miscellaneous .. .. .	659,272	526,961
	£ 2,551,024	5,669,228

\*Includes transfers to Special Purposes Accounts in respect of finance for Operating Accounts, Suspense Accounts and Reserve Accounts.



## TENDERS ACCEPTED BY THE DEPARTMENT OF MAIN ROADS

The following tenders (in excess of £3,000 (\$6,000)) for Road and Bridge Works were accepted by the Department during three months ended 30th September, 1965.

Work or Service	Name of Accepted Tenderer	Amount
State Highway No. 1—Princes Highway. Shire of Imlay. Construction of 6 span reinforced concrete bridge, 448 ft long over the Nullica River 4 m. south of Eden.	Central Constructions Pty Ltd ..	£    s.    d. 73,359    0    0 (\$146,718.00)
State Highway No. 4—Snowy Mountains Highway. Shire of Mumbulla. Supply and delivery of 56 precast pretensioned concrete bridge units for bridge over Hanscombes Creek 5.5 m. west of Princes Highway.	Gardiner Constructions Pty Ltd ..	5,004    9    4 (\$10,008.93)
State Highway No. 10—Pacific Highway. Shire of Manning. Supply and delivery of aggregate between 4.5 m. and 19.5 m. north of Taree.	Taree Crushed Metals Pty Ltd ..	3,782    15    0 (\$7,565.50)
State Highway No. 17—Newell Highway. Shire of Talbragar. Construction of 2 composite Australian Standard Beam and reinforced concrete bridges, one 56 ft 8 in long and one 170 ft long, over Overflow Channel of Talbragar River.	Transbridge Pty Ltd .. .. .	34,538    0    0 (\$69,076.00)
State Highway No. 17—Newell Highway. Shire of Namoi. Construction of 2 reinforced concrete bridges, one 80 ft 10 in long over Boggy Creek 23.5 m. north of Narrabri and one 120 ft long over Spring Creek, 5.75 m. south of Narrabri.	Central Constructions Pty Ltd ..	25,751    0    0 (\$51,502.00)

## TENDERS ACCEPTED BY COUNCILS

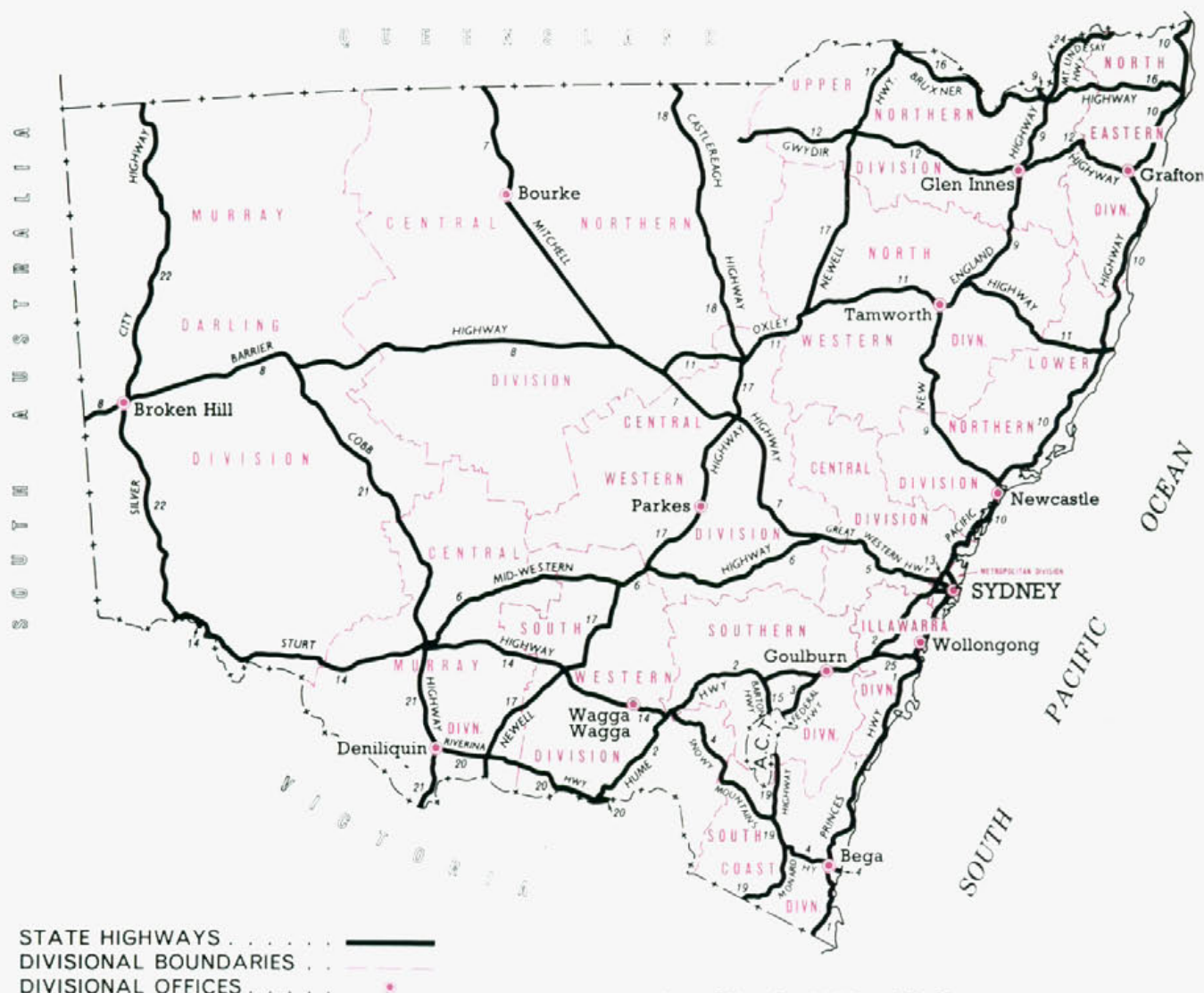
The following tenders (in excess of £3,000 (\$6,000)) for Road and Bridge Works were accepted by the respective Councils for the three months ended 30th September, 1965

