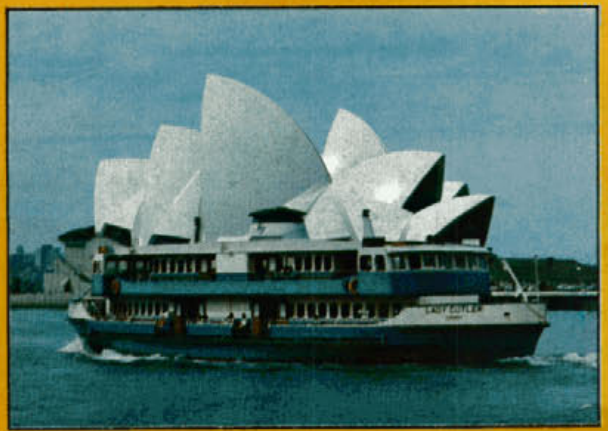
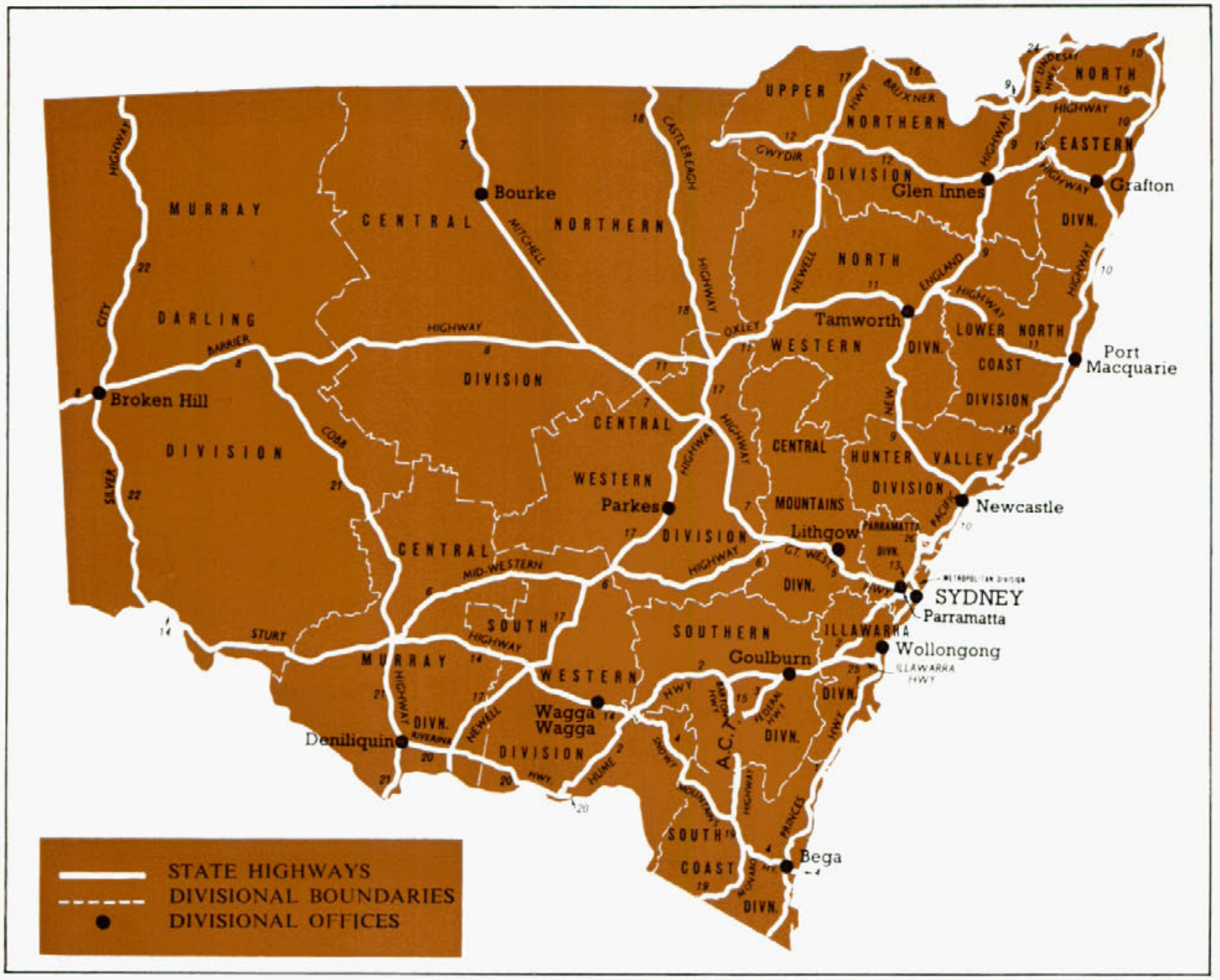
MAIN ROADS

JUNE 1976





New South Wales

Area—801 428 km²

Population as at 30th June, 1975—4 793 200 (estimated)

Length of Public Roads—208 804 km

*Number of Motor Vehicles registered as at 30th June, 1975—2 171 900**

** "This figure has been obtained from the Australian Bureau of Statistics. It should be noted that, due to the exclusion of certain categories of vehicles (such as tractors and trailers), etc., this figure is considerably lower than the statistics published prior to December, 1974, which were obtained from the New South Wales Department of Motor Transport."*

ROAD CLASSIFICATIONS AND LENGTHS IN NEW SOUTH WALES

Lengths of Main, Tourist and Developmental Roads, as at 30th June, 1975.

Freeways	91
State Highways	10 492
Trunk Roads	7 081
Ordinary Main Roads	18 316
Secondary Roads	287
Tourist Roads	400
Developmental Roads	3 642
Unclassified Roads	2 477
TOTAL	42 786 km

MAIN ROADS

JOURNAL OF THE DEPARTMENT OF MAIN ROADS, NEW SOUTH WALES

JUNE, 1976
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CONTENTS

Front cover: Roads are a vital part of our transportation network, combining with train, bus and ferry services to provide adequate facilities for travel within our community.

Back cover: Construction of section of the South Western Freeway—F5—near Aylmerton. This aerial view is looking towards Mittagong and the Hume Highway can be seen on the left. In the middle distance the completed Church Avenue (Colo Vale) overbridge can be seen

RINGS AND THINGS

To be a *snob* is, among other things, to live in—or at least to give the impression that you move in—*the right circles*. Most of us suffer at one time or another from the *snob syndrome* and any desire to rise to better circles is heightened by those newspapers and magazine articles which show how suburbs rate on some sort of status scale. But "*home is where the heart is*" and it seems of little value to praise particular districts and look down on others. For after all, no matter what our ratings, we are one community—from Bondi to Blacktown, from Liverpool to Leichhardt, from Cronulla to Castle Hill and from Penrith to Palm Beach.

If there's one thing that joins and holds Sydney-siders together (as well as with country people throughout the State), it is the Main Roads System. Wiley Park and St Ives might conjure up different images but they, like other suburbs near them, are linked by roads in general and by one road in particular—appropriately called and sign-posted Ring Road 3 (see article commencing on page 107).

Circles and rings in many forms are part of our everyday lives as well as of our most exciting celebrations and our most memorable moments. Friendship rings and wedding rings can range from those elaborately designed with diamonds and pearls to just simple bands of unadorned metal. All are precious to the people who exchange them, not only for their inherent value but moreso as symbols of very personal relationships. *Ring roads* are equally valuable, not only because of the cost of the work that is undertaken on them but also because they symbolise community (in contrast to personal) inter-relationships.

New train services or some similar fixed track public transport system may one day be introduced into more suburban areas, but, for today's needs, roads are an instant asset—available now, ready for use, without waiting.

There's no denying that traditionally Sydney's road network developed in the beginning as a radial system, but in latter years considerable emphasis has been placed on providing improved inter-suburban access that obviates the need to go through, or even near, the city centre. Ring Road improvements form part of this policy and they provide an immediate answer to the problem of getting conveniently from one side of our vast metropolitan area to the other, without crowding into city streets.

Some critics might suggest that our ring roads *go around in circles* instead of getting straight to the point by the most direct route. But circumferential routes have many special advantages and, using them, it wouldn't be the first time motorists might find that the longest way round was the quickest way home.●

ACCIDENT PREVENTION

Cause for Concern

General interest in accident prevention has increased considerably since the end of World War II when management and industrial organisations came to realise the extent of the ever-increasing cost of accidents occurring in industry. The cost is not only counted in dollars but in the waste of skilled and semi-skilled members of the workforce and in the social problems brought about by the suffering, not only of the injured worker, but of members of his family.

