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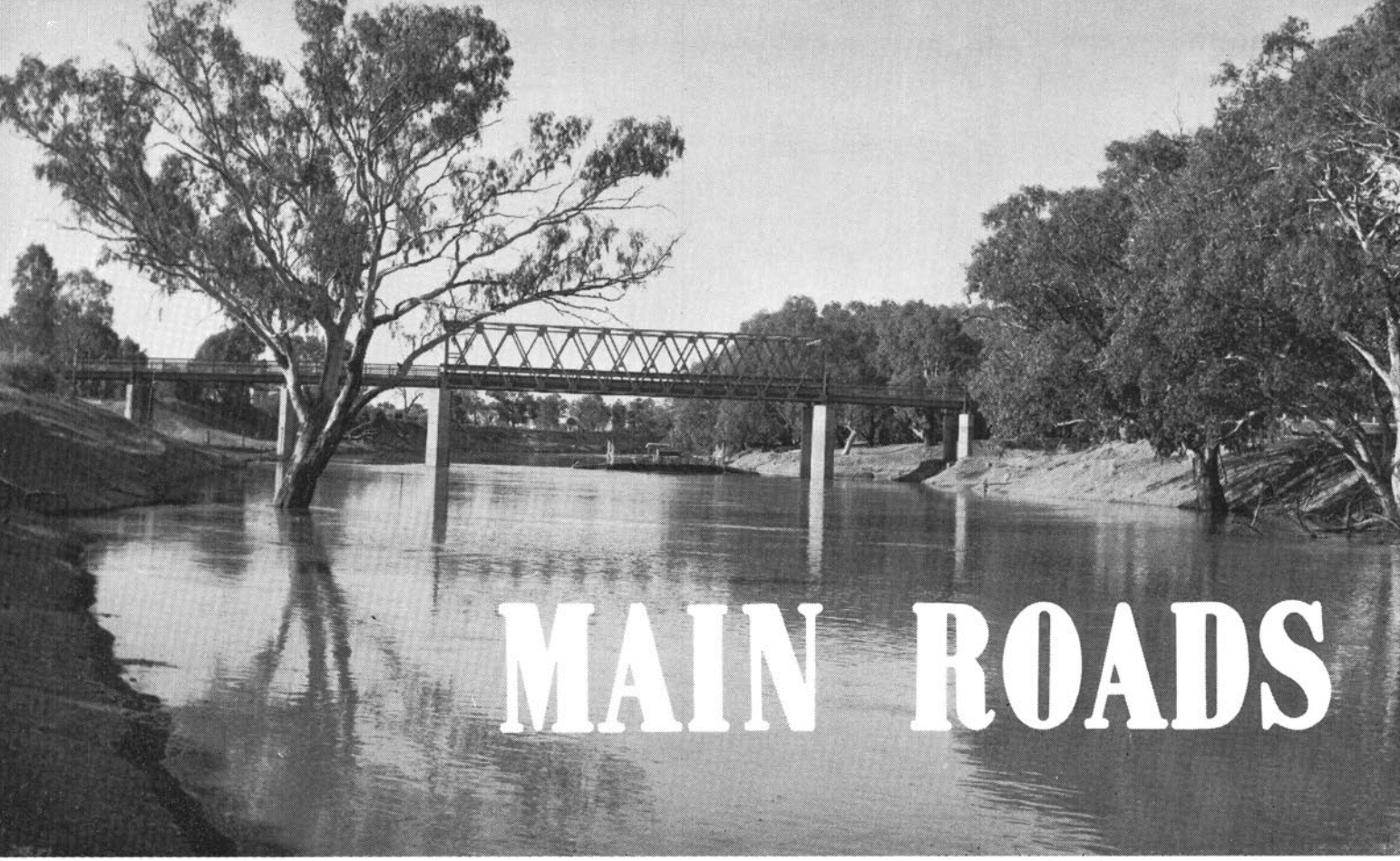
MAIN ROADS

SEPTEMBER 1964

JOURNAL OF THE DEPARTMENT OF MAIN ROADS • NEW SOUTH WALES



MAIN ROADS

Bridge over the Darling River at Tilpa

SEPTEMBER, 1964 Volume 30 Number 1

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COVER SHEET

An aerial view of Mount Kosciusko Road in the vicinity of Wragge's Creek. Snow clearing plant can be seen in operation on the road.

MAIN ROADS

SEPTEMBER 1964

JOURNAL OF THE
DEPARTMENT OF MAIN ROADS
NEW SOUTH WALES

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Bitumen Surfacing on Main Roads

The length of bitumen surface on the Main Roads of New South Wales was increased by 714 miles during the twelve months ended 30th June, 1964.

The total mileage of the State's Main Roads is now 22,286 of which 10,760 miles have been provided with a dustless surface, nearly one quarter of which have been provided within the last four years.

Of the 714 miles of new bitumen surfacing carried out in 1963-64, 253 miles were on State Highways. The mileage of the State Highways is 6,533 of which 4,750 miles or 72 per cent. have now been provided with a dustless surface.

SYDNEY HARBOUR BRIDGE

Provision of New Bituminous Pavement

A NEW bituminous pavement was provided on the carriageway of the Sydney Harbour Bridge earlier this year, replacing the previous surface, which had shown signs of deterioration.

The pavement on the deck of the carriageway consisted of a light-weight concrete (" coke breeze ") base on steel buckle plates, a layer of natural rock asphalt about 2 inches thick and a plant-mixed wearing surface of bituminous asphalt varying from $\frac{3}{4}$ inch to 2 inches in thickness. The rock asphalt formed part of the original pavement. The upper layer of the pavement, the bituminous asphalt, had been laid as part of a resurfacing in 1949-50.

Surface deterioration of the pavement first became significant in 1960. It was apparent that either an additional thin surface layer had to be provided, or alternatively, the old surface had to be removed and replaced with plant-mix bituminous asphalt. After consideration of the effect of the additional weight of pavement which would result from adding a thin surface layer, it was determined that, if necessary, a further 1 inch thickness could be safely added to the existing surface.

However, it was also decided to investigate in detail the state of the existing pavement by test coring and analysis of materials, while in the meantime, paying close attention to the condition of the existing surface.

During these investigations, it was observed that water seepage was occurring through the upper layers of the pavement and it was apparent that the removal of the existing surface and replacement by a new water-proof surface course would be desirable.

Also an investigation of the pavement level at the expansion joints revealed that the original natural rock asphalt conformed approximately to the level of the metal joints. The asphaltic surface laid in 1949-50 had raised the level of the surface from about $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches above the level of the joint, the differences in level being taken up by ramping for a distance of about 20 feet each side of the joint. Any additional material added with a view to obtaining some permanency would need to be at the very least $\frac{3}{4}$ inch consolidated thickness and the disparity in levels would be exaggerated accordingly. This meant that the existing surface should be removed for a distance of approximately 30 feet back from each joint and replaced by the new material to provide acceptable riding conditions.

It was considered preferable to remove all excess material and perished pavement and to reconstruct the surface to the original level. It was decided that the method of removal should be by heating and stripping in preference to the use of pneumatic tools because of the traffic problems involved. However, suitable machines to do this work were not available in Sydney until 1963, when one was imported from the United States of America by a private firm.

Preliminary trials were first conducted on the removal of deteriorated and deformed surface bitumen layers on Bradfield Highway, North Sydney, Parramatta Road, Leichhardt and also at Marrickville. The heater used appeared capable of satisfactory application to the type of work required on the Sydney Harbour Bridge and it was decided to invite public tenders for its use on a limited programme of road works and on the surface of the deck of the Ryde Bridge as a full scale trial for the proposed work on Sydney Harbour Bridge. There was also a pressing need for pavement restorations at various other locations in the Metropolitan area. These full-scale trials were carried out satisfactorily.

Subsequently, public tenders were invited and closed on 11th February, 1964 for the removal of the bituminous surface material from the deck of the Sydney Harbour Bridge by heating and planing. The successful tenderer was Therma-Bond Asphalt of Australia at a price of £9,680 2s. 0d. The work for which the contractor was responsible was the heating, planing and loading of the material into trucks. The Department was responsible for the provision for and control of traffic, the supply of trucks, haulage and disposal of the material and the resurfacing of the pavement. The asphaltic concrete material for the new pavement surface was supplied from the Department's bituminous mixing plant at Rosehill Maintenance Depot.

Because of the large volume of traffic using the Sydney Harbour Bridge during daylight hours, it was decided that the stripping and removal of the old pavement would be carried out at night. To ensure that the pavement provided a smooth riding surface, the final surface course was placed subsequently during daylight hours.

The contractor's equipment to carry out the heating, stripping and removal of the pavement, consisted of—

1 Heater—*American Manufacture.*
1 Heater—*Australian Manufacture.*
1 Belt Loader—*American Manufacture.*
1 Motor Grader with a shortened blade,
1 tandem drive motor Grader hired by the contractor.

The surface area to be removed comprised the six traffic lanes on the main carriageway of the bridge. The period of work originally intended was from 9.00 p.m. to 6.00 a.m. on Sunday to Thursday nights each week. Friday and Saturday nights were excluded because of the relatively high traffic densities on those nights. The hours of work were later extended to 8.00 p.m. to 6.30 a.m.

The work commenced from the northern end of Lane No. 6 on the eastern side of the bridge. All of the equipment was assembled in a cleared area north of the bridge approaches. The contractor's equipment moved along one lane at a time in a " tandem " type operation—Heater - Grader - Heater - Grader - Loader - Trucks, proceeding in that order.

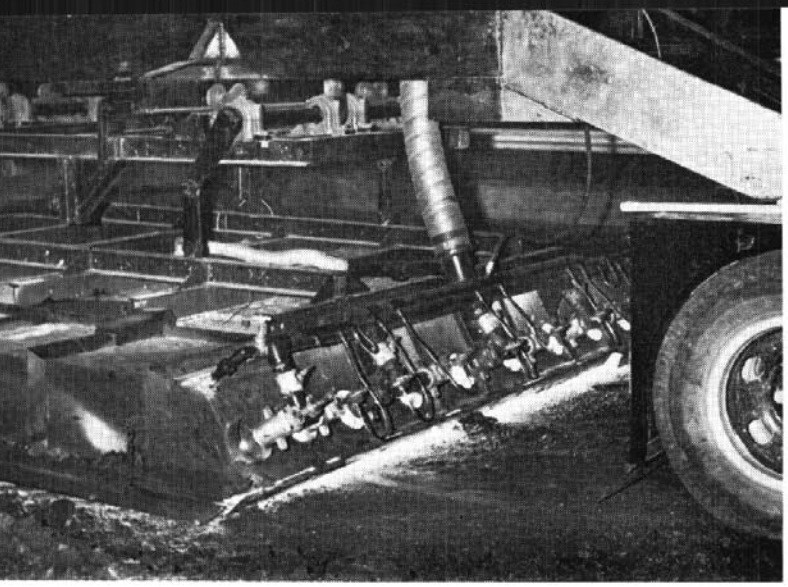
The Heaters moved at a speed of about 7 to 8 feet per minute. Heat was applied over a width of about 11 feet at a pavement surface temperature of about 2,000° F. The heated and softened material was bladed into windrows by the grader following immediately behind the heater and generally had a temperature in the windrow of about 200° F. Cooling was very rapid and the material loaded into trucks seldom exceeded 100° F. in temperature.

The width over which heat was applied to the pavement by each pass of a heater (11 feet) was about eighteen inches in excess of the traffic lane width and a total of five passes of the heaters covered the full width of the six traffic lanes. For most of the work several passes were necessary to clean the material down to concrete level. The greatest difficulty in cleaning down to concrete level was in the kerbside lanes, No. 1 and No. 6 where the kerbside material between the steel framed scuppers was difficult to heat, being on the extreme edge of the heaters and very awkward to reach with the grader blade.

The degree of resistance of the natural rock asphalt varied considerably and some patches were extremely resistant although very brittle when loosened.

The burning, planing, loading and removal operation was not affected by wet weather but the work was delayed by wet conditions because the new asphaltic concrete base course could not be laid successfully on a wet concrete surface and it was essential that any work commenced be completed to a stage where it was usable by the peak traffic the following morning.

The heating unit being followed by a grader



A close-up view of the burners on the heating unit

The belt loader gathering the surplus material and loading on to the following truck

Rain prevented work entirely on two nights. On two other nights it was necessary to use the Contractor's heaters to dry off the pavement base when rain had fallen while work was in progress. On these two occasions the pavement base was dried out sufficiently to permit of partial resurfacing to carry the morning peak traffic.

The new asphaltic concrete base course was placed at night immediately behind the Contractor's removal work. As the surface of the exposed "coke breeze" concrete was uneven, this base course was variable in thickness, averaging $1\frac{1}{2}$ inches and was made of $\frac{3}{4}$-inch grade asphaltic concrete. The second stage or final surfacing work was carried out in daylight hours at week-ends.

To provide the best possible conditions for the travelling public while the work was in progress, the Sydney Harbour Bridge Tow Truck and Traffic Control Organisation set out traffic diversion signs and traffic lane control flaps between 7.00 p.m. and 8.30 p.m. and subsequently re-arranged traffic control signs and flaps as the work proceeded throughout the night, finally clearing the area by 6.30 a.m. each morning.

Also the Department's Metropolitan Division Maintenance Linemarking Organisation painted temporary traffic lane lines on the new work prior to 6.30 a.m. each morning and loose material was swept from the cleared pavement ahead of the Department's asphalt spreading team and repeated immediately after the morning peak hour flow to remove any material loosened by traffic.