Council	Road No.	Work or Service	Name of Accepted Tenderer	Amount
Abercrombie ..	D.R. 1218 ..	Construction of bridge and approaches over Long Swamp Creek and 1.5 m. of road construction, including culvert over Jerrys Swamp Creek.	R. Ryder Constructions Pty Ltd.	£    s.    d. 3,832    10    0 (\$7,665.00)
Bogan ..	S.H. 8 ..	Supply and delivery of 1,500 cubic yards of aggregate between 45.27 m. and 50.84 m. west of Nyngan.	Cobar Aggregate and Sand Supply.	4,826    0    2 (\$9,652.02)
Bogan ..	S.H. 8 ..	Reconstruction and bitumen surfacing between 45.27 m. and 50.84 m. west of Nyngan.	W. E. Troth .. ..	50,863    4    6 (\$101,726.45)
Bogan ..	T.R. 57 ..	Winning, loading and hauling 10,560 cubic yards of gravel to various locations.	M. Foots .. ..	4,086    13    4 (\$8,173.33)
Bogan ..	T.R. 57 ..	Reconstruction and bitumen surfacing between 6.5 m. and 8.42 m. south of Nyngan.	J. L. Johnston Pty Ltd ..	11,002    11    0 (\$22,005.10)
Bogan ..	M.R. 204 M.R. 208 }	Winning, loading and hauling 8,336 and 4,320 cubic yards of gravel on Main Road No. 204 and Main Road No. 208 respectively.	W. E. Troth .. ..	5,883    11    0 (\$11,767.10)
Coolah ..	D.R. 1304 ..	Construction 4.57 m. from T.R. 55 towards Cassilis ..	Moore's Earthmoving ..	30,396    12    8 (\$60,793.27)