The humanitarian reasons behind accident prevention are themselves sufficient reason for some direct and positive action being taken to reduce the toll. Not only does the injured person suffer but frequently his family suffers and this in turn may lengthen and inhibit his rehabilitation. The social implications of lengthy periods of rehabilitation and the associated strain of family concern are beyond costing in dollars and place an extra load on the already overtaxed facilities of our social welfare services.

Much of the responsibility for accident prevention is invariably placed on supervisory staff but, nevertheless, the basic responsibilities go much deeper than this. Workers must take full responsibility for their own actions so that, in carrying out their allotted tasks, they will not endanger themselves or their fellow employees. Neither should their actions create in the minds of others the thought that an unsafe way of completing a task is acceptable.

Formal Principles

The accident prevention principles to which the Department subscribes are probably best set out in the booklet "Safety Policy Rules and Instructions", which was published ten years ago by the Department of Labour and Industry. This booklet requested all Government and Semi-Government Instrumentalities to co-operate in carrying out the following safety policy.

"This Organisation recognises the need to accept, and does accept, the responsibility of safety and health of its employees in their work situation.

POLICY

1. *It is the policy of this Organisation to exert every effort to reduce the number of accidents which occur during the course of employment and, if possible, to eliminate all such accidents and consequent suffering, hardship and loss involved.*

2. *Each foreman, supervisor or officer is responsible for the safety, health and working environment of all employees under his control.*

   To ensure that the above policy is carried out the Organisation will:

   - ☆ *Provide and maintain safe and healthy working conditions for its employees.*
   - ☆ *Observe and implement the relevant Acts and Regulations concerning working conditions in industry generally.*
   - ☆ *Promote safety and health in all its activities by education and instruction.*
   - ☆ *Insist on all employees observing safety and health rules and regulations.*
   - ☆ *Take disciplinary action against an employee, who by refusal or neglect, fails to observe safety or health requirements.*

SAFETY RULES

Safety rules shall be observed by all supervisors and employees. Some of the more general rules are as follows:

- ☆ *Personal and/or other protective equipment provided, must be worn and used, as directed.*
- ☆ *Employees will not be permitted to wear unsuitable clothing or footwear in situations where the wearing of such clothing or footwear is considered to be hazardous.*
- ☆ *Safety devices and guards shall not be removed or made inoperative on plant and equipment in normal operation. Defective, unsafe or unguarded machines and equipment must receive prompt attention to eliminate the danger.*
- ☆ *A jet of compressed air shall not be directed at the body of any person.*
- ☆ *Climbing, riding, stepping, on or over moving belts and conveyors is prohibited.*
- ☆ *Only authorised persons are permitted to operate any machine or vehicle.*
- ☆ *Riding on vehicles and earthmoving equipment, other than in seats provided, is prohibited.*
- ☆ *Mischievous conduct (skylarking, practical jokes, etc.) will render the culprit liable to disciplinary action.*
- ☆ *Recognised aisles and passageways must be kept clear and work areas clean and tidy.*

☆ *Report all accidents, however trivial.*

☆ *Minor injuries must receive attention and be recorded.*"

The Need for Education

While it is clear to everyone that science and technology have brought us many new products and benefits, it is not always realised that they have also brought many new hazards. The increasing levels of water and air pollution; the long-term hazards of atomic explosions; the problems of radioactive waste disposal; the continuing tragedy of fatalities from vehicle and plane crashes; and the widespread misuse of drugs and insecticides are all symptoms of this problem and of mans' difficulty in using his new inventions and products maturely.

No longer is safety just commonsense; it now depends very much on specialised knowledge. Consequently, "education for safety" should be an integral part of the education programmes of industrialised communities.

Education for safety should provide for two main areas. Firstly, it should aim for a broad appreciation of the common hazards we face in modern living and give some guidance towards a safe approach in various everyday situations. Secondly, there is needed a more specialised education in those problems of industrial safety directly related to the particular work or occupation in which a person is involved.

The basic approach behind any safety education programme should be a "broad spectrum" attitude, not only to make people safe in their industrial or work situations but also to educate them to be *safe* individuals—safe at home, at work and at play. It is all-too-often forgotten that the talents of an employee are lost irrespective of where the accident occurs.

The Cost of Accidents

Statistics relating to industrial accidents causing personal injuries usually list such *direct* costs as hospital and doctor's fees, legal costs, Common Law settlements and other payments made to or on behalf of the injured person. However, the *indirect* or *hidden* costs are not readily accessible for perusal. In fact few, if any, organisations have extended their accident prevention programmes to cover the investigation of such *indirect* costs as the replacement of destroyed or damaged machinery, tools, equipment and materials; lost production; and employee replacement.

In 1929 H. W. Heinrich (author of "Industrial Accident Prevention", published by McGraw-Hill) conducted an investigation of some 75 000 industrial accidents in the United States of America and established that *indirect* costs were four times greater than *direct* costs. While this statement has created much argument over the years it has never been refuted. Similar investigations have recently revaled that the cost ratio could be as high as 10 to 1.

One of the *direct* costs which highlights the escalating cost of personal injury accidents that occur in the working environment is the payments made under Workers Compensation Insurance to injured workers. The annual payments made by Compensation Insurance Companies in New South Wales over recent years are listed above.

From the above table, it can be readily seen that, if Heinrich's 4 to 1 cost ratio is accepted as accurate, the cost of damage to plant and machinery, lost production, replacement costs, etc., is approaching $400,000,000 annually in New South Wales alone.

It should be emphasised that the overall cost burden of industrial accidents is not borne solely by industry and the insurance organisations. Accident costs are passed on to all members of the community as additional charges added to the production costs and profit margins of each article produced and/or each service given.

Factors emerging from major research programmes conducted over extended periods throughout a wide variety of industries indicate where our efforts to reduce industrial accidents should be concentrated.

Year ending 30th June	Compensation paid (including hospital and medical costs, etc.)	Amounts paid for Common Law verdicts, legal and investigation costs, etc.	Total
	$	$	$
1969	33,316,348	Not known	..
1970	36,981,532	Not known	..
1971	40,261,943	Not known	..
1972	51,058,265	15,739,261	66,797,526
1973	66,420,519	18,093,361	84,514,080
1974	75,968,626	22,106,007	98,074,613

From Statistical Reports of the Workers' Compensation Commission of New South Wales.

Researchers tell us that . . .

☆ 98% of accidents are preventable,

☆ 88% of all industrial accidents are caused by human *failures*,

☆ 10% are caused by defective and dangerous machinery, and

☆ the remaining 2% are virtually unavoidable.

Analysis of information by Heinrich in his investigation of 75 000 industrial accidents revealed that:

☆ 90% of the accidents produced no injuries,

☆ 8·8% of the accidents produced minor injuries (i.e., required first aid treatment only),

☆ 0·3% of the accidents produced major injuries (i.e., time lost following the accident was in excess of 3 days).

This information is graphically portrayed below.

The ratio 1:29:300 is the average for all accidents investigated. It does not mean that each person will have 300 *no injury* accidents and 29 *minor injury* accidents before they have an accident causing *major* injury. Sometimes, the first accident experienced by an individual will result in *major* injury.

Under present accident investigation methods, usually only those accidents causing *time lost* injuries in excess of three days are investigated (i.e., about 0·3% of all accidents). The remaining 99·7% are not studied and are generally forgotten, yet this group accounts for a large proportion of the property damage caused by accidents within an organization. Therefore, to gain benefits and to reduce accident and damage costs, it is essential for any safety programme to include the investigation of *all* accidents, whether personal injuries have occurred or not. (See later remarks under "Property Damage Control" on page 103.)

The Department's Safety Activities

For many years the Department has shown its concern for the safety of its employees and it readily accepts the responsibilities associated with maintaining a safe and healthy working environment.

By the inclusion of instructions on safety procedures in departmental circulars, manuals and other publications, field officers and supervisors are continually reminded of their responsibility to ensure that the safety and health of employees is given priority. The Department's desire to be active in safety and health matters is further indicated by the appointment of a Safety Officer in 1969 to advise and assist field officers, supervisors and others.

The Safety Officer's duties include:

☆ field inspection of Departmental activities;

☆ advice, when required, on matters relating to the safety of employees;

☆ compilation of accident statistics; and

☆ preparation of an annual report covering the investigation of all serious accidents.

Field Inspections

Field inspections are undertaken at regular intervals by the Safety Officer and these include inspection of Works Office installations and field operations for both construction and maintenance works.