It became apparent early in the work that the contractor's equipment should be clear of the bridge early each morning, and to ensure this, the first general movement on to the bridge commenced at about 8.00 p.m., the heaters were lit at about 8.30 p.m. and the contractor's plant removed from the bridge by 5.30 a.m.

The Department's equipment employed on the site consisted of—

1 Paving Machine
1 10-12 ton smooth wheel Roller.
2 Multi-tyred (up to 12 tons) Rollers
1 Bitumen Kettle for tack coating
6 Asphalt Haulage Trucks (8 ton)
Linemarking Organisation
Mechanical Street Sweepers
Tow Truck and Traffic Control Organisation.

In addition to the regular attendants and plant personnel with the above equipment, three general labourers were engaged on miscellaneous minor fringe duties throughout.

Because of a possible breakdown, which would have caused considerable difficulty, the Department held in reserve a drag-spreader (for surfacing), a rotary broom, a 2-wheel drive $\frac{3}{4}$ cu. yd. bucket front end loader and

a hired sprayer (Bremner type) for tack coating. Arrangements were also made with the North Sydney Council for the loan of Council's 10-12 ton smooth wheel roller in the event of an emergency.

The work was commenced on the night of the 26th April and completed on the morning of 28th May, 1964; 3,072 tons of material were removed from the pavement and 1,893 tons of surface course were applied. The area treated amounted to 260,414 square yards.

To provide a smooth riding surface, the final wearing coat was applied in daylight. Lanes 1, 2, 3 and part of Lane 4 were completed on Sunday, 31st May, 1964 a total of approximately 712 tons being placed on that day. The balance of Lane 4 and Lanes 5 and 6 were completed on Sunday, 21st June, 1964, when approximately 438 tons were applied. The average thickness of this final surface was one inch.

The equipment used in the final surfacing consisted of two tamper-spreader Pavers, three 10-12 ton smooth-wheel Rollers and four Multi-Tyred Rollers. This made up two complete paving groups which were supplemented by the Sydney Harbour Bridge Tow Truck and Traffic Control Organisation, and a small group for linemarking and replacement of self-wiping reflectors. The width of each paving run was made to coincide with the traffic lane width and consisted of two 10 ft. 0-in. and four 9 ft. 3-in. lanes. This eliminated ridging which would affect riding qualities.

To prevent corrosion of the steel kerbs adjacent to Lanes 1 and 6, the final 4-inch width was hand packed with a hot sheet asphalt and a 1-inch wide strip of a liquid rubber bitumen mixture was poured against the steel.

The opportunity was taken to install self-wiping reflectors on all lanes. These had not been provided on all lanes previously.

When inspected after being exposed, it was noted that the original " coke breeze " concrete base was in good condition throughout.

SYDNEY HARBOUR BRIDGE ACCOUNT

Receipts and Payments for the period from 1st July, 1963 to 30th June, 1964

Receipts	£
Road Tolls	1,812,171
Contributions—	
Railway passengers	140,336
Omnibus passengers	15,393
Rent from properties	53,574
General Loan (State Government)	150,000
Miscellaneous	731
	£2,172,205

Payments	£
Cost of collecting road tolls	200,070
Maintenance and minor improvement	297,752
Interest, exchange and management expenses on loans	574,070
Alteration to archways for occupation by tenants	2,172
Administrative expenses and Miscellaneous charges	24,922
Transfers to Expressways Fund	1,539,000
Provision of traffic facilities	29,179
Alteration to toll gates	1,322
Toll collection equipment and establishment	115
	£2,668,602

One of the units recently placed in operation for light snow clearing

Additional SNOW CLEARING EQUIPMENT

THE Department extended its snow-clearing organisation on the Mt. Kosciusko Road (Main Road No. 286) and on the Snowy Mountains Highway (State Highway No. 4) at the commencement of the 1964 winter by the addition of five new snow-clearing units. Two of these will be used for light snow clearing and three for heavy and deep snow.

Light snow clearing

The two units purchased for light snow clearing are Bedford four-wheel drive trucks, powered by 133 H.P.

A new unit recently placed in operation for heavy and deep snow clearing

petrol engines, fitted with 3-cubic yard tipping bodies. The transmission provides eight forward gears.

Before being placed into service, these trucks were fitted with 10 ft. reversible, trip-type snow clearing blades, designed and manufactured at the Department's Central Workshop, Granville. Tailgate spreaders and power steering were also fitted. The cabins were fitted with heating and demisting equipment.

These units have a tare weight of 5·5 tons when fully equipped. They are the first of their type to be used by the Department and are designed for the fast clearing of light snow.

Heavy and Deep Snow Clearing

Three new units placed on heavy and deep snow clearing are Magirus Deutz four-wheel drive trucks fitted with tray bodies and vee-type snow ploughs. They are powered by V8, air-cooled 200 H.P. diesel engines with twelve forward gears. Power steering, operated on compressed air from the truck's brake system, is also fitted. Heating and demisting equipment is fitted in the cabins.

The vee-type ploughs have a cutting width of 9 feet at ground level and an overall width of 12 feet at the top of the blade.

Tare weight of these units is 7·75 tons.

These machines have replaced other less powerful equipment which has been in service since 1946.

All five new units are operating satisfactorily on the Snowy Mountains Highway (State Highway No. 4) and the Kosciusko Road (Main Road No. 286).

NEW AUSTRALIAN STREET LIGHTING CODE

A new Australian Standard Street Lighting Code (AS.CA. 19 Part I) has been published by the Standards Association of Australia.

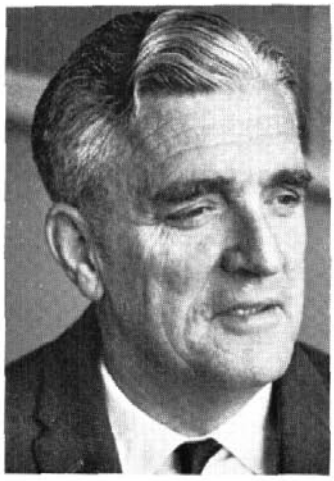
The code applies to the lighting of traffic routes and constitutes the first part of a revision of the 1939 edition of the Code. The main purpose of the code is to establish a minimum standard for the lighting of traffic routes throughout Australia and is intended for application by Local Government and other Authorities concerned with street lighting.

Highways, arterial roads, local business streets, expressways, freeways, bridges, tunnels and underpasses are all covered by the code.

The Department of Main Roads was represented on the committee set up by the Standards Association to formulate this code. There were representatives from all Australian States on the Committee which studied overseas recommendations and reports and observed the results of several trial installations carried out on roads with typical Australian road surfaces.

OVERSEAS REPORT

Prequalification of Tenderers



Extracts from a report by G. V. Fawkner, Deputy Chief Engineer, Department of Main Roads, New South Wales, following an overseas mission to the United States of America, Europe and the United Kingdom.

IN all Federal Aid Projects in the United States of America, it is required by law that all construction work be carried out by contract, except under emergency circumstances, where day labour work can be approved by the Bureau of Public Roads. In practice, all construction work is done by contract.

Prequalification of tenderers is not required by the Bureau of Public Roads but is in general use in all of the States visited. It is understood that of the 50 States of the Union 40 have some form of prequalification. The Bureau does not object to prequalification—in fact encourages it.

The details of prequalification vary from State to State and at the present time the American Association of State Highway Officials is endeavouring to develop uniform prequalification standards throughout the States and to obtain reciprocity between States. The Bureau of Public Roads examines all State prequalification practices annually in order to ensure that free competition for contract works is not being impaired.

Details of the prequalification requirements of the States of California, Texas and Oregon were examined.

In California, prequalification of Contractors is a requirement of State Law for works estimated to cost more than 50,000 dollars (about £A22,500) and tender forms are not made available to tenderers unless they are prequalified.

The standard specifications of the Texas Highway Department require that a prospective tenderer shall submit:

1. A completed confidential questionnaire containing financial, equipment and experience data.
2. A balance sheet and statement of financial resources certified by an independent public accountant.

The statements are required to be on hand at the State Highway Department Head Office ten days prior to the date of opening of tenders.

In Oregon, State law makes it unlawful for tender forms for any work estimated to cost 10,000 dollars or more (£A4,500) to be issued to a prospective tenderer who is not prequalified to submit a tender.

The information required by all three States is somewhat similar. A financial statement showing assets and liabilities of the prospective tenderer with sufficient detail for checking is required and this must be certified by an independent public accountant. A statement of experience in the highway contractor's field is also required and this includes the construction experience of the principal individuals in the tenderer's current organisation. Details of construction equipment owned by the tenderer are also required, these details include description and capacity of items, age of items, purchase price, book value, market value, liens, if any, against the

equipment and a statement regarding the availability of the equipment. Prospective tenderers are also required to give details of all banks, equipment suppliers and materials suppliers with whom they have done business in the previous three years, and details of all contract works carried out in the previous five years. All information is supplied on a confidential basis.

The methods of determining prequalification limits from the information supplied by the prospective tenderers vary in the three States.

In California the financial statement is examined to determine the working capital (excess of current assets over current liabilities) and the net worth (surplus of capital over liabilities). A financial limitation is then determined and this is taken as ten times the working capital or four times the net worth, whichever is the smaller. If the amount of the financial limitation so determined does not exceed $50,000, or if a certificate signed by an independent public accountant is not supplied, the financial limitation would be zero.

After establishment of a financial limitation, consideration is given to the factors of experience, quantity and suitability of equipment, performance on past work, and any other factors which may have a bearing on the ability of the contractor to carry out satisfactorily a highway construction project. The California State Highways Department then applies a special formula for determining the respective prequalification ratings for contractors. This formula appears to be somewhat cumbersome, but seems to work quite well in practice. Its main merit is that it does achieve a reasonable degree of uniformity even though the contractor's statements may be appraised by different people.

Information made available by the Division of Highways indicated that at 1st July, 1963, there were 835 contractors qualified to tender for Californian State Highway projects, with an estimated combined bidding capacity of $2,532,881,000 (or approximately £A1,151,000,000). These 835 contractors were grouped as follows:—

$10,000,000 and over	.. .. ..	83
$5,000,000 to $10,000,000	.. ..	141
$2,500,000 to $5,000,000	.. ..	232
$1,500,000 to $2,500,000	.. ..	298
$1,000,000 to $1,500,000	.. ..	355
$500,000 to $1,000,000	.. ..	517
$250,000 to $500,000	.. ..	681
$100,000 to $250,000	.. ..	806
$50,000 to $100,000	.. ..	835

The strength of the contract field is obvious.

The method of determining prequalification limits in the State of Oregon is somewhat simpler. Liquid assets are determined by allowing: Cash—100 per cent.; notes receivable, variable, generally not above 80 per cent.; accounts receivable from contracts 100 per cent.; sums earned on uncompleted contracts between 80 per cent. and 100 per cent., depending on the contracting agency (generally 100 per cent. if the contract is held with a public agency); accounts receivable from other sources—80 per cent.; deposits for tenders or other guarantees—usually 100 per cent.; interest accrued on loans—100 per cent., if receivable within a year; real estate about 25 per cent.; stocks and bonds—80 to 100 per cent.; materials in stock for uncompleted contracts—100 per cent.; other materials—75 per cent. or less; equipment 50 per cent. of book value; furniture and fixtures—50 per cent. or less of book value; other assets—variable depending on their nature.

Liabilities are usually allowed for at 100 per cent. except in instances in which a liability is payable over a period of years, in which case the amount payable within the next year is taken as the liability.

In computing the value of equipment and real estate, a deduction is made from the value of the asset of the amount of any liability against it and computations are made on the balance. For example, if a Contractor owns equipment valued at $500,000 but owes $200,000, the asset is taken as having a value of $300,000 and, using the proportion of 50 per cent., the Contractor would be allowed $150,000 for equipment.

Total liabilities are thus subtracted from total assets and if there is a fair balance in the statement between liquid assets, equipment and experience, a factor of five is applied. For example, if net assets are $100,000, liabilities $50,000, the net assets of $50,000 multiplied by five would provide a prequalification amount of $250,000. The factor of five is the normal factor, but the figure may be as low as two, if the balance between liquid assets, equipment and experience is not good. On the other hand the factor may be as high as eight. The prequalification factor is determined on the following basis:—

Factor 2: Cash only—or very poor performance record with the Highway Department or with other highway agencies.

Factor 3: Cash and equipment and no experience; or limited experience and shortage of liquid assets; or poor performance record with the Highway Department or other highway agencies; or use for reasonable correlation in relation to size of projects reasonably performed.

Factor 4: Cash and experience plus limited equipment but shortage of liquid assets; or uneven performance record with Highway Department or other highway agencies; or use for reasonable correlation in relation to size of projects previously performed.

Factor 5: Cash and equipment and average experience. This is a normal rating.

Factor 6: Same as No. 5, plus good performance generally on at least one contract with the Highway Department or consideration of good reports from other highway agencies.

Factor 7: Same as No. 5, plus excellent performance generally on at least two contracts with the Highway

Department or in consideration of excellent reports from other highway agencies.

Factor 8: Adequate cash, equipment and experience plus several years of excellent contract performance with the Highway Department, or on consideration of outstanding reports from other highway agencies.

The prequalification amount so determined, i.e. by multiplying net assets by the prequalification factor, is used as a yardstick in issuing tender documents on any one job.