## TENDERS ACCEPTED BY COUNCILS—continued

Council	Road No.	Work or Service	Name of Accepted Tenderer	Account
Gilgandra ..	T.R. 77 ..	Construction of a 4 cell 8 ft x 4 ft reinforced concrete box culvert at 2.25 m. at Jumpers Creek deviation.	Transbridge Pty Ltd ..	3,500 6 9 (\$7,000.68)
Gilgandra ..	M.R. 572 ..	Construction of 6,280 lineal ft of roadway, including culverts, between 3.72 m. and 4.91 m. from Eumungerie.	J. A. Burrell .. ..	5,342 12 0 (\$10,685.20)
Gilgandra ..	T.R. 77 ..	Construction of approaches to culvert at 7.3 m. east of Gilgandra.	J. A. Burrell .. ..	4,375 7 0 (\$8,750.70)
Goodradigbee ..	M.R. 278 ..	Reconstruction between 3.75 m. and 5.10 m. from Yass.	M. J. Dawthwaite & Co. Pty Ltd.	10,007 0 0 (\$20,014.00)
Jindalee ..	T.R. 84 ..	Construction of 3 cell 9 ft x 8 ft reinforced concrete box culvert at Deep Creek, 25 miles west of Murrumburrah.	A. G. and L. Wicks ..	3,387 1 0 (\$6,774.10)
Jindalee ..	T.R. 84 ..	Construction of 5 span 95 ft long R.C. slab bridge and 3 cell 7 ft x 5 ft box culvert over Dundauman Creek 1.75 m. from Stockinbingal.	S. G. Turner & Sons Pty Ltd.	11,380 18 0 (\$22,761.80)
Jindalee ..	T.R. 78 T.R. 84 }	Bitumen surfacing at various locations .. ..	Boral Road Services Pty Ltd.	3,144 5 7 (\$6,288.56)
Kyogle ..	S.H. 24 ..	Bitumen sealing between 3.57 m. and 4.79 m. north of Woodenbong.	Boral Road Services ..	6,402 0 8 (\$12,804.07)
	T.R. 83 ..	Bitumen sealing between 24.3 m. and 29.8 m. north of Kyogle.		
	M.R. 361 ..	Bitumen sealing between 23.9 m. and 30.6 m. from Woodenbong.		
Liverpool ..	S.R. 2071 ..	Reconstruction and surfacing between Campbell and Short Streets.	Readymix Group (N.S.W.)	11,685 0 0 (\$23,370.00)
Liverpool ..	M.R. 535 ..	Mulgoa Road. Reconstruction westerly of Wallgrove Road at Judds Hill.	Ray Fitzpatrick Quarries Ltd.	6,448 0 0 (\$12,896.00)
Macintyre ..	M.R. 137 ..	Bitumen sealing between 10.4 m. and 17.35 m. north of Inverell.	Emoleum (Australia) Limited.	4,578 13 5 (\$9,157.34)
Merriwa ..	M.R. 209 ..	Construction of a 2 span 84 feet 4 in long steel and concrete bridge over Wappinguy Creek 5.6 m. east of Merriwa.	A. Cipolla .. ..	8,547 16 0 (\$17,095.60)
Namoi ..	M.R. 127 ..	Construction of 12 cell 8 ft x 3 ft reinforced concrete box culvert at Carbeen Creek 47.3 m. from Narrabri.	L. G. Rixon .. ..	8,898 5 0 (\$17,796.50)
Newcastle ..	M.R. 316 ..	Supply and delivery of fill material to the approaches to Selwyn Street, Railway Overbridge.	Brambles Industrial Services.	7,091 13 4 (\$14,183.33)
Nymboida ..	T.R. 74 ..	Construction of a prestressed and reinforced concrete bridge 95 feet 6 inches long over Goolang Creek at approximately 24 miles south west of Grafton.	Central Constructions Pty Ltd.	18,981 0 0 (\$37,962.00)
Tamarang ..	T.R. 72 M.R. 126 M.R. 129 }	Bitumen surfacing at various locations .. ..	Boral Road Services ..	7,579 19 3 (\$15,159.93)
Tweed ..	D.R. 3148 ..	Smith's Creek Road. Construction of three low level bridges at 3.80 m., 4.80 m. and 6.50 m. from Main Road No. 142.	Kennedy Bros .. ..	7,993 10 0 (\$15,987.00)
Weddin ..	M.R. 398 ..	Bitumen surfacing between 6.25 m. and 12.7 m. from Grenfell.	Boral Road Services Pty Ltd.	4,786 2 7 (\$9,572.26)
Weddin ..	M.R. 398 ..	Supply, deliver and spread 15,253 cubic yards of gravel between 6.25 m. and 12.7 m. from Grenfell.	Stubbs Transport Co. ..	3,815 6 6 (\$7,830.65)
Weddin ..	M.R. 398 ..	Supply and stockpile 1,080 cubic yards of $\frac{3}{4}$ in cover aggregate between 6.25 m. and 12.7 m. from Grenfell.	Border Sand and Gravel Pty Ltd.	3,563 15 0 (\$7,127.50)
Young ..	M.R. 241 ..	Supply and delivery of 1,220 cubic yards of aggregate to various locations.	Border Sand and Gravel Pty. Ltd.	3,233 0 0 (\$6,466.00)

# State Highway System of the State of New South Wales



Area of New South Wales, 309,433 square miles.

Length of public roads within New South Wales, 131,300 miles.

MILEAGE OF MAIN AND DEVELOPMENTAL ROADS, AS AT 30th JUNE, 1964

State Highways	6,531
Trunk Roads	4,153
Main Roads	11,627
Secondary Roads (County of Cumberland only)	138
Tourist Roads	180
Developmental Roads	3,021
	<hr/> 25,650

UNCLASSIFIED ROADS, in Western part of State, coming within the provisions of the Main Roads Act . . . 1,102

**TOTAL** . . . . . 26,752