During Works Office inspections, attention is given to such matters as:

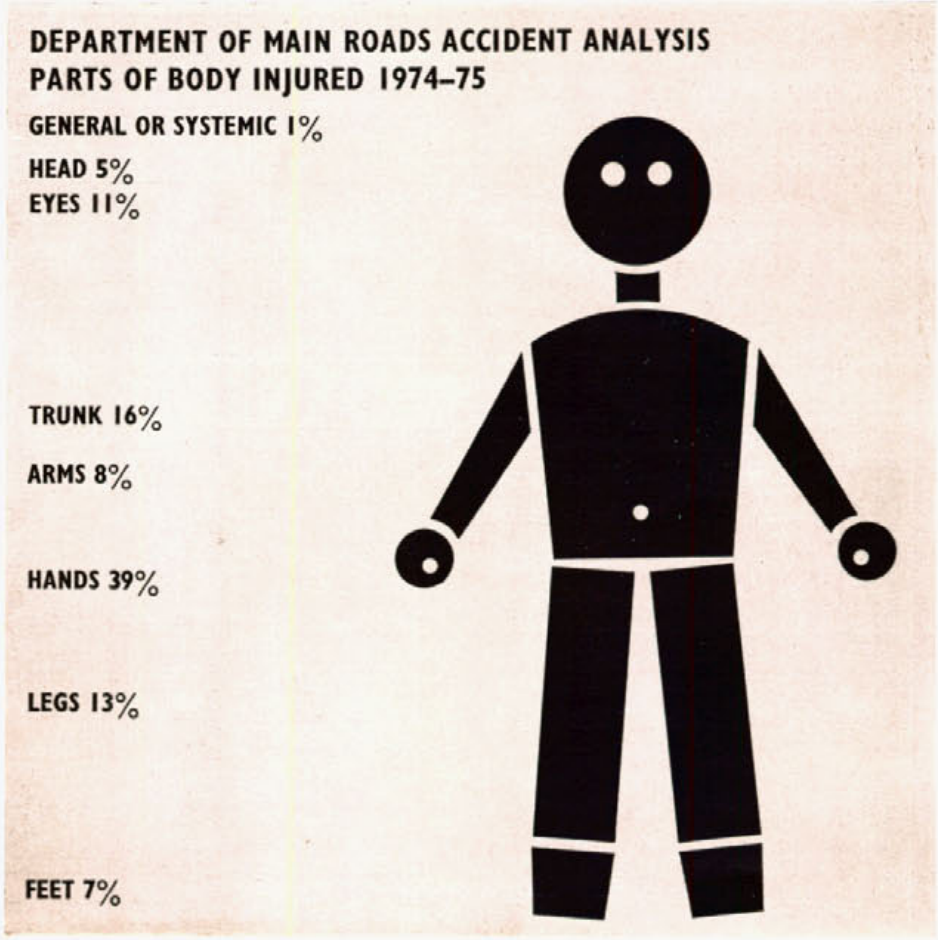
☆ protection for operators of machines in the workshop;

☆ the condition of electrical tools and leads;

☆ the layout and general use of storage areas;

☆ the storage of flammable liquids;

☆ the decanting and use of liquified gases



☆ the type, condition and placement of fire fighting equipment; and

☆ general procedures and "*housekeeping*".

Field inspections include checking such aspects as:

☆ the guarding of plant;

☆ the type and condition of lifting and pulling equipment;

☆ the usual procedures for the operation, cleaning, parking, etc., of plant items;

☆ general activities at work in progress;

☆ the use of temporary warning signs at work sites;

☆ traffic control and the duties of flagmen;

☆ scaffolding and rigging procedures;

☆ the fire fighting equipment used a sub-depots; and

☆ general procedures and "*housekeeping*" at sub-depots.

Particular attention is given to compliance with those acts and regulations which apply to the Department's activities. Where compliance with certain acts and regulations is not binding on the Crown, the Department, of its own volition, does comply and these acts and regulations are used as the minimum standard to be observed in field activities.

During field inspections, lectures on industrial safety are presented to employees. Movie (16 mm) films, slides and charts are used during these lectures and the topics covered have included:

□ Accident Costs;

□ Personal Protective Equipment;

□ Lifting Equipment;

□ Use of Ladders;

□ Guarding of Machines;

□ Manual Handling; and

□ Safety Footwear.

Safety lectures and notes have been produced for in-service training of engineers, foremen and potential foremen.

Safety Instructions

Over recent years, a growing number of circulars and instructions have been issued by the Department and, in some instances, these circulars and instructions have been incorporated in departmental publications. The following are some of the more important of these circulars and instructions.

☆ Parking of Wheeled Plant Items. *Security of Equipment and Safety of the Public.*

☆ Mobile Cranes. Electrical Hazards.

☆ Safety Precautions while Compacting High Fills.

☆ Riding on Plant.

☆ Temporary Warning Signs.

☆ Prevention of Accidents.

☆ Reporting of Fatal and Serious Accidents on Departmental Works.

☆ Notification of Accidents to Department of Labour and Industry under Scaffolding and Lifts Act.

☆ Dust Control during Drilling in Rock.

☆ Fire Protection at Works Offices, Sub-Depots and Camps.

☆ First Aid.

☆ Safety Helmets.

☆ Safety Footwear.

☆ Control and Guidance of Traffic by Flagmen at Works in Progress.

☆ Equipment to Prevent Drowning.

☆ Use, Care, Inspection and Recharging of Fire Extinguishers.

Investigations and Reporting

An important part of any accident prevention programme is the investigation of accidents to define causes and minimise the chance of similar incidents occurring again.

Where accident investigations are undertaken the complete history of the occurrence should be recorded and analysed. The use of such terms as "carelessness", "inattention", and "negligence" do not generally convey adequate information concerning the causes of accidents. The use of such terms highlights behavioural patterns, which are unfortunately widely used and accepted as descriptions of accident causes. However, investigations which do not research beyond these terms neither help in understanding accident problems nor lead to the development of suitable countermeasures.

Where departmental employees are working in situations controlled by the Scaffolding and Lifts Act and Regulations,

□ all accidents which result in an employee being injured and being absent for more than 48 hours afterwards,

□ and all accidents which involve the failure of any load-bearing member of a hoist, crane or device,

must be reported to the Department of Labour and Industry.

An annual report on the accidents occurring during Departmental activities is also submitted to an Inter-Departmental Committee on Occupational Safety and Occupational Health. To gather information for the submission of this report, the *inevitable* forms are required to be submitted from field offices. The two forms are the "Injury Report" and the "Injury Report—Fortnightly Return".

The "Injury Report" lists the details of the accident together with the injured employee's name and details of the first aid treatment given. In completing these reports, field office staff are urged (as mentioned above) to avoid the use of such terms as "carelessness", "inattention" and "negligence" which can all-too-often obscure the real cause of the accident. A thorough investigation can usually reveal the root cause and this, in turn, can prevent the recurrence of serious disabling injuries from similar avoidable accidents. Where a fault or problem has been encountered (particularly with plant or equipment) and corrective action instituted, the dissemination of information relating to that particular hazard and its elimination is of considerable importance in future accident prevention programmes.

It is clearly essential to look beyond the obvious causes, as there is always more than one cause of an accident. Each situation must be carefully examined to ascertain whether such causes as inadequate or misunderstood instructions, fatigue, improper motivation, insufficient

training, or lack of skills are applicable. Investigations may also reveal serious faults in the design of machines and equipment; faults which frequently lead to accidents being loosely labelled as "operator carelessness". Such design faults could include restricted access to controls and switches, controls which are difficult to activate and an unsuitable allocation of work space which causes fatigue and loss of concentration.

Statistical Analysis

Accident statistics play an important part in any safety programme by highlighting areas of a particular hazardous nature and areas where changes in an existing programme are needed. The effect of a particular education programme can also be gauged by observing trends appearing in statistical results.

The Department compiles its statistics in accordance with the Standards Association of Australia Standard "Recording and Measuring Work Injury Experience", which requires that certain information be recorded in all accident reports.

The "*Work Injury Experience*" of the Department is calculated in two ways—firstly, as a Disabling-injury Frequency Rate and, secondly, as a Severity Rate. The following definitions are presented to assist in the understanding of these rates.

A "*Work Injury*" is any injury to a person which arises out of and in the course of employment and which requires first-aid or medical treatment. This term includes any occupational disease or work-connected disability.