The procedure adopted in Texas is somewhat similar to that of Oregon. The standard specifications of the Texas Highway Department require that the tenderer must be capable of performing each of the various items of work tendered for. A tender will not be considered unless the tenderer shall have filed with the Department, at least 10 days prior to the date for the closing of tenders, a complete statement of his financial resources and of his experience on similar work. Each tenderer is also required to furnish a statement listing the equipment available for the work for which the tender is being submitted. New statements are required each year and, once submitted, the statements are good for a period of one year from the date of the statement; however the Department reserves the right to require a new statement at any time. The financial statements are not acceptable unless audited by an independent certified public accountant, registered and in good standing in any State.

From the information supplied, the prospective tenderer's " bidding capacity " is determined by the Texas Highway Department. This is generally described as the working capital multiplied by a factor determined by the Highway Department. Working capital generally is represented by the excess of current assets over current liabilities. In determining these the Department makes certain modifications which give rise to the terms " Includable Assets " and " Includable Liabilities ". Examples of these modifications are:—

Cash:

Cash which is restricted in any manner as to withdrawal or not in the firm name of a partnership or corporation is omitted from the " Includable Assets ".

Accounts and Notes Receivable:

Any Notes receivable, or portion thereof, which will not be due and payable within one year are omitted from " Includable Assets ".

Deposits:

Deposits which may be treated as " Includable Assets " are those which may be reasonably expected to be refunded within one year or upon the request of the depositor.

Cash Value-Life Assurance:

This asset less any loans against the policies, may be classified with " Includable Assets ", if not otherwise restricted as to use.

Marketable Securities:

These assets are accepted as " Includable Assets " at their market value, provided the securities are those generally traded by brokers, therefore having a readily ascertainable value, and they are not securities of affiliated or subsidiary companies. The liability for income tax on the unrealised capital gain is recognised as an " Includable Liability ".

Notes and Accounts Payable:

These liabilities are " includable " if they fall due within one year from the date of the statement. Instalments on notes falling due beyond one year are omitted from " Includable Liabilities ".

Lease (Rental) Purchase Agreements:

Where the option to buy equipment has been exercised or a legal agreement to rent said equipment for a specific length of time has been made, then the portion becoming due within one year would be classified as an " Includable Liability ".

The determination of the factor to be used in arriving at a tenderer's " Bidding Capacity " follows somewhat similar empirical rules as previously described for the Oregon State Highway Department.

GENERAL

Officials of all State Highway Departments visited expressed themselves as being very much in favour of the prequalification system. It was stated that the Contractors' Associations supported the system and individual contractors were in favour of it. No one thought that the system tended to stifle competition or to raise contract prices. The Secretary of the Oregon State Highway Department, however, did express the opinion that prequalification systems should be kept as simple as possible and that if these systems became too complicated, there would be a tendency for contract prices to rise. This appears to be contrary to the Californian experience where the system of evaluation of information supplied by tenderers appears to be more complicated than in other States.

It is interesting to note that the Port of New York Authority which is a two-State organisation, controlling border works in the States of New York and New Jersey, is not bound by State Laws requiring prequalification of tenderers and does not require prequalification. It does, however, require the submission with the tender of information regarding the financial status of a tenderer and the Authority reserves to itself the right to refuse tenders from people considered financially unqualified to carry out the work.

PERFORMANCE BONDS

All States visited in the United States of America require a contractor to furnish a performance bond for the full amount of the contract, guaranteeing the performance of the whole of the contract work at the

contract price. Performance bonds are provided by bonding companies and the rates paid by contractors for these bonds are small—varying between 0·4 per cent. and 0·75 per cent. of the amount of the contract. The bonding companies themselves carry out a complete examination of the contractor's financial resources, experience, technical ability and equipment resources and the low rates charged for performance bonds are indicative of the thoroughness of the investigation and the judgement of the bonding companies. One gains the impression—in some States more than in others—that the prequalification system works very well because of the performance bonds and the sound judgement of the bonding companies.

There appears to be no formal prequalification system in England similar to those in use in the United States, but in recent years, select lists of contractors have been prepared for motorway works. Contractors are invited to submit their names for inclusion in the select lists and are required to submit answers to a questionnaire involving financial and technical resources. The last five or six contracts for major works on the Motorway System have been let on the basis of tenders called from contractors on the select lists.

In Germany, there is no provision for prequalification of tenderers, as used in the American States, but tenderers are required to submit details of financial and technical ability, experience and equipment, with their tenders. On major works costing in excess of one million marks (£A125,000), the contract field is generally limited to established contractors, but there is no restriction on tendering. A new contractor may tender, but will need to satisfy the authorities that he is financially and technically capable of carrying out the work. On certain more complex works, including large and complex bridge works, public tenders are not invited and tendering is limited to a select list of tenderers considered to be capable of carrying out the work. Similarly, in Italy, tenders for major works on the Autostrada are invited from a select list of tenderers.

The American system of prequalification of tenderers appears to be a workable system and preferable to the select list system used in England and on the Continent. The workability of the system, it is believed, is largely due to the performance bond requirements and the availability of bonding companies which are prepared to furnish performance bonds at low rates. The prequalification system for bridge contractors at present in use in the Department of Main Roads, New South Wales, would undoubtedly be strengthened if similar performance bonds—at low rates—were possible in this State.

MAIN ROADS FUNDS

Receipts and Payments for the period from 1st July, 1963 to 30th June, 1964

	County of Cumberland Main Roads Fund	Country Main Roads Fund
	£	£
RECEIPTS—		
Motor Vehicle Taxation (State)	2,719,612	10,878,449
Charges on heavy commerical goods vehicles under Road Maintenance (Contribution) Act, 1958 (State)	923,221	3,692,880
Commonwealth Aid Roads Act, 1959	1,923,782	7,417,129
Road Transport and Traffic Fund	....	1,126,835
From Councils under Section 11 of Main Roads Act and/or for cost of works	2,866,766	14,827
Temporary Advance from State Treasury	350,000	....
Other	207,153	172,406
Total Receipts	8,990,534	23,302,526
PAYMENTS—		
Maintenance and minor improvement of roads and bridges	1,607,160	6,929,143
Construction and reconstruction of roads and bridges	3,455,574	11,708,869
Land Acquisitions	1,416,227	226,205
Administrative Expenses	335,678	1,056,429
Loan charges, payment of interest, exchange, management and flotation expenses	59,180	495,950
*Miscellaneous	1,777,794	2,313,603
Total Payments £	8,651,613	22,730,199

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

WOLLONGONG . . . .

North-South Arterial Road

WOLLONGONG, situated on the coast fifty miles south of Sydney, is the third city in order of size in New South Wales. The population of the City of Greater Wollongong is increasing rapidly and has risen from 134,000 in December 1961, to a present population of approximately 160,000.

The Wollongong district is a centre of heavy industry, including coal mining, iron and steel production and associated activities.

The Prince's Highway (State Highway No. 1), the main arterial route from Sydney, meets the coast near Thirroul towards the northern end of the city and then follows generally along the coastal plain in a southerly direction. It has been evident for some time that the existing highway along the narrow coastal strip near Wollongong would be inadequate to meet future traffic needs.

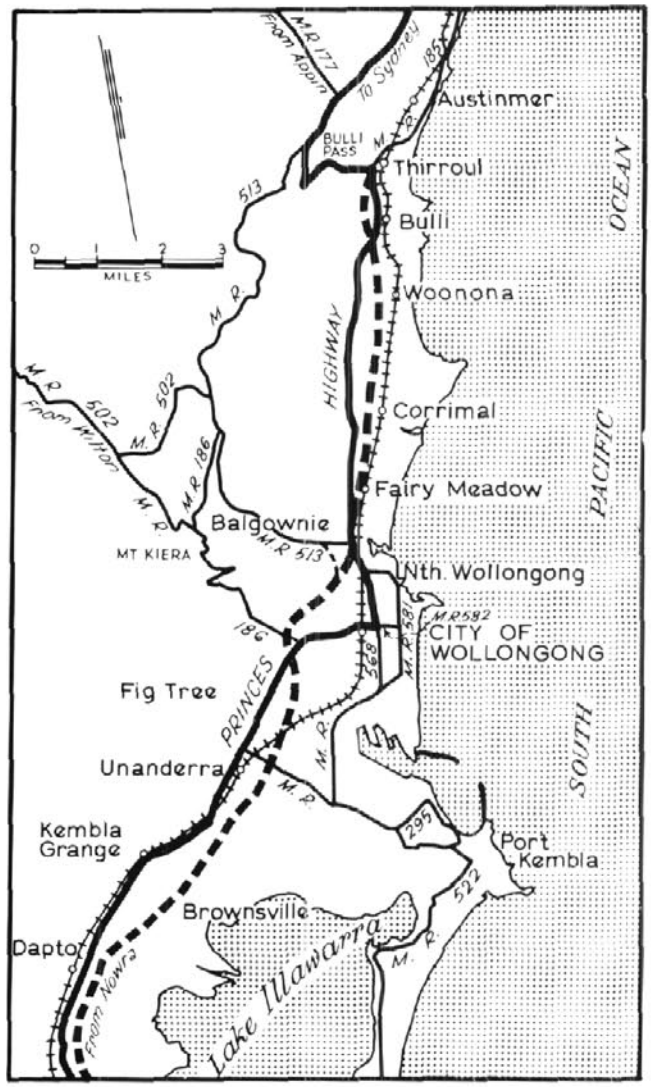
North of the central business area of Wollongong there was extensive development of roadside property, and it was apparent that widening of the Highway would be a lengthy and costly process.

South of the central business district of Wollongong the property abutting on the Highway was not so closely built upon, and consequently while acquisition of additional land to widen the road reserve could be a lengthy process, the cost of widening and the extent of interference with built-up roadside property would not be nearly so great as on the length of the Highway to the north of the central business district.

It was decided to complete pavement construction on the northern section to the full width of the available carriageway, i.e. 42 feet, and on the southern section to realign the existing Highway to provide a road reserve width of 100 feet, which would allow of the ultimate construction of a six-lane carriageway with a central median.

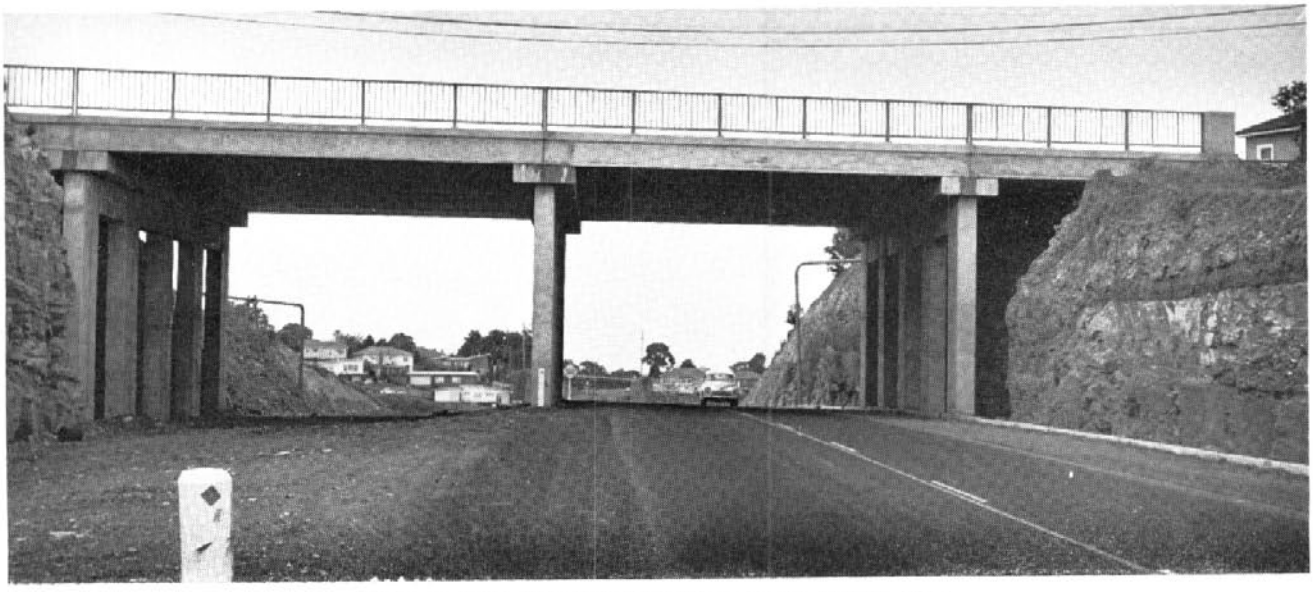
At the same time it was decided to plan for the construction of a north-south arterial road additional to the Highway and generally parallel to it, which would provide a deviation to the west of and around the central business area of Wollongong.

Present proposals for the northern section of the North-South Arterial Road, i.e. from Thirroul to North Wollongong, provide for dual carriageway construction with intersections at grade, but with partial restriction on access from adjoining property.



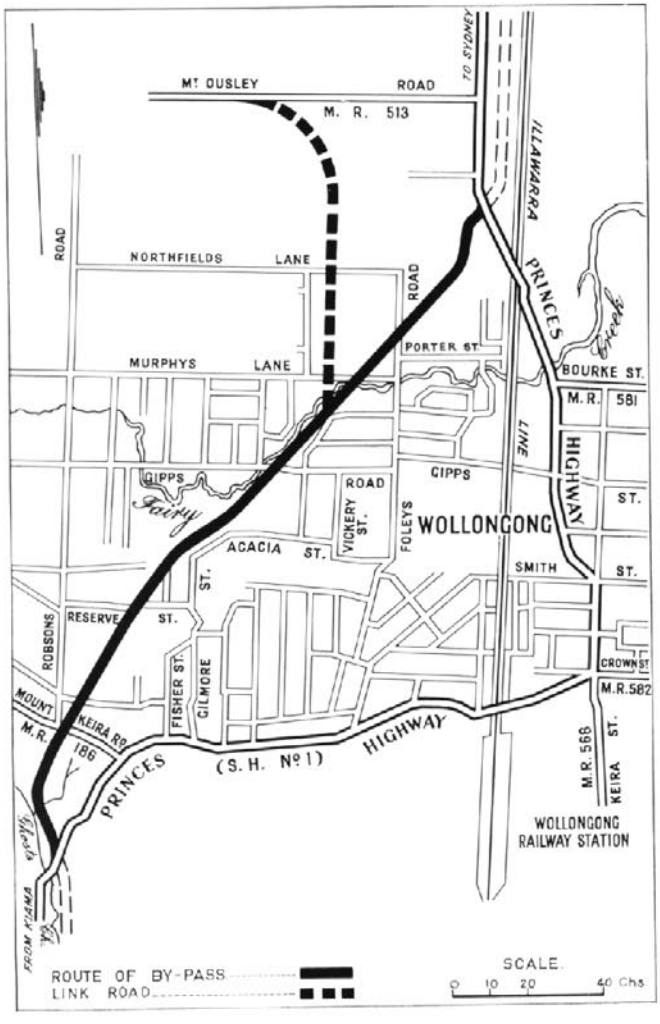
Locality Sketch

On the section of the North-South Arterial Road to the west of and around the business centre of Wollongong, i.e. from North Wollongong to Ghosts Creek,



Bridge carrying Mount Keira Road over the Arterial Road

Locality Sketch

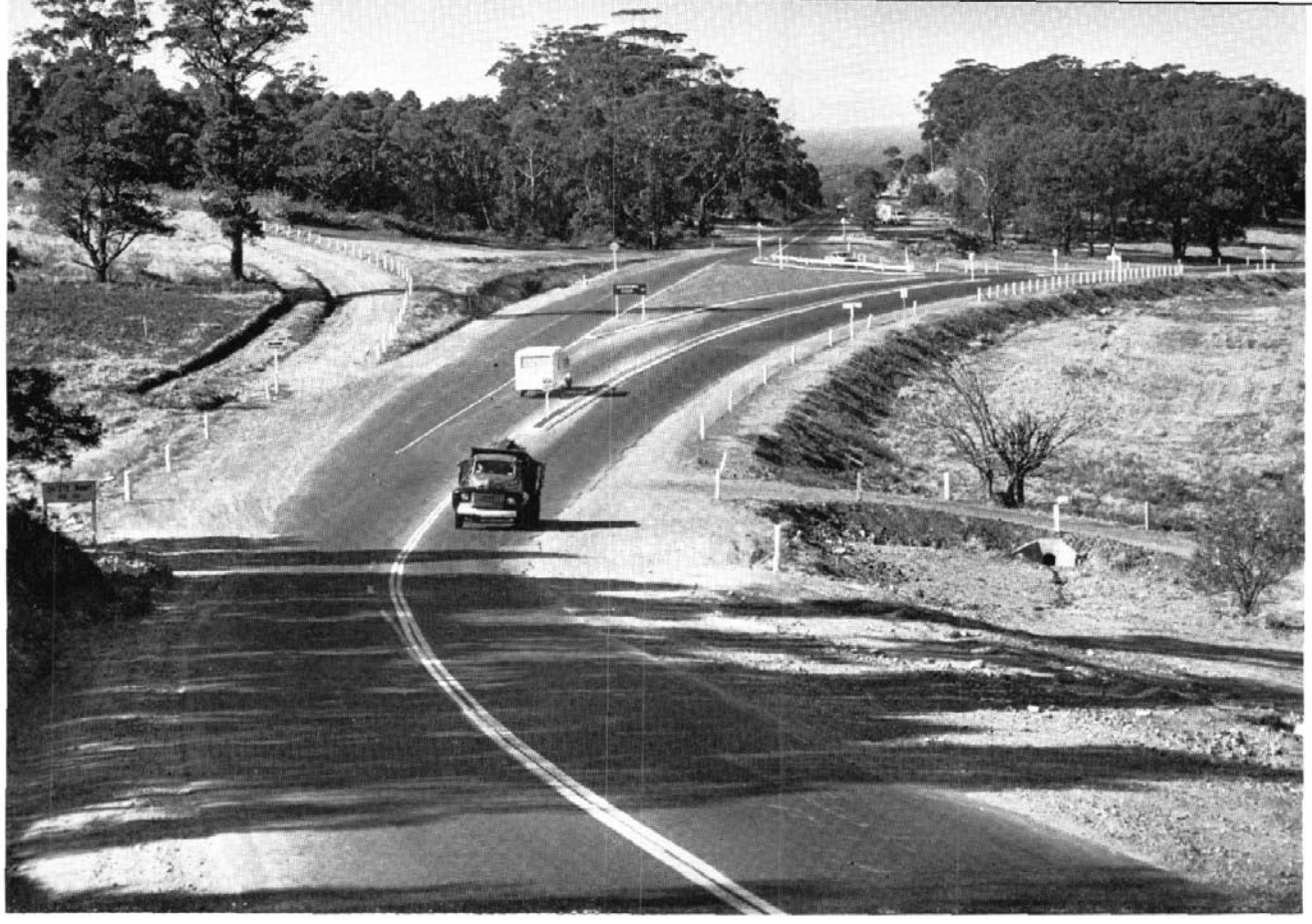


and on the southern section from Ghosts Creek to south of Dapto there will be dual carriageways with grade separation at all crossings and intersections and no access from adjoining properties.

Because of increasing traffic congestion on the Prince's Highway through the main shopping and business centre of Wollongong, the Department, in 1959, put in hand construction of one half of the dual carriageway of the arterial road on the length between North Wollongong and Ghosts Creek so as to provide an alternative route to by-pass the central business area. This work was described in the June 1961 issue of " Main Roads ". Construction of the two-lane 23 ft. wide pavement was completed from North Wollongong to Ghosts Creek and opened to traffic in July 1963. Earthworks and bridges over most of this section were constructed to allow for the later provision of a second carriageway.

The length of this section is approximately 2·1 miles. Ultimately, all cross roads will be carried over the new road or discontinued. Reinforced concrete bridges have been constructed at Gipps Road, Reserve Street and Mt. Keira Road (Main Road No. 186) to provide grade separated crossings. A further bridge known as the Porter Street Bridge, is to be built in the vicinity of Foleys Road to provide grade separation at this point. At the present time and pending construction of this bridge, traffic is permitted to cross the Arterial Road at grade and turning movements are not restricted.

Channelised intersections have been constructed at each end of this by-pass. These intersections are to be fully grade separated when the route is finally developed.



Channelised intersection at the junction of Mount Ousley Road and the Link Road

A link road has also been constructed between Mt. Ousley Road (Main Road No. 513) and the Arterial Road in the vicinity of Murphys Lane. This link road is 0·9 miles long and was completed and opened to traffic in March 1964.

The pavement is 14½ inches thick, consisting of 8 inches of sandstone basecourse, and 6 inches of crushed stone surface course with a ½ inch bituminous flush seal. A premixed bituminous macadam and asphaltic concrete surface course will be added later. Channelised intersections have been constructed at the junctions with Mt. Ousley Road and the Arterial Road.

The construction of the link road has cut Murphys Lane and Northfields Lane. Traffic is at present permitted to cross the link road at Northfields Lane pending the construction of a bridge over the link road to serve both Northfields Lane and Murphys Lane.

When construction of the bridge over the link road (known as Porter Street Extension) and construction of the Porter Street Bridge over the Arterial Road is completed, all crossings at grade will be eliminated. Loading and unloading ramps will also be constructed in the vicinity of these bridges to permit traffic from the local street system to gain access to the link road and the Arterial Road.

Pending construction of the grade separation bridges, it is proposed to install street lighting at the channelised intersections and the Illawarra County Council has been asked to assist with the preparation of plans for the installation of the lighting.

The North Wollongong to Ghosts Creek section of the Arterial Road and the link road to Mt. Ousley Road is to be proclaimed a motorway and plans have been prepared for the fencing of the route, including man-proof fencing in certain locations.

Construction will shortly commence on the duplication of the present two-lane pavement between North Wollongong and Ghosts Creek to provide a divided four-lane road on this section together with full grade separation of the intersection with the link road.

After this work is completed the next work to be undertaken will be extension southwards from Ghosts Creek to Five Islands Road (Main Road No. 295) and northwards from North Wollongong towards Corrimal. Extension southwards will involve the construction of grade separated interchanges at Ghosts Creek (the junction with the Prince's Highway) and at Gladstone Avenue (Coniston Road). Ten bridges over streams and to provide for grade separation will be required in extending construction to Five Islands Road. Survey and design is now being undertaken on the section from Ghosts Creek to Five Islands Road. Extension northwards will provide relief to the present traffic congestion at Fairy Meadow where over 26,000 vehicles per day are using the existing two-lane highway. This work will involve the construction of a major junction at North Wollongong.

<

A section of the Arterial Route showing one completed carriageway. Overbridges have been constructed to the full length required to span both carriageways

Plant engaged on snow clearing

SNOW

MOUNT KO

oad closed at The Smiggin Holes after exceptionally heavy snowfalls

EARING

USKO ROAD

The road is cleared of snow near the Hotel Kosciusko

MOUNT KOSCIUSKO ROAD

MAIN ROAD No. 286

Section from Jindabyne to the Summit

THE Kosciusko State Park, the largest park in Australia, embraces an area of more than 2,000 square miles of the Australian Alps, including Mount Kosciusko (7,314 feet). It is an impressive area of year-round tourist attraction. Not only is Mount Kosciusko the highest peak in the country, but the vast slopes of the main range of the alps offer unique sights for the tourist. In winter the slopes are snow-covered, providing a fast developing area for winter sports and in summer the scenic beauty is an attraction to visitors.

Linking this area to the arterial network of Main Roads in New South Wales is the Mt. Kosciusko Road, Main Road No. 286, extending from the Snowy Mountains Highway 5 miles west of Cooma through Berridale and Jindabyne and thence through Wilson's Valley, Rennix Gap, The Smiggin Holes, and Perisher Valley to the summit of Mount Kosciusko. The full length of Main Road No. 286 is about 64 miles and from the township of New Jindabyne to the summit is 31·5 miles.

The section of this road from Jindabyne to the summit of Mt. Kosciusko was originally constructed by the Department of Public Works about 1909 as a National Work. Responsibility for its maintenance and improvement was transferred to the Main Roads Board in 1928.

In addition to normal road maintenance including snow clearing, the Main Roads Board and subsequently the Department of Main Roads has carried out a programme of gradual improvement by constructing concrete bridges and culverts at the major stream crossings and widening the pavement. However, it recently became obvious that with the increasing popularity of the area and the consequent increase in traffic on the road, there should be an accelerated programme for extensive improvement.

In the summer of 1963-64 the Department put in hand a programme of roadworks, involving an expenditure of £300,000 during that year with the intention of continuing work at least at this rate until a bitumen surfaced road was completed to the summit of Mount Kosciusko.

By the end of June, 1964 the first section of bitumen surfaced pavement was completed on the section of Main Road No. 286 to the west of Jindabyne. A total length of 10·18 miles was sealed by the Department and a length of 1·5 miles was sealed by the Snowy Mountains Hydro-Electric Authority, to give access to the town of New Jindabyne.

Apart from the work being carried out by the Department, a major deviation is being constructed by the Snowy Mountains Hydro-Electric Authority to provide a deviation around Jindabyne Dam. The total length of this deviation is 12·05 miles, of which the section to the west of the Snowy River, a length of 7·30 miles, is now in use. The Department sealed 6·38 miles of this deviation in the 1963-64 programme.

The Department's reconstruction programme is aimed initially at providing a good standard bitumen surfaced road to The Smiggin Holes, about 19 miles from Jindabyne, but reconstruction will be carried out year by year until the summit is reached.

Reconstruction under the current programme is aimed at providing the maximum improvement as quickly as possible and the work is being carried out in two separate sections:—

(1) Working generally from the Jindabyne Deviation westwards to provide as long a length as possible of sealed road from Jindabyne.

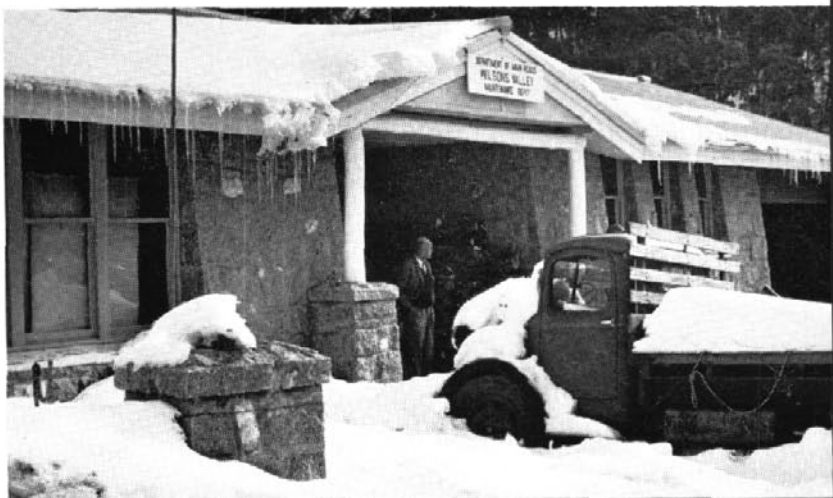
(2) Commencing at the turn-off to Island Bend with the heavier type of construction required above the snow-line, and working westwards so that a sealed pavement will be provided on the steeper grades from this point to Wragges Creek. This length of about 2·5 miles includes a number of steep grades where drivers have experienced difficulty under heavy snow conditions.