An "*Occupational Disease*" is one attributed to the environmental factors of a particular process, trade or occupation to which the employee is not normally exposed away from his employment.

A "*Disabling Injury*" is a work injury which results in death, a permanent disability or an inability to work for at least one full day or shift. This inability to work includes any time after the day or shift on which the injury occurred, whether or not the days of disability were days on which the injured person would otherwise have been at work.

The **Disabling-injury Frequency Rate** is based on the total number of disabling injuries which occur during the period being studied. It is the number of disabling injuries per million man-hours worked and is expressed by the following formula.

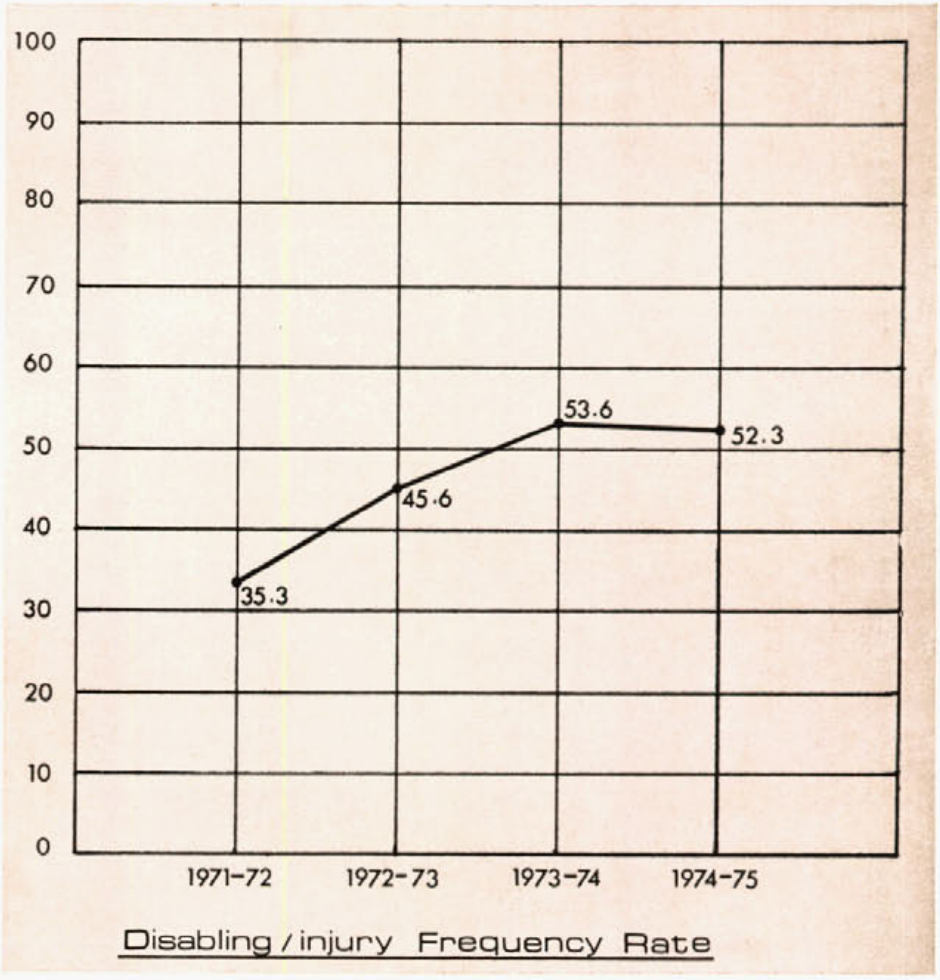
$$\text{Disabling-injury Frequency Rate} = \frac{\text{Total No. of Disabling Injuries} \times 1\,000\,000}{\text{Man-hours Exposure}}$$

The **Severity Rate** is a measure of the disabilities suffered by employees in relation to man-hours exposure. The Severity Rate relates the total days charged (i.e., the number of days lost due to inability to work) to the total number of hours worked during the period, and expresses them in terms of a million-hour unit.

The Severity Rate is calculated by the following formula.

$$\text{Severity Rate} = \frac{\text{Total Days Charged} \times 1\,000\,000}{\text{Man-hours Exposure}}$$

In cases of death or permanent disability, "*Scheduled Charges*" replace the figure for time actually lost and these apply whether or not any time was actually lost. These "*Scheduled Charges*" range from 50 days for an amputation of the first joint of the little finger to 6 000 days for a fatality. It should be noted that over short periods, the



"*Scheduled Charges*" will tend to overshadow the actual time lost (i.e., "total days charged" or days of disability).

While Severity Rates are of importance in evaluating safety programmes, the fluctuation caused by the inclusion of "*Scheduled Charges*" for permanently disabling injuries makes the interpretation of the results difficult (especially over short periods) without some knowledge of the supporting facts.

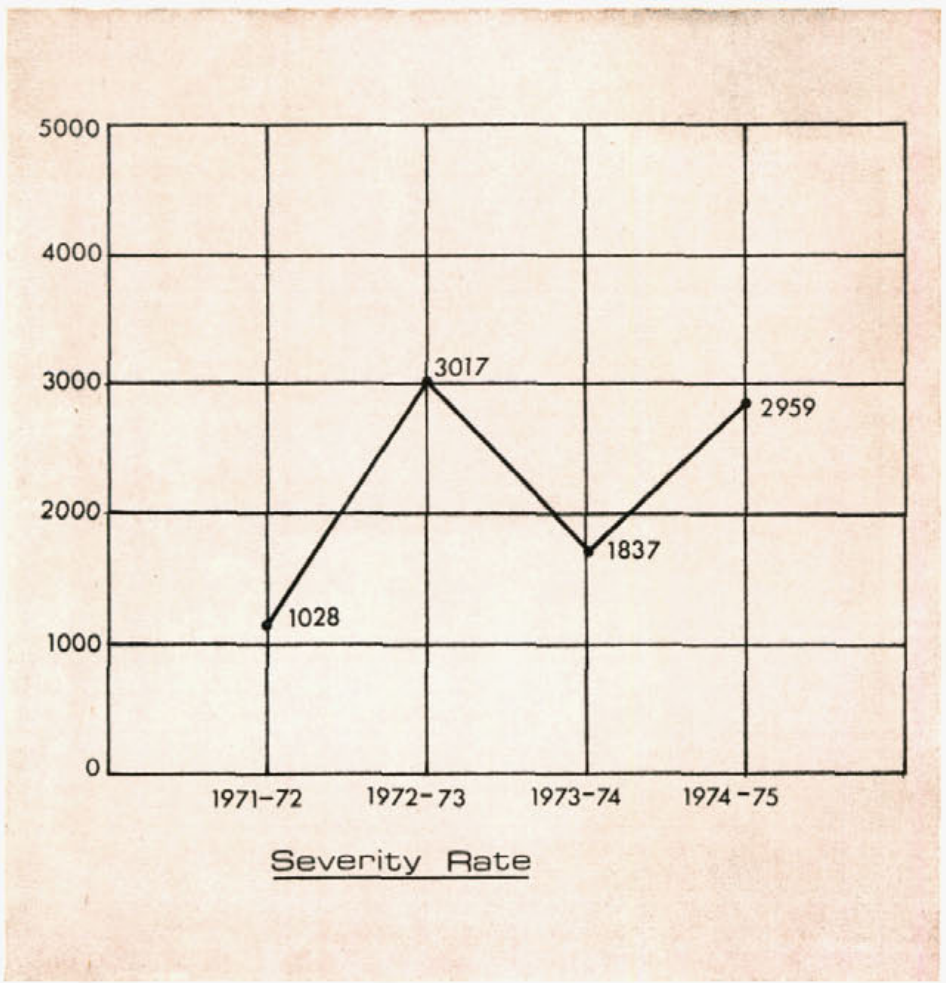
The Department's "*Work Injury Experience*" over the four years from 1971–72 to 1974–75 is shown in the two graphs below.

Statistical analysis can bring to notice particular types of accidents occurring in specific areas and can also indicate causes that may require particular attention.

The diagrams on pages 100, 104–5 show percentages for "Agencies of Injuries", "Types of Injuries" and "Parts of Body Injured" for the whole of the Department's activities during 1974–75. Similar information is recorded for each Division and for each field office.

Property Damage Control—The Next Step

As explained earlier, it is an accepted safety principle that the *indirect* costs of accidents (i.e., property damage, etc.) will be in excess of the *direct* costs, in a ratio which could range as high as 10 to 1 depending on the industry in question and the effectiveness of the accident prevention system used.



In 1956, the Luken's Steel Company of Pennsylvania, U.S.A., (which then employed about 5 000 persons) had reached a point in their safety programme where future reductions in personal injuries appeared almost impossible, yet many hundreds of thousands of dollars were still being spent on repairs to plant which had been damaged in *no injury* accidents.

The management at Luken's Steel Company decided to record, investigate and cost each accident, however minor and irrespective of whether personal injury had occurred. Accident reporting procedures and rules were changed to accommodate the new method of accident investigations and *all* company employees were required to report *all* accidents, without exception.

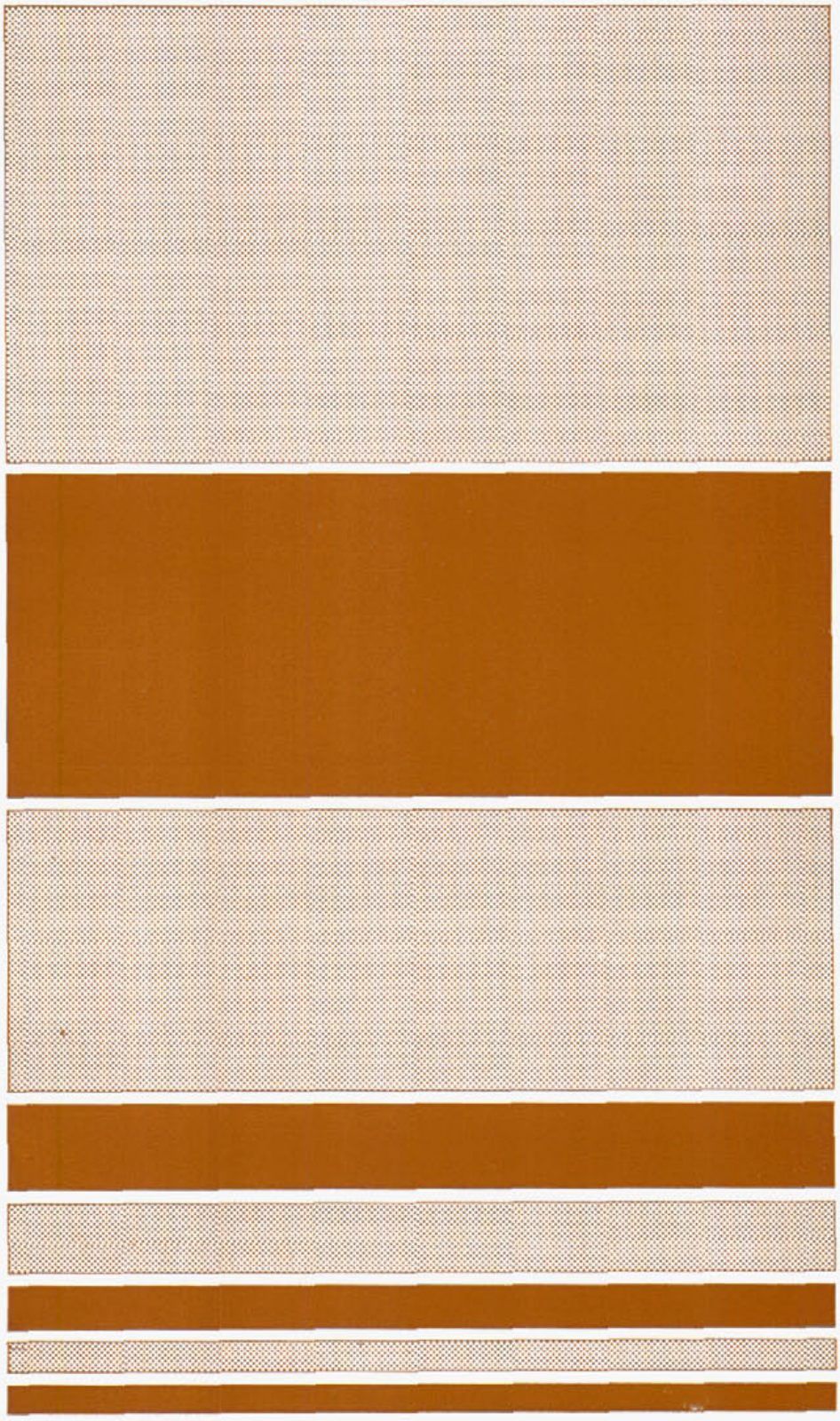
After the initial introductory problems were overcome, the system of accident prevention based on these reports proved most successful, not only in reducing the heavy *indirect* costs of property damage, but also in further reducing the already excellent personal injury record.

This concept of accident prevention based on *Damage or Loss Control* is being widely used overseas and has proved most successful in a variety of industrial situations from supermarket warehouses to complex heavy industries. The value of the introduction of a similar system into the Australian industrial scene can easily be envisaged, when the compensation payments for New South Wales alone exceed $98,000,000 (see table on page 99).

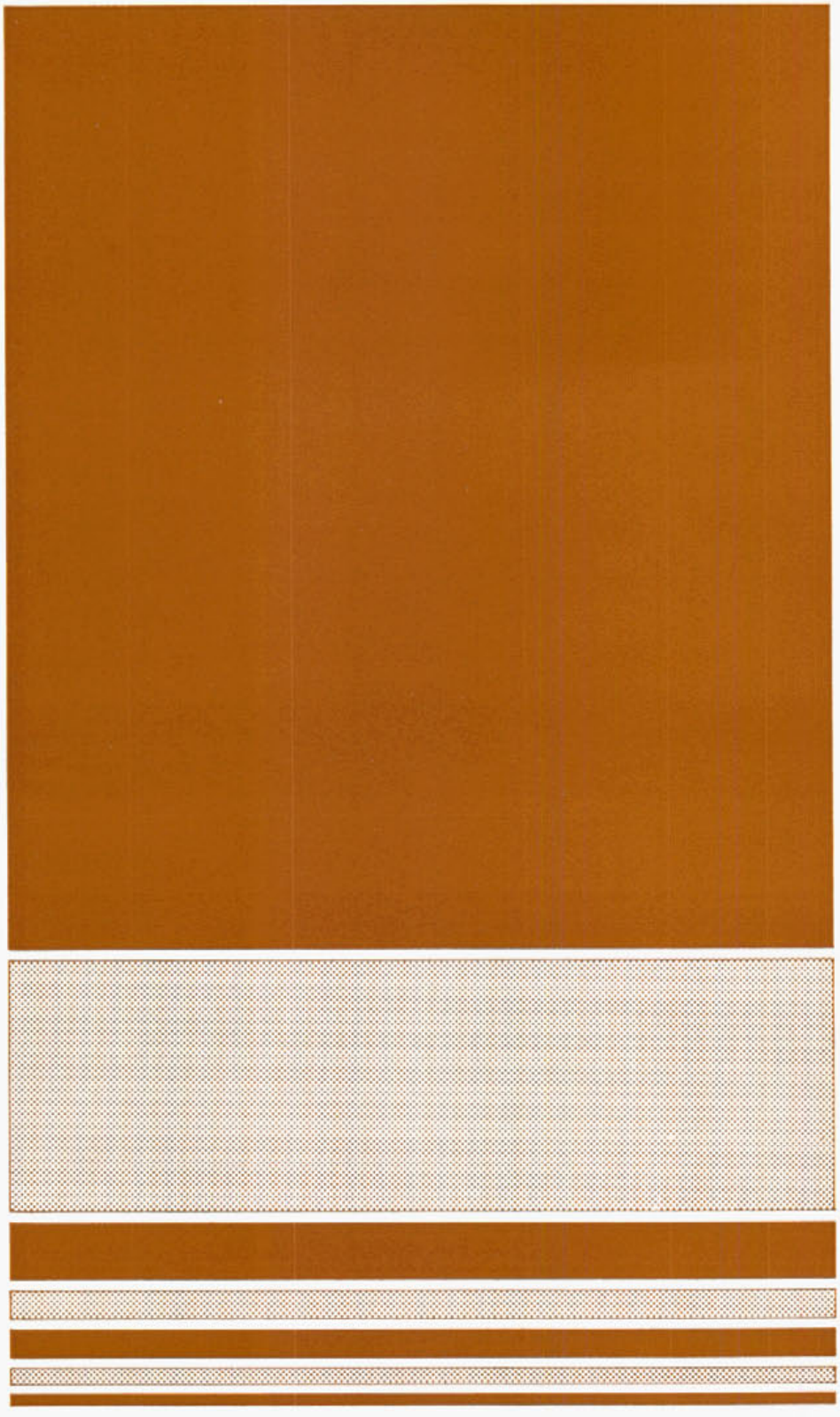
It seems that the next logical step will be to integrate a property damage element into *All-accident Control and Investigation Programmes* so that not only can accidents causing personal injury be reduced but considerable cost savings can also be made by reducing property damage.