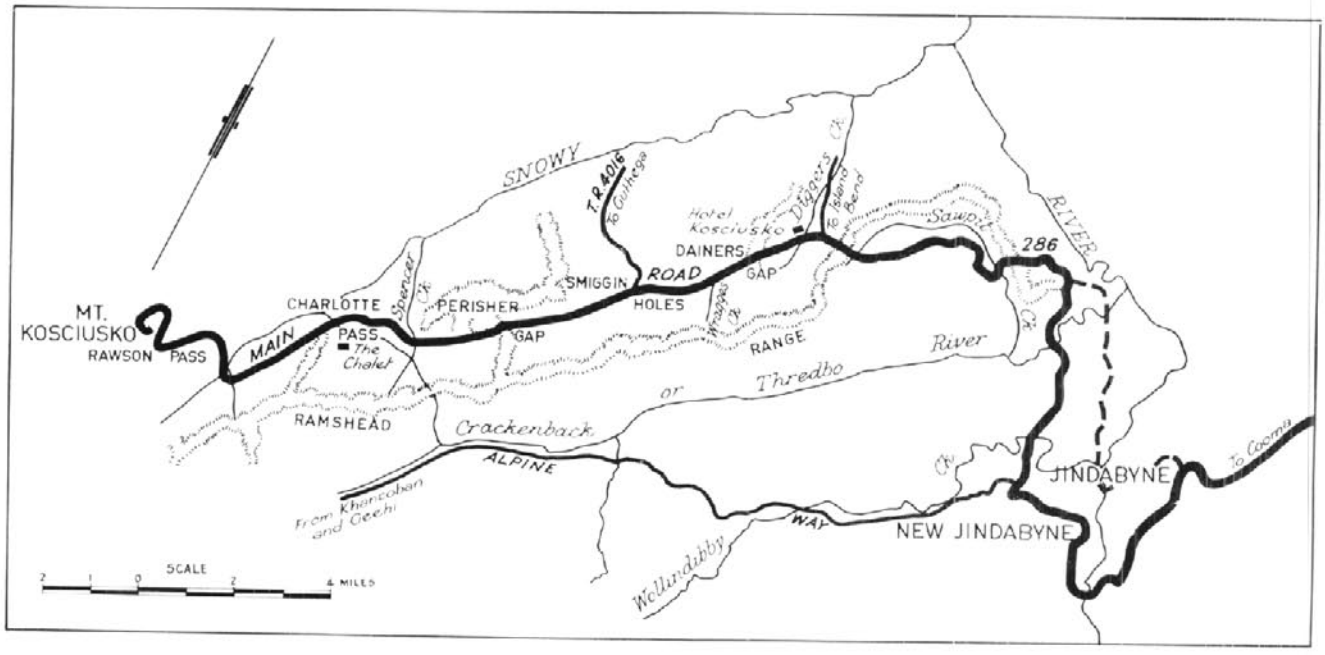
Special construction methods are necessary above the snow-line due to saturation of the subgrade during thaw

Parking area at Sawpit Creek adjacent to Main Road No. 286

Section of the deviation around Jindabyne

The Department of Main Roads Maintenance Depot at Wilson's Valley





Locality Sketch

Perisher Valley

The Smiggin Holes

Charlotte Pass

periods, risk of heaving due to freezing, and mechanical damage caused by snow ploughs and vehicle chains.

Above Dainer's Gap the reconstructed pavement consists of about 12-inches thickness of compacted gravel as a sub-base, a 9-inches thick base course of free-draining crushed rock, and a surface course of $2\frac{1}{2}$ inches of crushed metal penetrated with hot bitumen and sealed with hot bitumen and $\frac{3}{8}$-inch crushed metal cover aggregate.

Above the snow-line, particular care also has to be taken to protect the new work from erosion, as natural re-growth is very slow. The Department has sought the advice and assistance on this subject from the Soil Conservation Service of New South Wales and the Department of the Interior, Canberra.

Special equipment is being made available from the Department of the Interior to enable speedy and efficient re-vegetation of batters. The machine, a batter-stabilizer, consists of a mobile gun which blows a mixture of seed and fertilizer on to the batters. It also spreads a protective cover of chopped straw and bitumen emulsion which holds and protects the seed during germination. This work is generally carried out in the year following construction, because of the limited period available for construction and the necessity for seeding while the ground is warm.

In addition to improvements to the actual roadway, progressive improvements are being made to the Department's snow-clearing organisation. In the winter of 1963, three blower-type units, three new snow ploughs mounted on four-wheel drive vehicles, and two lighter trucks fitted with snow ploughs and mechanical spreaders were added to the equipment available.

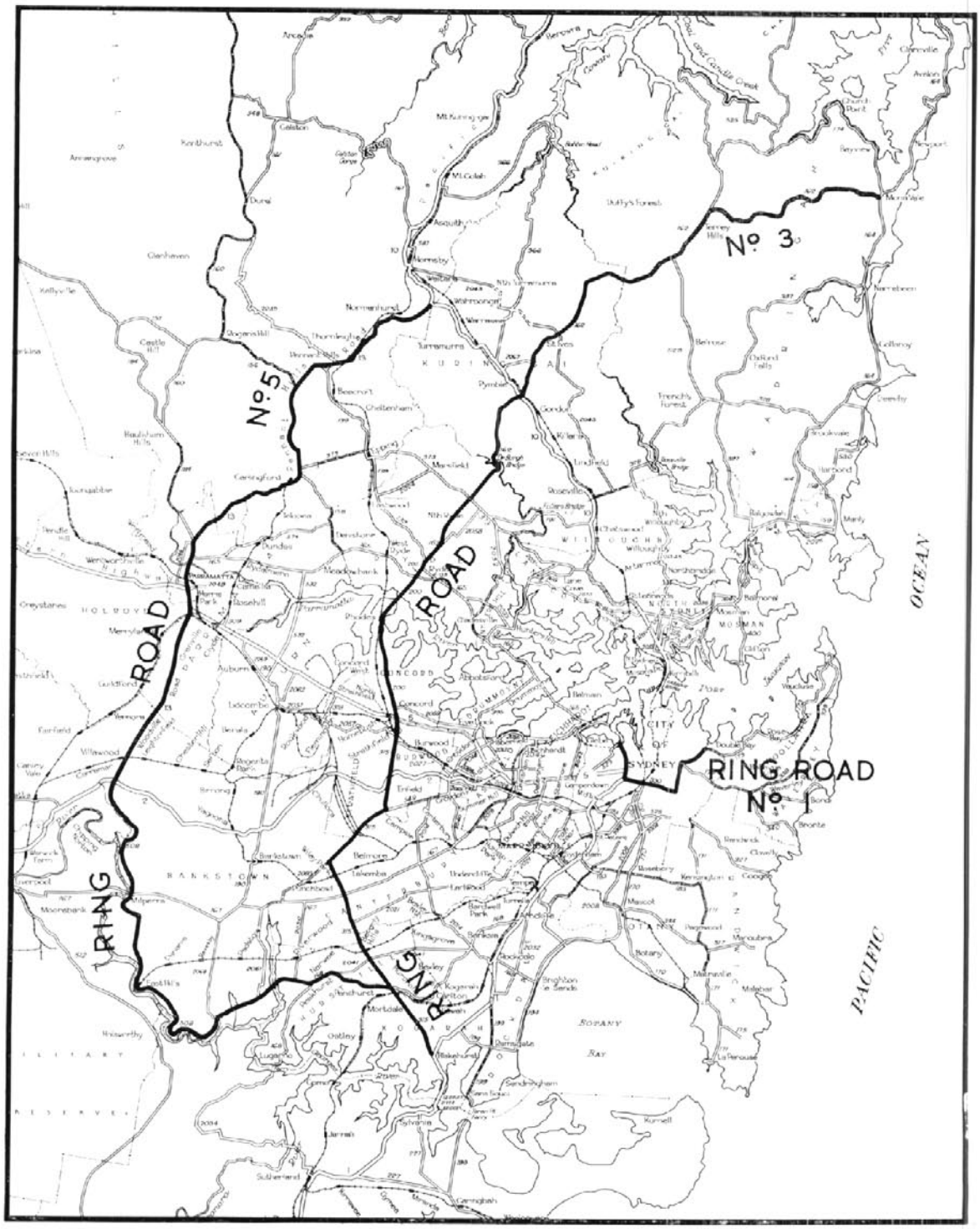
The mechanical spreaders are used for spreading a thin layer of a sand and calcium chloride mixture over the surface of the road. The calcium chloride lowers the melting point of ice on the pavement, thus preventing pavement icing. The sand improves vehicular traction.

Whilst coarse salt and calcium chloride have been used for many years in other countries, their use in New South Wales has been limited. Calcium chloride is used by the Department in preference to salt, as it is less likely to cause corrosion to the underside of vehicles. It is expected that its use will improve driving conditions on icy pavements.

The additional snow clearing vehicles purchased and put into operation for the 1964 season are described on page 6 of this issue.

The improved snow-clearing fleet, part of which will be used between Adaminaby and Kiandra on the Snowy Mountains Highway (State Highway No. 4) will, under other than exceptional conditions, enable the road from Jindabyne to Smiggin Holes to be kept open continuously during each winter. Because of the exceptionally heavy falls of snow and blizzard conditions during the early part of this season, both roads were temporarily closed.

SYDNEY METROPOLITAN RING ROADS SIGNPOSTING



Ring Road Information Sign

The Deputy Premier and Minister for Highways, Mr. P. D. Hills, watching the first Ring Road Sign being placed in position

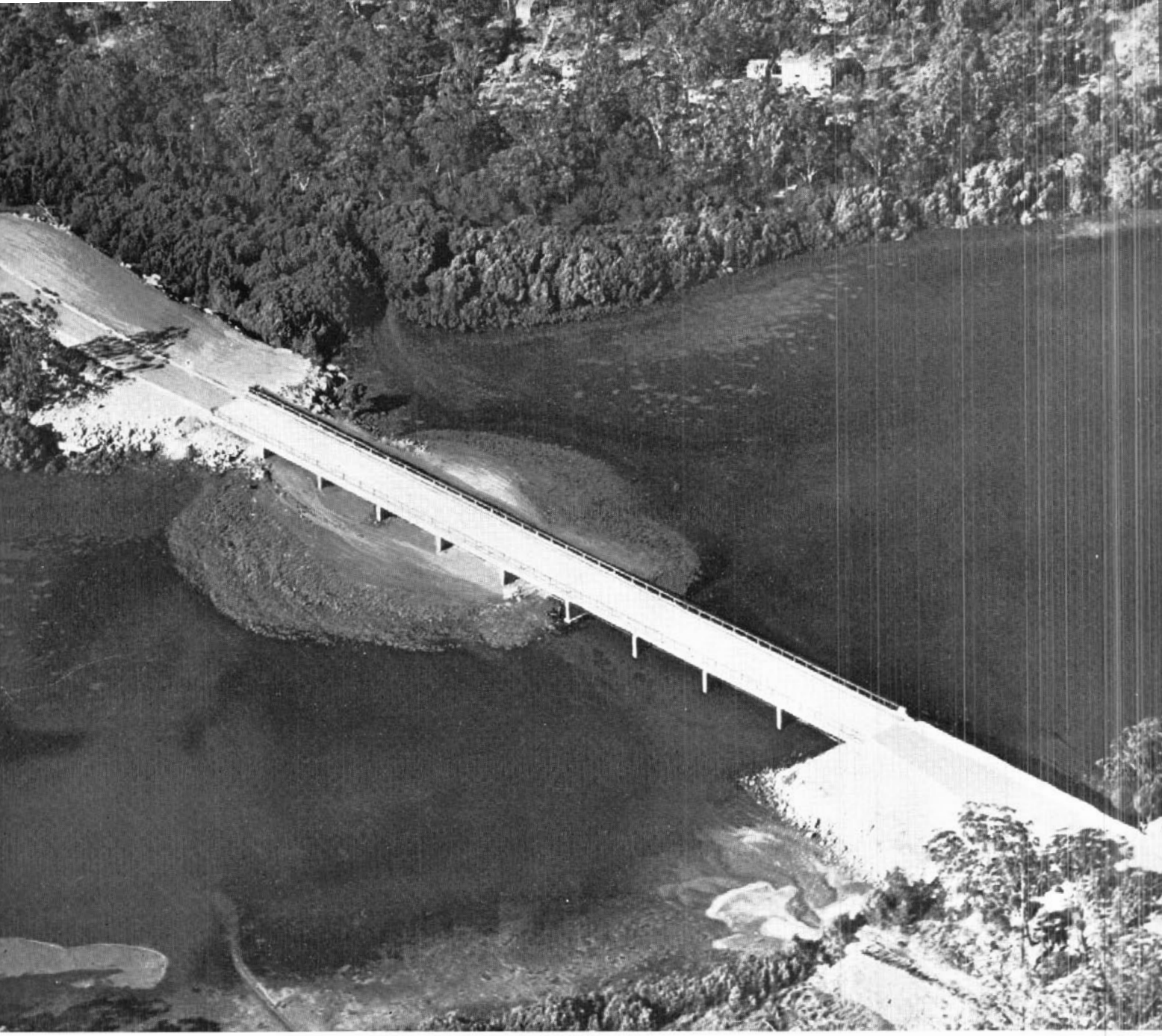
Three main road routes in the Sydney metropolitan area have been selected for special signposting, on a trial basis, as ring routes to guide traffic around the more congested inner areas of the City.