* *This article has been prepared from material supplied by the Department's Safety Officer, Mr A. Mouatt.*

DEPARTMENT OF MAIN ROADS ACCIDENT ANALYSIS AGENCIES OF INJURIES 1974–75



DEPARTMENT OF MAIN ROADS ACCIDENT ANALYSIS
TYPES OF INJURIES 1974–75



ABRASIONS, BRUISES, LACERATIONS AND FOREIGN BODIES 68%

STRAINS, SPRAINS 22%

BURNS, SCALDS 5%

FRACTURES 2%

OTHER INJURIES 1·8%

OCCUPATIONAL DISEASES 1%

AMPUTATIONS 0·09%, FATALITIES 0·11%

FOCUS ON . . .

Below left (Top): Aerial view of construction of Warringah Freeway, looking southeast, from Willoughby Road, Naremburn. (Bottom): Bridge to carry West Street over the Freeway at Naremburn, looking west. Details of this work were given in the December 1974 issue of "Main Roads" (Vol. 40, No. 2), pp 34-7.

Below (Top): The Department's exhibit at the 1976 Royal Easter Show featured colour photographs illustrating the role of roads in community service. (Bottom): Two views of the Department's new divisional office at Lithgow which was officially opened on 27th April, 1976.

. . . Warringah Freeway

. . . Royal Easter Show '76

. . . New Divisional Office

RECENT RECONSTRUCTION ON RING ROAD 3

MONA VALE TO TOP RYDE

Sydney's road system is both a radial and a circumferential network. The radial routes such as the Pacific Highway, the Great Western Highway (Parramatta Road), the Hume Highway and the Princes Highway allow movement towards and away from the city area. There is also a demand for *inter-suburb* movement between areas on or near different radial routes. This cross movement is catered for by circumferential routes such as Cleveland Street (on Ring Road 1), Concord Road (on Ring Road 3) and Pennant Hills Road (on Ring Road 5).

Ring Road 3 connects Pittwater Road, in the Warringah area, at Mona Vale to the Ku-ring-gai area at Pymble and then across to Ryde, Strathfield, Wiley Park, Hurstville and to the Princes Highway at Blakehurst. Along the length of Ring Road 3, there are both residential and industrial areas whose development depends on adequate access. The value and appeal of these areas will be directly linked to the improvement of the Ring Road and the convenience it offers. The growth of areas like Riverwood, Ashfield, etc., (which are served by radial roads intersecting the Ring Road) will also depend on the access provided by the Ring Road.

Ring Road 3 thus plays an important role in assisting growth and decentralisation away from the city centre. But, as well as this, as every northside Sunday driver knows, Ring Road 3 is a very popular route for getting to any of the beautiful surfing beaches ranging from Collaroy up to Palm Beach.

Bumper-to-bumper delays on the drive back home might make many motorists think that weekend traffic is abnormally high, but Departmental traffic counts show that generally the number of vehicles on Saturday or Sunday are little different from those for other days of the week (being sometimes more and sometimes less, depending, among other things, on the weather). The main difference is that whereas weekday traffic is spread throughout the day, weekend traffic is concentrated into two peaks—beach bound traffic going east in the morning and homeward bound traffic going west in the evening.

Traffic counts taken during 1973 show that the annual average daily traffic (A.A.D.T.) volumes (i.e., in both directions) were 18 950 on Mona Vale Road at Pymble and 32 520 on Ryde Road at De Burghs Bridge. The former figure might be compared with approximately 10 000 vehicles a day in 1959 and the latter with about 22 000 vehicles a day in 1967.

So, for over 11 million vehicle journeys a year, the reconstruction and widening of Ring Road 3 between Mona Vale and Top Ryde will be a welcome improvement.

The Main Roads which make up Ring Road 3 and the sections which come under the care of the Department's Metropolitan and Parramatta Divisions are outlined below.

Metropolitan Division

Main Road No. 162: Mona Vale Road—Mona Vale to Pymble.

Main Road No. 162: Ryde Road—Pymble to De Burghs Bridge.

Parramatta Division

Main Road No. 162: Lane Cove Road—De Burghs Bridge to Ryde.

Main Road No. 200: Devlin Street/Church Street/Concord Road—Ryde to Strathfield.

and

Main Road No. 589: From Concord Road to Cooper Street at Strathfield.

Main Road No. 315: The Boulevarde/Coronation Parade—Strathfield to Belfield.

Metropolitan Division

Main Road No. 315: Punchbowl Road/King Georges Road—Belfield to Blakehurst.

Within the Metropolitan Division, the Department maintains all sections except Main Road No. 315 from Beverly Hills to Blakehurst. This section is maintained by Hurstville and Kogarah Municipal Councils.

Within the Parramatta Division the Department maintains all sections except Concord Road and Main Road No. 589 within Concord Municipal Council and the length of Main Road No. 315 within Strathfield Municipal Council.

RECENT AND CURRENT WORKS: MONA VALE TO TOP RYDE

Mona Vale Road—Mona Vale to Pymble

Work on this section is being undertaken by the Department's North Metropolitan Works Office, Mowbray Road, Lane Cove (see article on establishment of this Works Office in December, 1974, issue of "Main Roads", Vol. 40, No. 2, p. 61).

- Junction with Pittwater Road (Main Road No. 164).

This junction is currently being reconstructed to the ultimate layout which provides for six lanes in Main Road No. 164, together with turning bays and channelisation. This work was commenced in 1975 and will be completed during 1976.

- Pittwater Road to Alan Street, Mona Vale.

This 1·5 km section, on the coastal plain, will be constructed to four lanes as an initial stage and will be widened to six lanes when the traffic demand calls for this.

- Alan Street, Mona Vale to Richmond Avenue, North St Ives.

Planning and design on this 13·4 km length is just commencing.

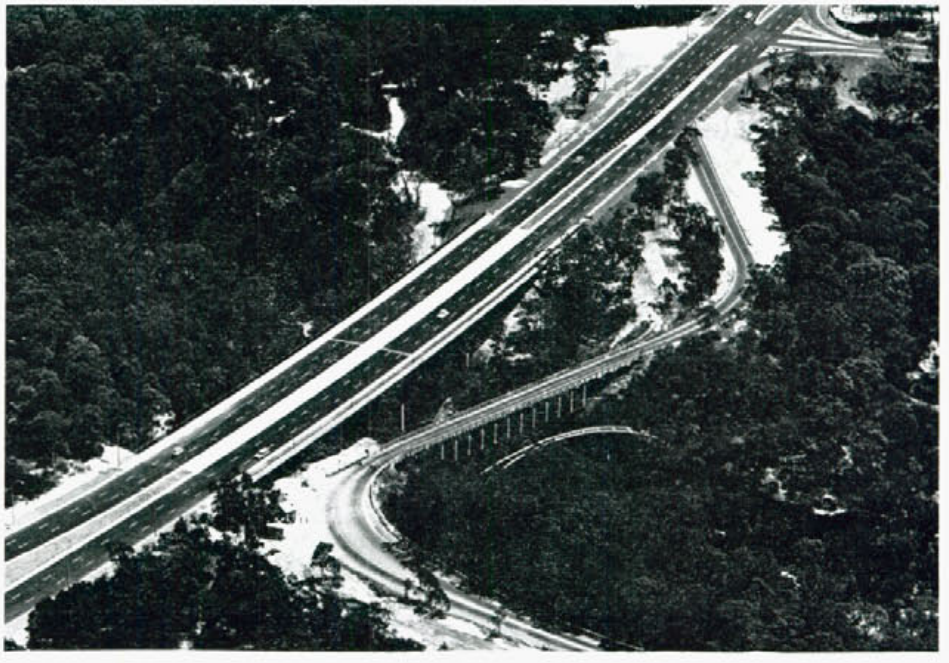
Construction will proceed as funds become available. Within this section, the junction with Forest Way (Main Road No. 529) was reconstructed in 1975 to ease traffic congestion at this point.

- Richmond Avenue, North St Ives to Killeaton Street, St Ives (Secondary Road No. 2043).

Work commenced on public utility and property adjustments early in 1976. Roadworks to cater for six lanes of traffic are scheduled to commence late in 1976 and be completed early in 1979. The terrain is much easier through this 2·18 km section and some of the properties have been built to the final boundary.

- Through St Ives Shopping Centre—Killeaton Street to Cowan Road.

Aerial view looking east, showing the new (1967) and old (1901) De Burghs Bridges and the greatly improved travelling conditions on Ring Road 3



This 1·35 km section was completed in 1969 and provides for three lanes of traffic in each direction, with a narrow median.

□ Cowan Road, St Ives to Highlands Avenue, Gordon.

Work commenced at the St Ives end early in 1975 and is currently proceeding towards the Pacific Highway. Work on this 1·05 km length is expected to be completed during 1977. Because of the steeply sloping nature of the country and the closeness of the houses to the road, alterations to properties have been kept to a minimum by providing separate grade lines for each carriageway. A crib wall will retain the batter between the two carriageways. Despite this, property adjustment through this section has been extensive, partly because many of the cottages have high sandstone fences which have to be shifted back to the new alignment. The cross section provides for three lanes in each carriageway, with a narrowed median.

□ Intersection with the Pacific Highway at Pymble, and approaches.

The present intersection is a major bottleneck to peak-hour traffic. Basically, it provides for two lanes of traffic in each direction in each road but right turning movements from all four approaches reduce the effective capacity of the intersection.

The first stage in the improvement of the intersection will provide six lanes in each road, together with separate turning lanes. The ultimate scheme provides for a two-level interchange and includes a new railway overbridge. No date has been fixed for the commencement of this work.

Ryde Road—Pacific Highway at Pymble to De Burghs Bridge

This 3·35 km section was commenced in 1967 and the final section was opened to traffic late in 1974.

This reconstruction was also carried out by the Department's North Metropolitan Works Office.

The cross section adopted on this length consisted of three lanes in each direction separated by a grassed median, 3·0 m to 4·6 m in width. The most difficult section was that crossing Blackbutt Creek at the bottom of a steep incline just southwest of the Pacific Highway. Extensive retaining walls were necessary to protect residences on the high (southeast) side of the road. Similarly, extensive works were necessary on the low side to separate the high fill and the creek.

Lane Cove Road—De Burghs Bridge to Epping Road

Following the opening of the new De Burghs Bridge on 15th December, 1967 a six-lane, divided carriageway was extended southeast to Giffnock Avenue, North Ryde. The reconstruction past Giffnock Avenue has been delayed by the acquisition of a property which was finalised only in December, 1975. A temporary connection has been provided between Giffnock Avenue and Epping Road and the final construction along this length will be undertaken in conjunction with work at the intersection (outlined below).

An expanding light industrial area northwest of Lane Cove Road and the increasing traffic generated by the Macquarie University have prompted the Ryde Municipal Council to widen Waterloo Road (West). In conjunction with Council's work, the Department will undertake further widening in Lane Cove Road to provide continuous left turn lanes to and from Waterloo Road (West). This work is dependent upon Council's progress with property acquisitions.

Interchange at Lane Cove Road and Epping Road

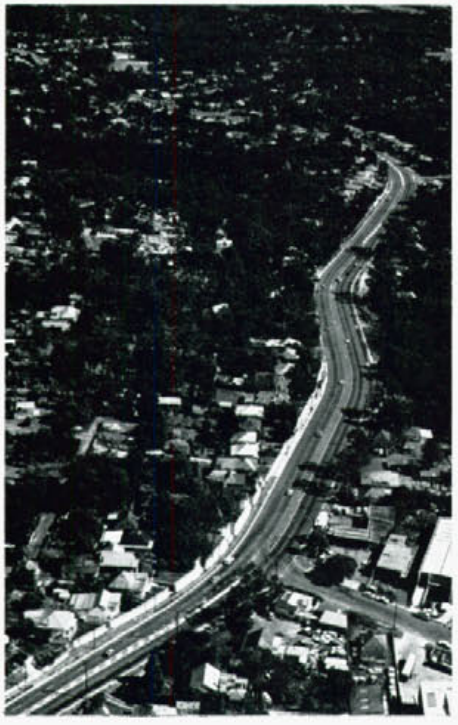
The design of this interchange was described in the December, 1974 issue of "Main Roads" (Vol. 40, No. 2, p. 53).

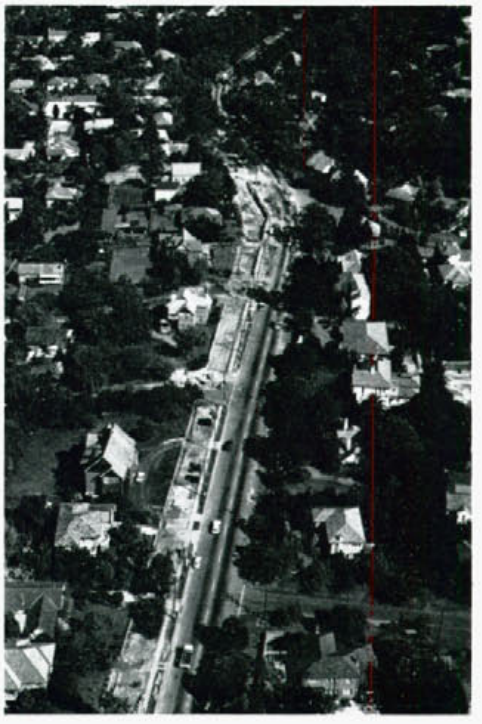
The major structure is an overbridge which will eventually carry Epping Road traffic over Lane Cove Road. Work is already well advanced on the construction of the four ramps which will temporarily carry Epping Road traffic around the construction site.

As a matter of expediency, to enable the overbridge construction to commence as soon as practicable, the ramps are being constructed of sufficient length only to provide adequate working space during construction of the overbridge and of sufficient width to provide two traffic lanes in each direction plus sheltered right turn lanes. This arrangement will simulate existing conditions so that bridge construction activities should not significantly affect the existing traffic behaviour.

The road pavements of the ramps are being constructed to their ultimate level as far as practicable and work on the temporary

Left: Aerial view looking west above Ring Road 3 (Ryde Road) at West Pymble Bottom left: Looking down on Ring Road 3 (Ryde Road) as it approaches the Pacific Highway at Pymble. Below: Section of Ring Road 3 (Mona Vale Road) as it passes through St Ives Shopping Centre—looking east. Bottom right: Widening in progress along section of Ring Road 3 (Mona Vale Road) at St Ives—looking west towards the Pacific Highway





connections back onto Epping Road is being kept to a minimum.

During construction of the overbridge, work will proceed on the extension of these four ramps, which will later provide access to adjoining properties and cater for signal-controlled turning movements. The widening of Epping Road to six lanes between Delhi Road (Main Road No. 191) to the southeast of Lane Cove Road, and Shrimptons Creek (to the northwest) will also be undertaken.

Tenders for the construction of the overbridge were invited in June 1976.

Lane Cove Road—Epping Road to Top Ryde

Since early December, 1975, a six-lane divided carriageway has been available for traffic in Lane Cove Road from just southwest of Epping Road to the intersection with Blaxland Road at Top Ryde. The Department took over the care and control of this length of Lane Cove Road from the Ryde Municipal Council in February, 1974 and has since constructed the three lanes which now form the southbound carriageway between Epping Road and Goulding Road, Ryde. The existing road along this section has been retained as the northbound carriageway. The strength of this existing pavement is being investigated to establish the extent of reconstruction required prior to its asphaltic concrete re-sheeting.

One of the most interesting aspects of the recent construction on this section was the 290-metre long retaining wall which was built between the southbound carriageway and the service road which provides access to properties from just north of Cooney Street to Lorna Avenue, North Ryde. Suitably reinforced masonry blocks provided a more economical solution than a conventional, reinforced concrete, cantilever retaining wall. The wall was built under a minor contract at a cost of approximately $40,000 ($68.50 per square metre). The backs of the masonry blocks have been painted with two coats of a sealing emulsion, and sub-soil drains have been installed along the full length of the foundations. To optimise drainage conditions, the full depth of the wall was back-filled with sand for a width of approximately 0·5 metres. This work was part of the contract which also includes the erection of corrugated, steel guardrail above the wall, following completion of the pavement on the access road.

A variety of property adjustments was required between Allengrove Crescent and Kent Road, North Ryde. At the request of the property owners south of Coxs Road from whom frontal strips were recently acquired, sandstone faced batters were constructed to a similar standard to those previously provided by the Department on Ryde Road between De Burghs Bridge and the Pacific Highway. At other locations, brick walls are being constructed for heights of up to approximately 1 metre while brick-veneer has been provided outside suitably reinforced, masonry block walls to retain fills of greater height.