The first ring road route signs were placed in position on 28th August, 1964.

The trial signs are distinctive and unlike any other signs used in Australia. They are 17½ inches in diameter, the route number being indicated by a 7 inch high white numeral within a white shield. The background of the sign is blue and the whole sign is made up from reflective material.

To fully mark the three routes, 263 signs will be required. They will be erected at intervals and at turns along each route and at points of entry to each route.

In addition to the ring road route signs, special information signs, showing localities through which the route passes, will be erected near the beginning, mid-way and towards the end of each route. They will also be erected close to the points of entry to the ring routes on all important Main Roads which junction with or cross a ring road. These signs are about nine feet long and five feet high.



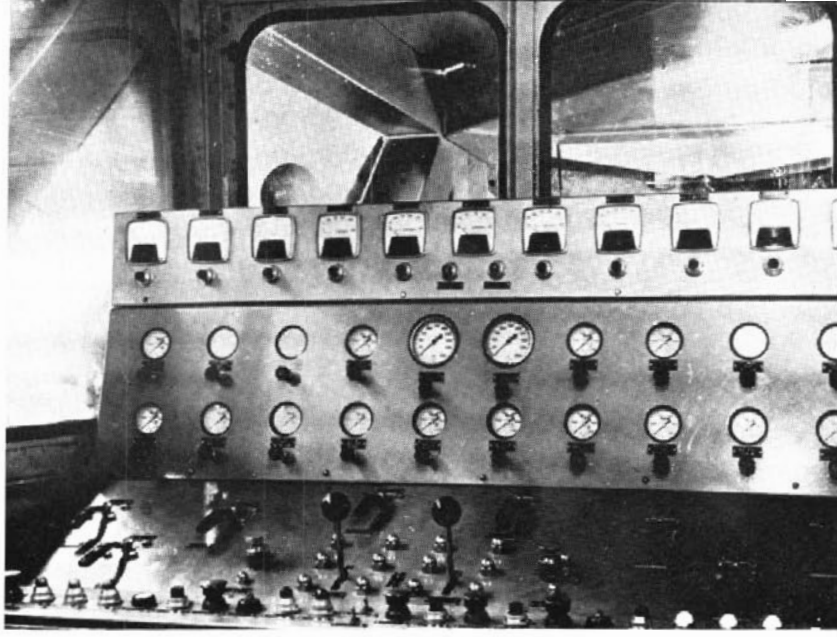
Bridge over Salt Pan Creek

A new bridge over Salt Pan Creek was opened to traffic on Friday, 11th September, 1964. The Deputy Premier and Minister for Highways, the Hon. P. D. Hills, M.L.A., performed the opening ceremony.

The new bridge, illustrated above, is a prestressed and reinforced concrete structure, 600 feet long. The carriageway is 28 feet wide and a footway is provided on the southern side. A smaller bridge, 75 feet long, has been constructed in the eastern approach. Another bridge, over Little Salt Pan Creek, was completed and opened to traffic in September, 1963.

These three bridges and the associated roadworks connecting them form part of Henry Lawson Drive, which for the greater part of its length follows the George's River, and which now completes a circumferential route for traffic between Illawarra, South-Western and Western Suburbs.

EQUIPMENT FOR BORING TUNNELS



The Operator's control panel

THE Assistant Commissioner for Main Roads, Mr. R. J. S. Thomas, accompanied by the Chief Engineer of the Department of Main Roads, Mr. T. M. Coulter, visited Pakistan in July 1964, to inspect construction work being carried out on a hydro-electric and irrigation scheme on the Jhelum River at Mangla, about 800 miles from Karachi.

The inspection was primarily to evaluate the work of a " Mole ", a large tunnel boring machine. Technical information relating to this machine and its work could be of benefit to the Department should the occasion arise when it may have to tunnel in soft rocks, such as sandstone.

The capacity of the machine and the speed of tunnelling were impressive. The bore under inspection was 36 feet 8 inches in diameter and one tunnel, 1,500 feet in length, was bored in one calendar month.

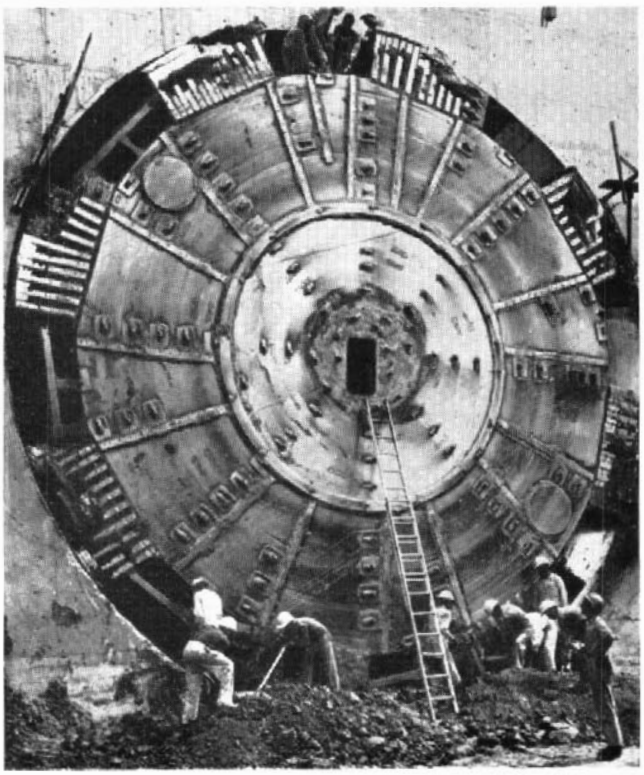
In the work inspected there was no excess of excavation which often occurs when using explosives with conventional tunnelling methods and there were no vibration or noise problems which occur when explosives are used.

The boring tool is a rotating head carrying a number of cutting edges mounted on a carriage. The carriage also supports an operator's air-conditioned control room and facilities for placing steel supports within three feet of the working face.

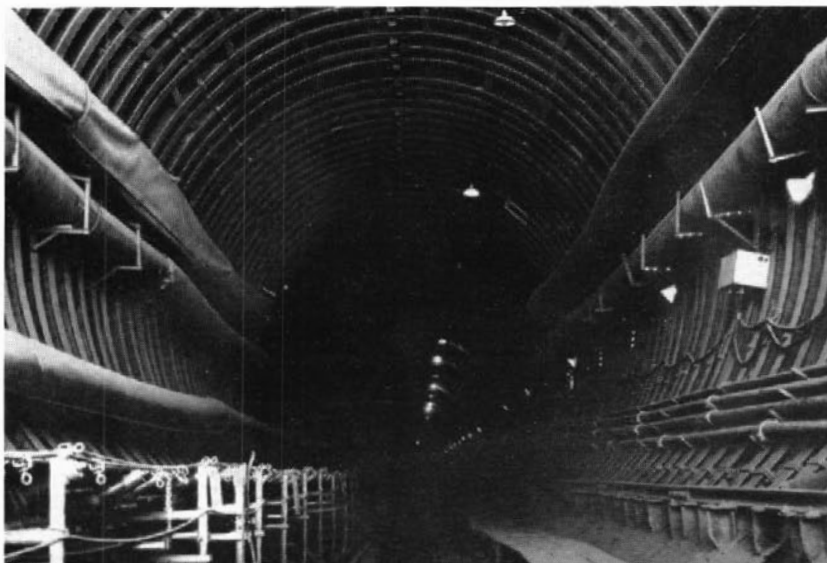
The excavated material is delivered from revolving buckets on the cutting head to a conveyor belt for disposal outside the tunnel. The whole unit is electrically operated.

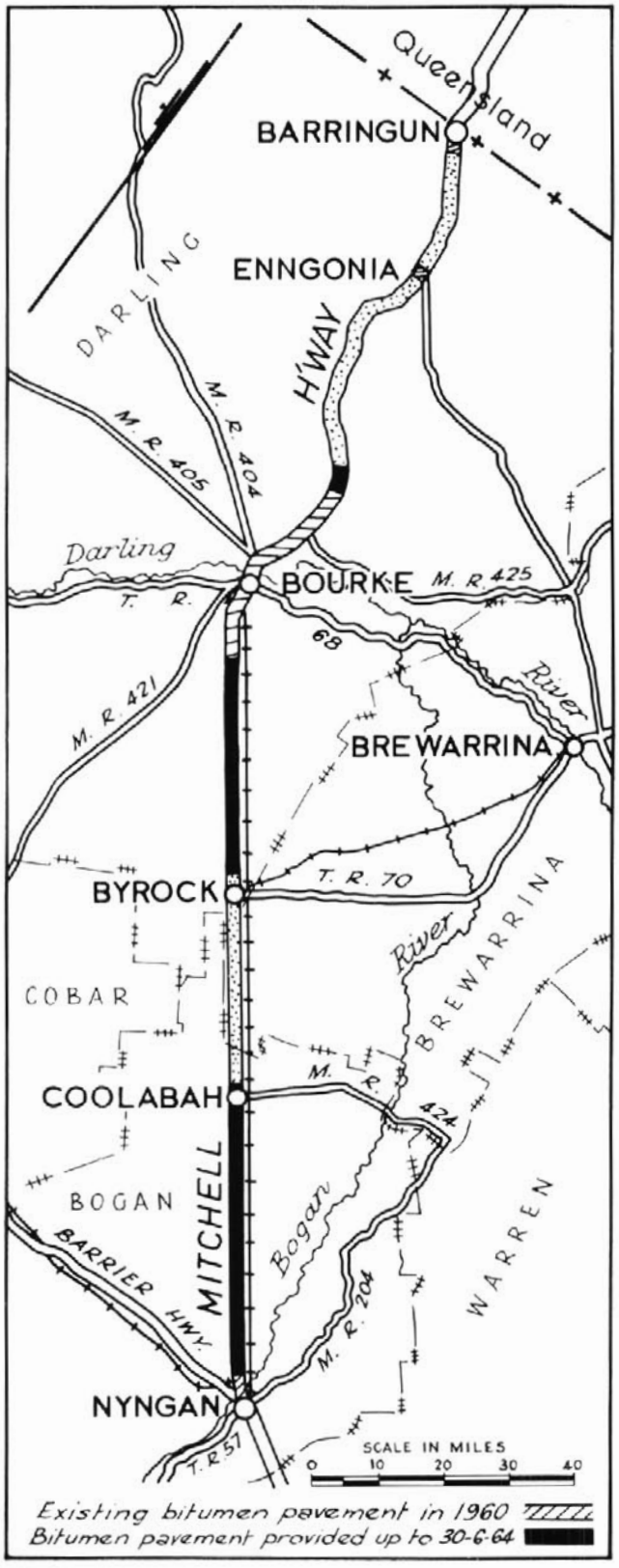
The machine has to be designed and built for each particular size of bore.

The cutting face of the boring machine



A section of tunnel bored by the Mole machine





Locality Sketch

NYNGAN TO BARRINGUN

Bitumen Surfacing the Mitchell Highway

FOR several years the Department has been carrying out an intensive programme of extensions to the lengths of bitumen surface on the network of State Highways in New South Wales. There are 6,533 miles of State Highways, of which 4,750 miles have a dustless surface. Most of the bitumen surface yet to be provided is on Highways in the western areas of the State and a policy of progressive development of these Highways is being followed with the object of the early completion of a fully surfaced Highways system.

In keeping with this policy the Department, in 1960, commenced the reconstruction and bitumen surfacing of the Mitchell Highway (State Highway No. 7) from Nyngan north-westerly to the Queensland border near Barringun. At that time, a continuous length of bitumen surfaced pavement linked Nyngan with Sydney.

The total distance between Nyngan and Barringun is 214 miles. Prior to the commencement of the work in 1960, only 32 miles of this length were bitumen surfaced. The sections of bitumen surface extended from Nyngan to one mile north of Nyngan, from 15 miles south of Bourke to 15 miles north of Bourke, with short lengths through the villages of Coolabah, Byrock, Enngonia and Barringun. The remaining lengths totalling 182 miles consisted of unsurfaced pavement generally formed of naturally occurring soils.

By 30th June, 1964, an additional 86 miles of bitumen surfaced pavement had been provided on this highway with the completion of the sections from 1 mile to 48·6 miles north of Nyngan, 15 miles to 47·4 miles south of Bourke and 15 miles to 21 miles north of Bourke. The accompanying locality sketch shows the location of the bitumen surfaced pavement in 1960 and the extensions to June, 1964.

The road is located in generally flat country with gentle undulations on some sections. The area served by the road is sparsely settled and the land is used principally for wool growing.

The construction work, including bitumen surfacing, is being carried out by the Department by day labour. At the commencement of this work in 1960, a Works Office was already established at Bourke.

In order to expedite the reconstruction and bitumen surfacing of the highway the Department decided to establish another Works Office at Nyngan to carry out works simultaneously from Nyngan and Bourke. Two organisations based on these two Works Offices, each under the control of a Works Engineer, have been working continuously on the reconstruction of the highway since 1960. Camps for the accommodation of the men employed on the road work have been provided at various convenient locations along the route of the road.

The road project from Nyngan to Barringun is one of reconstruction and improvement of an existing unsurfaced pavement. As the existing alignment is generally satisfactory, no major deviations have been necessary.

Engineering Surveys have been carried out by the Department's Surveyors although some sections have been surveyed by private Surveyors under contract to the Department.

The road design is being undertaken by the Department, the design standards adopted being—

Design Speed	60 m.p.h.
Pavement width	22 feet
Formation width	34 feet

The work is located in a low rainfall zone, and problems have been encountered in obtaining sufficient natural supplies of water for road construction purposes, particularly in the Bourke-Byrock area. In addition to purchasing water from private property owners and from ground tanks controlled by the Pastures Protection Boards and the Railways Department, a number of ground tanks have been excavated along the route of the road for the purposes of storing water for roadworks. Also, the Water Conservation and Irrigation Commission sank two bores for the Department at 26 miles and 38 miles south of Bourke. Water was obtained from the bore at 26 miles and this bore has operated successfully.

Some sections of pavement where natural gravels suitable for use in the surface course of the pavement were not available within economical haulage distance were cement stabilised. Experimental lengths of pavement incorporating bitumen emulsion and cement-stabilised edge strips have also been constructed.

The total cost of construction to June 1964, including the establishment of the Nyngan Works Office, was approximately £1,162,000.

The Department's objective is to complete the bitumen surfacing of the section between Nyngan and Bourke in 1965 and then proceed with the section north of Bourke commencing first on the length between Enngonia and Barringun.

Construction work in progress on State Highway No. 7 about 61 miles north of Nyngan

Reconstructed section of Mitchell Highway about 36 miles north of Nyngan

Reconstructed section 46 miles south of Bourke

TRAFFIC LINEMARKING MACHINES

MOST of the centre-line road marking in this State is now performed by self-propelled traffic linemarking machines designed by the Department and constructed at its Central Workshops.

The machines were developed for operation by two men, a driver and a spray gun operator. The linemarkers are capable of applying plain or bearded lines in a single or double line system. Either one or two colours may be used in a combination of broken and continuous markings. In the construction of the machines, industrial and automotive components, for which spare parts and service facilities are readily available, were used wherever practicable.

Power from a 4-cylinder air cooled petrol engine is transferred through a conventional single plate clutch, 4-speed automotive transmission and transfer box to a spiral bevel drive rear axle. A novel feature is the articulated steering in which the separate forward and rear chassis sections are connected at a central pivot. The compound pivot joint also allows independent transverse twisting of the front and rear sections. When marking small radius curves, the articulated steering enables the spray gun assembly to accurately follow the guide arm and pointer which is mounted on the front of the machine. Power-assisted steering is fitted and a rotary vane type air compressor driven from the engine power take-off provides compressed air for operation of spray guns and paint tank agitators.

The linemarker carries 44 gallons each of white and yellow paint in pressurised containers mounted at the rear of the vehicle and 360 lbs. of reflective glass beads in a container mounted above the spray guns. The machine weighs 3 tons fully laden and is designed to negotiate a gradient of 18 per cent. The maximum travel speed is 15 miles per hour and where long distances are involved, the machine is transported on a tandem axle trailer developed for the purpose.

Five automatic spray guns grouped between the front wheels are so positioned that any normal spray pattern can be selected without side movement of the spray guns.

A bead dispenser fed from the bulk bead storage tank is fitted with adjustable flow gates and pneumatic vibrator to achieve free flow of beads and close control over the application rate. The dispenser is synchronised with the spray guns to enable simultaneous operation with any selected gun.

Broken centre lines are applied by medium of a cam mechanism driven by a fifth wheel. Interchangeable cams may be fitted to produce different spray patterns.

All linemarking functions are controlled by operation of electric solenoid control valves. Application of a particular line combination is initiated by the operator closing a switch on the control panel thereby energising the appropriate gun and bead control circuit. Intermittent paint application for broken lines is controlled by a micro-switch actuated by the fifth wheel and cam mechanism. The machine sprays at speeds up to 10 miles per hour.

Traffic Linemarking Machine

"Drabbles" and "Maltings" Overbridges near Mittagong

Elimination from route of Hume Highway

TRAVELLERS who have passed along the Hume Highway will recall the two bridges, known as "Drabbles" and "Maltings", across the Main Southern Railway Line on the Sydney side of Mittagong. Each has sharp curves on both approaches and steep grades. Located between them is a small timber bridge known as "Oaklands" Bridge. The three bridges and approaches constitute a one half-mile section of poorly-aligned and graded Highway with a bad record for traffic accidents.

The Department of Main Roads has eliminated the section by construction of a deviation. The line selected for the deviation is located entirely on the western side of the Main Southern Railway Line, and crosses the Picton Loop Railway Line and also the Nattai River. (See locality sketch.) Thus, the deviation replaces three bridges with two.

The deviation has been designed to make provision ultimately for dual carriageways, but only one carriageway has been constructed at this stage to meet existing traffic requirements.

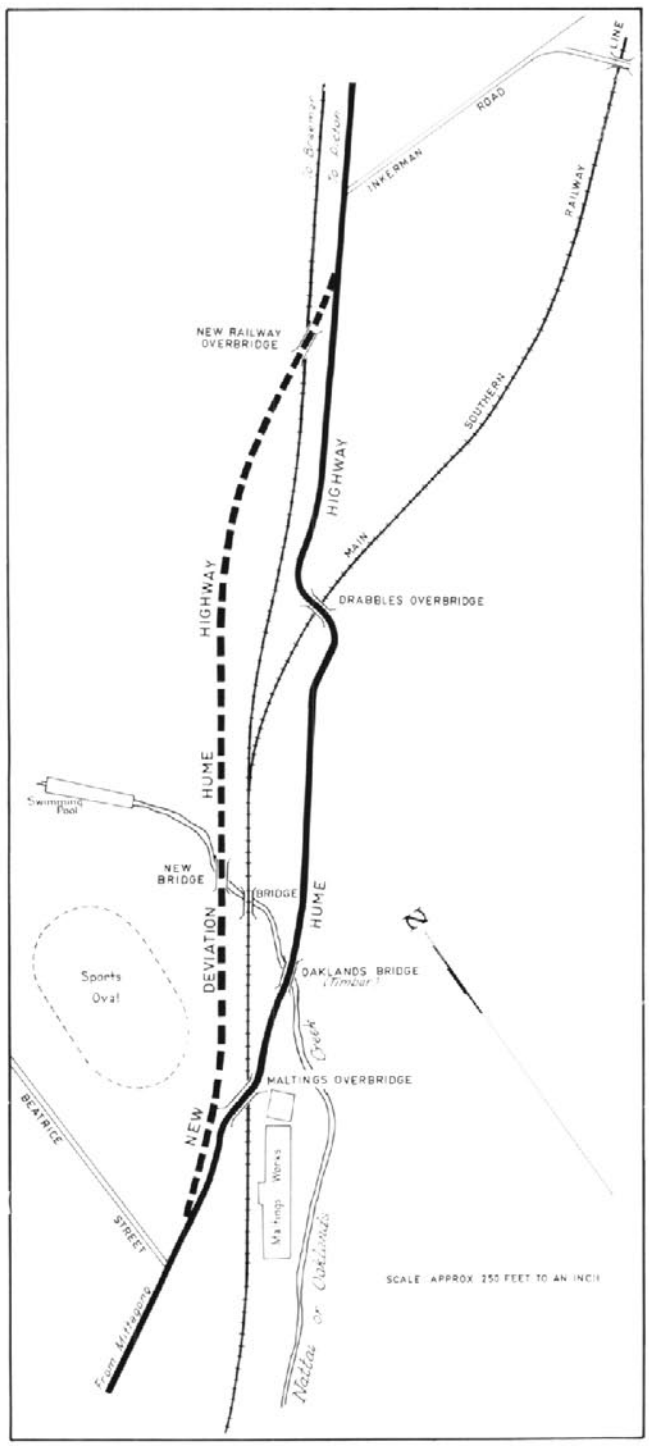
Work on the deviation commenced in September 1962, with the construction of the new bridge over the Nattai River by contract to the Department of Main Roads. Built of reinforced concrete, it is on a 30° skew to the river, has three 25-feet spans and is 28 feet wide between kerbs. It was completed in June, 1963.

The Department of Railways designed and built the bridge over the Picton Loop Railway Line. The unusual features of this structure are that it carries the road at a skew of approximately 70° to the railway line and because of this skew and curves in each approach, a warped deck surface is required to give the correct shape of pavement. This was provided by plant-mixed bituminous materials placed on the concrete deck.

The Department of Main Roads commenced the construction of the road formation by day labour in August, 1963. The new roadworks are three-quarters of a mile in length. The formation width is 44 feet except on the high embankment on the approaches to the railway overbridge, where it is 36 feet.

More than 43,000 cubic yards of earthworks were involved in the deviation of which 36,000 cubic yards were borrowed from a pit established approximately three-quarters of a mile from the work.

The new road crosses land which consists of a layer of silty loam about 4 feet thick overlying a fine sandstone



The new route seen from the air. The old route showing the three narrow bridges is on the right of the photograph

rock. A feature of the area is the existence of a large number of springs and seepages. Road construction was commenced following an abnormally long wet season when the ground was saturated and difficult to work. Considerable care was required in preparing the road-bed to provide for drainage of the springs and seepages and in preparing the haulage roads to the borrow pit.

A pavement 24 feet wide has been provided, and was constructed with a basecourse of a local sandy loam and a surface course of fine crushed rock (basalt). It is designed to carry the heavy loading to which the Hume Highway is subjected. Initially, the pavement has been finished with a flush seal of hot bitumen with aggregate cover, to be followed at a later date by the provision of an asphaltic concrete surface.

As stated earlier, the two railway overbridges on the old route of the Highway were known as the " Drabbles" and " Maltings " overbridges. The " Drabbles " overbridge, which is the northernmost of the two, derived its name from William Drabble, who was a resident of the area about 1900. He was a former Mayor of the old Municipality of Mittagong. The latter took its name from the adjoining Maltings works of Tooth & Co. Ltd.

TENDERS ACCEPTED BY COUNCILS

The following tenders (in excess of £3,000) were accepted by the respective Councils for Road and Bridge Works for the three months ended 30th June, 1964.

Council	Road No.	Work or Service	Name of Accepted Tenderer	Amount £ s. d.
Ashford	T.R. 63 M.R. 137	Bitumen surfacing various sections	Emoleum (Aust.) Ltd.	3,504 18 8
Boomi	M.R. 232	Construction of a 3-span reinforced concrete bridge, 105 feet long, over Carore Creek, 7 m. from Moree.	N. Del Gatto	24,899 6 0
Campbelltown	M.R. 179A	Construction of approaches to bridge over Water Race Creek, 2·43 m. from Main Road No. 178.	Colbind Pty. Ltd.	3,453 7 0
Coolah	T.R. 62	Construction of a 4-span reinforced concrete bridge, 100 feet long, over Croppy Creek, 8 miles from Coolah.	Central Constructions Pty. Ltd.	15,873 0 0
Coolah	T.R. 77	Supply and delivery of 1,140 cubic yards of aggregate to stockpiles between 3 m. and 7 m. west of Dunedoo.	N. C. & A. D. Bennett	3,420 0 0
Coonabarabran	T.R. 55 and M.R. s 129 and 329.	Bitumen surfacing various sections	Emoleum (Aust.) Ltd.	9,646 10 9
Cessnock	M.R. 218	Construction of reinforced concrete footway adjoining bridge over Chinamans Hollow at Weston.	Austral Reinforcing Services Pty. Ltd.	3,646 18 0
Demondrille	T.R. 84	Supply and delivery of 910 cubic yards of aggregate to stockpiles at various locations.	Downes Bros.	3,022 10 0
Dumaresq	S.H. 9	Construction of a 5-span reinforced concrete bridge, 125 feet long over Saumarez Creek, 5·60 m. south of Armidale.	Dayal Singh Construction Pty. Ltd.	20,522 0 5
Guyra	M.R. 135	Bitumen surfacing of various sections east and west of Guyra.	Emoleum (Aust.) Ltd.	6,240 7 11
Jindalee	T.R. s 84 and 87, M.R. 235.	Supply and spraying of 15,130 gallons of bitumen at various locations.	Boral Road Services Pty. Ltd.	3,446 2 7
Lismore	T.R. 65	Supply and spraying of 26,019 gallons of bitumen and 2,602 gallons of flux between 1·38 m. and 3 m. east of Lismore.	Boral Road Services Pty. Ltd.	5,366 8 9
Liverpool Plains	T.R. 55	Construction of a 6-span reinforced concrete bridge, 189 feet long, over McPhersons Gully, 4 m. north of Tambar Springs.	S. Turner & Sons Pty. Ltd.	20,925 0 0
Liverpool Plains	T.R. 55	Construction of channel and levee banks approximately 1·50 m. long at McPhersons Gully, 4 m. north of Tambar Springs.	Dayal Singh Constructions Pty. Ltd.	12,249 15 0
Manilla	T.R. 63	Road construction including earth works and gravel paving between 20·87 m. and 22·62 m. north of Tamworth.	C. T. Marshall	9,147 0 4
Murrumbidgee	D.R. 1283	Construction between 9·90 m. and 19·70 m. south of Sturt Highway (S.H. No. 14).	Ryan Bros.	6,135 8 4
Muswellbrook	M.R. 208	Construction of a 3-cell 10 ft. x 10 ft. reinforced concrete box culvert at Dingo Gully, 8 m. from Sandy Hollow.	Austral Reinforcing Services Pty. Ltd.	6,592 10 0
Narraburra	T.R. s 57 and 84, M.R. 398.	Bitumen surfacing various sections	Boral Road Services Pty. Ltd.	5,790 11 5
Narrandera	M.R. 387	Supply and delivery of 1,410 cubic yards of aggregate to stockpiles between 4.70 m. and 12·40 m. west of Coolamon Shire boundary.	Ganmain Quarrying Co.	4,210 3 3
Oberon	M.R. 253	Road construction, including gravelling and construction of culverts between 2·02 m. and 5·45 m. from Oberon.	A. H. Bowie Pty. Ltd.	13,596 0 6
Oberon	M.R. 253	Reconstruction and gravelling between 6·28 m. and 8.46 m. from Oberon.	G. Abignano Pty. Ltd.	13,777 2 0
Oberon	M.R. 256	Construction of two 3-span, 105 feet long bridges using precast, pretensioned bridge units, over Little River and Running Stream at Porters Retreat.	Leewill Constructions Pty. Ltd.	35,987 0 0
Patrick Plains	M.R. 503	Construction of a 5-span reinforced concrete bridge, 165 feet long over Loders Creek, 6·26 m. south of Singleton.	Central Constructions Pty. Ltd.	25,550 0 0
Scone	T.R. 62	Bitumen surfacing between 13 m. and 14·50 m. west of Scone.	Boral Road Services Pty. Ltd.	5,279 6 2
Scone	M.R. 105	Construction, including culverts, and paving with gravel between 9·02 m. and 11 m. east of Scone.	Gama Constructions	18,317 10 0
Shoalhaven	S.H. 1	Reconstruction and cement stabilisation of Kinghorne Street, Nowra.	Unipave Constructions Pty. Ltd.	9,132 0 0
Shoalhaven	S.H. 1	Supply and laying of bituminous macadam in Kinghorne Street, Nowra.	Bituminous Pavements Pty. Ltd.	5,546 0 0
Taffaganda	T.R. 51	Construction of approaches to bridge over Mongarlowe River, 16 m. from Braidwood.	Horrex Pty. Ltd.	20,309 14 4

TENDERS ACCEPTED BY COUNCILS — continued

Council	Road No.	Work or Service	Name of Accepted Tenderer	Amount
				£ s. d.
Tumut ..	T.R. 85 ..	Reconstruction and bitumen surfacing between 3·11 m. and 6·40 m. from Snowy Mountains Highway (S.H. No. 4) at Gilmore.	Horrex Pty. Ltd. ..	26,467 3 8
Wakool ..	M.R. 319 ..	Construction of a 4-span steel and reinforced concrete bridge, 226 feet long over flood plain, 4·50 m. north of Barham.	Green Bros. Epsom Pty. Ltd.	25,019 14 6
Walcha ..	S.H. 11 ..	Construction of a 2-span reinforced concrete bridge, 50 feet long over Reedy Creek, 9·50 m. east of Walcha.	Kennedy Bros.	7,972 18 0
Warren ..	D.W. 3021	Installation of 26 precast concrete box culverts and pipe culverts including headwalls, between 1·20 m. and 27·50 m. north from Marra Creek.	J. M. Oriel & Sons ..	4,120 0 0
Wingecarribee ..	D.R. 1299 ..	Construction between 4m. and 8 m. from Canyonleigh Road.	J. T. Hawkins	4,352 7 0

TENDERS ACCEPTED BY DEPARTMENT OF MAIN ROADS

The following tenders (in excess of £3,000) for Road and Bridge Works were accepted by the Department during the three months ended 30th June, 1964.

Work or Service	Name of Accepted Tenderer	Amount
		£ s. d.
State Highway No. 2—Hume Highway, Shire of Wollondilly. Construction of a 2-span reinforced concrete bridge 60 feet long, over Myrtle Creek 3·50 m. south of Picton.	Gromat Constructions	11,333 0 0
State Highway No. 10—Pacific Highway, Shire of Tintenbar. Supply and delivery of 42 tons of mild steel reinforcement to bridge being constructed over Emigrant Creek 3·40 m. south of Ballina.	Stewarts & Lloyds Pty. Ltd.	3,010 5 0
State Highway No. 10—Pacific Highway, Shire of Stroud. Supply of filling material and construction of southern approach to bridge over Myall River at Bulahdelah.	Goodsir & Cooper Pty. Ltd.	66,739 11 8
State Highway No. 14—Sturt Highway, Shire of Narrandera. Construction of an 8-cell, 6 feet x 2 feet reinforced concrete box culvert, 1·30 m. west of Gillenbah.	Siebels Bros. Pty. Ltd.	3,101 12 0
State Highway No. 17—Newell Highway, Shire of Namoi. Supply and delivery of 196 precast, pretensioned concrete bridge planks and 12 precast, pretensioned piles for bridge over Pan Creek, 21·30 m. north of Narrabri.	A. Goor Pty. Ltd.	4,758 0 0
State Highway No. 22—Silver City Highway, Shire of Wentworth. Supply, delivery and erection of steelwork for and final completion of two 24-feet wide bridges, one 11 spans with overall length of 528 feet and one 5 spans with overall length of 240 feet, over the Great Ana Branch of the Darling River at Bunneringee.	L. M. Robertson Construction Co. ..	103,887 0 0
Trunk Road No. 68—Shire of Darling. Construction of approaches to bridge over Bogan River at Beemery, including pipe culverts.	G. E. G. & J. Muggleton	12,354 17 10
Trunk Road No. 83—Shire of Copmanhurst. Construction of a 3-span reinforced concrete bridge, 105 feet long over creek at Selection Flat, 41 m. north of Grafton.	Central Constructions Pty. Ltd. ..	15,024 0 0
Main Road No. 108—City of Newcastle. Erection of steelwork in superstructure, placing of concrete deck and final completion of bridge over South Arm of Hunter River at Tourle Street, Mayfield.	Transfield Pty. Ltd.	58,486 14 0

MAIN ROADS STANDARD SPECIFICATIONS

Note: Drawings are prefixed by letter "A", instructions are so described; all other items are specifications or forms
(Revised schedule September, 1963)

ROAD SURVEY AND DESIGN

	Form No.
Design of two-lane rural highways (Instruction) (1960)	355, 355A, 355B
Design of urban roads (Instruction)	369
Design of intersections (Instruction)	288
Design of acceleration and deceleration lanes (Instruction)	402
Design of kerb-lines and splays at corners (Instruction)	499
Design of subsoil and subgrade drainage (Instruction)	513
Horizontal curve transitions for 30, 40, 50 and 60 M.P.H. design speeds. (1963.)	A 1488, A, B and C.
Method of setting out horizontal curve transitions	A 1487

STREET DRAINAGE

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Concrete kerb and gutter, light type	A 221
Gully grating	A 190
Gully pit, Specification (245) and Drawings; gully pit with grating (A 1042); kerb inlet only (A 1043); grating and extended kerb inlet (A 1352); extended kerb inlet only (A 1353).	
Integral concrete kerb and gutter	243
Mountable type kerb with reflectors	A 3536
Perambulator ramp	A 3491
Vehicle dish crossing	A 134A
Waterway calculations for urban drainage (Instruction) (Reprint of part of M.R. Form No. 371)	371B

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Three cell, height of opening 4 ft. to 7 ft. (A 1033-36); 8 ft. (A 1038); 9 ft. (A 1040); 10 ft. to 12 ft. (A 4843-45).	
Four cell; height of opening 4 ft. to 12 ft.	A 4846-54
Reinforced concrete box culverts with concrete wearing surface and concrete handrailing, heights of opening 3 ft. to 12 ft. 1, 2, 3, and 4 cells.	A 4994-97
Posts and handrails for culverts	A 3732
(b) **Precast reinforced concrete box culverts—**	
Culverts with height of opening 12 in., 18 in., 24 in., and 30 in.	A 3847
Precast concrete box culvert	138
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(d) Formwork slabs for prestressed concrete bridge girders	A 5560
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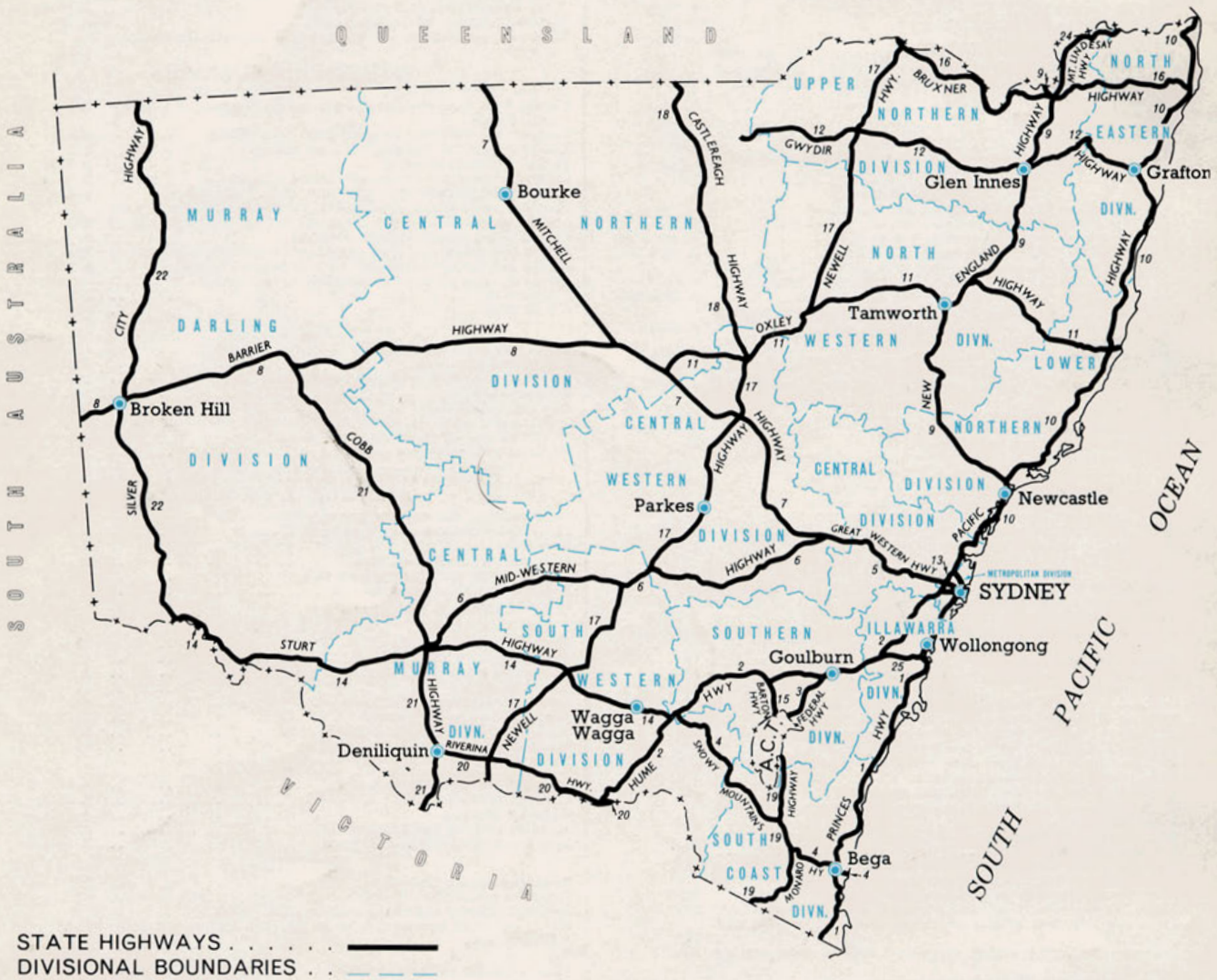
MANUALS AND BULLETINS

Bulletin relating to Miscellaneous activities on Main Roads.
Control and guidance of traffic at Works in Progress.
General Conditions of Assistance to Councils.
Guide to Main Roads Administration for use of Aldermen and Councillors.
Highway Bridge design, Specification of State Road Authorities.*
Manuals, No. 1—Plant*; No. 2—Survey and Design for Main Roads Works*; No. 3—Materials*; No. 4—Roadside Trees*; No. 5—Explosives*; No. 6—Bridge Maintenance*; No. 7—Road Maintenance*.
Proclaimed Main Roads (Schedule of gazetted descriptions).
Policy for geometric design of rural roads—State Road Authorities*.
Tables for the use of road designers (1962)*

All standards may be purchased from the Head Office of the Department of Main Roads, 309 Castlereagh Street, Sydney. Single copies are free to Councils except those marked *. A charge will be made for a set of standards.

State Highway System of the State of New South Wales



STATE HIGHWAYS . . . . . ——————

DIVISIONAL BOUNDARIES . . — — — —

DIVISIONAL OFFICES . . . . . ⊙

SCALE OF MILES

50 0 50 100 150 200

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

Length of public roads within New South Wales, 131,032 miles.

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

State Highways	6,533
Trunk Roads	4,163
Main Roads	11,590
Secondary Roads (County of Cumberland only)	132
Tourist Roads	136
Developmental Roads	3,018
	25,572
UNCLASSIFIED ROADS, in Western part of State, coming within the provisions of the Main Roads Act,	1,030
TOTAL	26,602

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