☆ ☆ ☆

An article entitled "Sydney Metropolitan Ring Roads Signposting" appeared in the September, 1964 issue of "Main Roads", Vol. 30, No. 1, pp. 22–3 and included a map showing the routes of Ring Roads 1, 3 and 5.

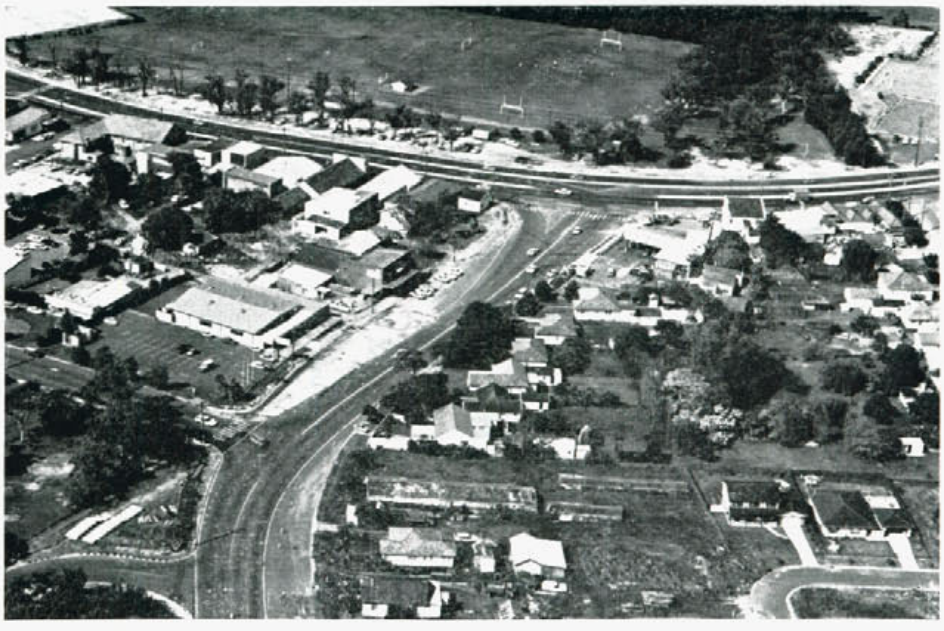
An article on the opening of the first De Burghs Bridge 75 years ago in 1901, appears on page 125, while a brief description of "The Man Behind the Name"—E. M. De Burgh—is given on page 127.

WHY IT TAKES SO LONG
ROAD WIDENING PROCEDURES

To watching residents and passing motorists, the reconstruction and widening of urban roads must appear to be extremely slow. What seems to be a simple job actually takes 2 to 3 years to complete. The following list of steps might help to explain why it is not just a matter of *grabbing the extra land and spreading bitumen over it.*

1. First, a layout plan is produced to show how the present road pavement can be widened to six lanes with the minimum effect on adjacent properties. This plan has to include arrangements at major intersections and junctions with minor roads, as well as access to individual properties.
2. From the layout plan, a detailed design is prepared. During the preparation of the design, the Department of Motor Transport, Traffic Police and the local council are consulted and their concurrence is sought.
3. The next step is to acquire from the landowners along the route, those strips of land which are needed in order to widen the road. As later construction will involve alterations to fences, driveways and gardens, agreement to these alterations is reached with each landowner at the same time as acquisition negotiations are proceeding.
4. Copies of the plans are forwarded to all public utility authorities so that each can submit an estimate of the cost of any necessary adjustments to its services. These authorities include the Metropolitan Water, Sewerage and Drainage Board, Sydney (or other) County Council, Australian Gas Light Company, Telecom Australia, etc.
5. The next step is to plan the stages of construction. For example, a project may be divided into three sections and each section constructed in two stages. It is usual for one carriageway to be constructed while traffic uses the old road (which is temporarily widened, if necessary). When this is completed, traffic is then directed onto the new carriageway while the second carriageway is constructed (that is, the existing road is reconstructed).
6. The first work can now commence. The initial step in construction is to move all the property boundaries back to the new line. The agreed adjustments to the properties are carried out at the same time. Any necessary demolition is arranged and the route is cleared.
7. All the public utility services are adjusted on the cleared section. Each authority prefers to work alone, so this step can take a long time.
8. It is only at this stage that the actual road construction can proceed.
9. The whole process is repeated for each stage of each section. With careful planning, property adjustments can be undertaken two stages ahead of construction, and utility adjustments one step ahead.

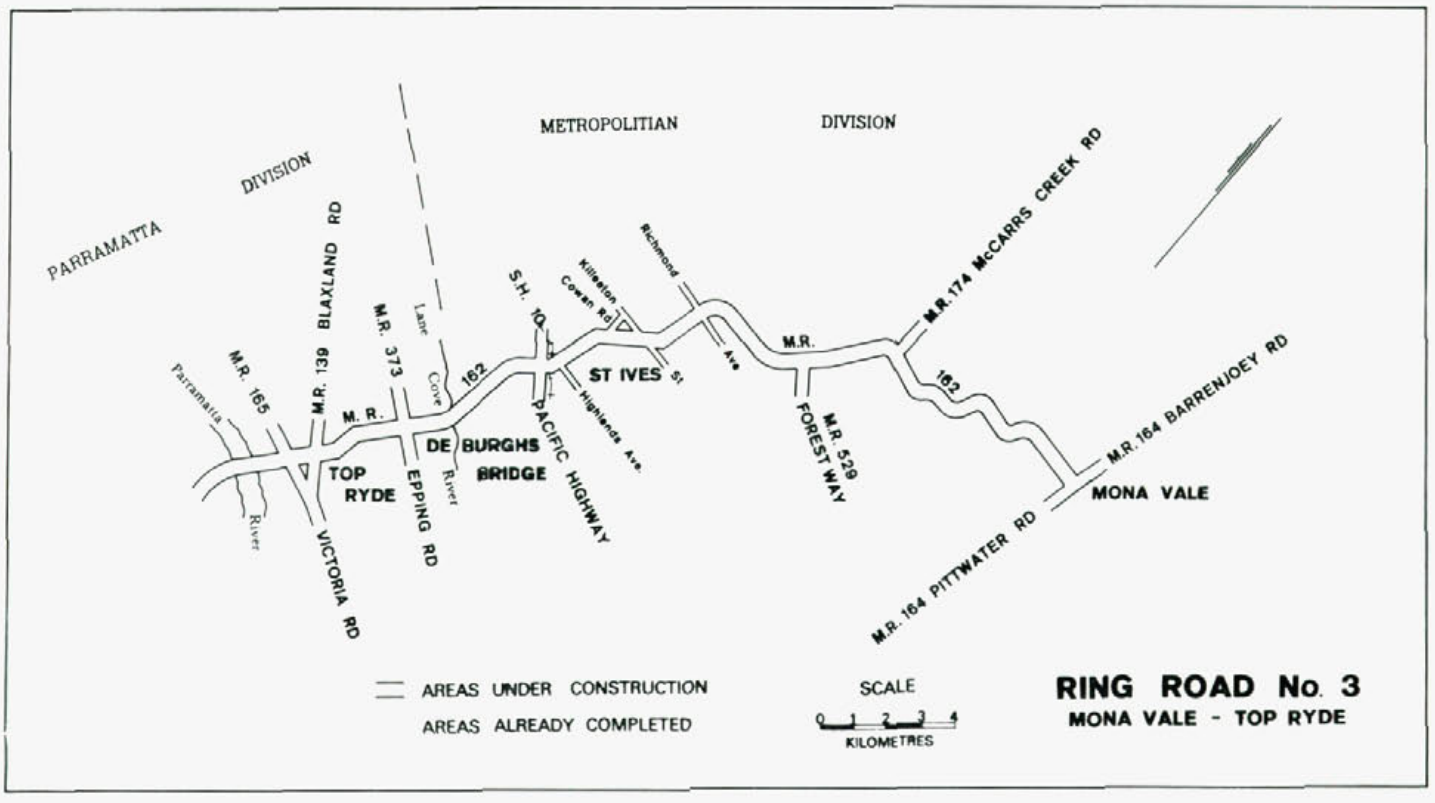
The eastern end of Ring Road 3 (Mona Vale Road) at its junction with Main Road No. 164 (Barrenjoey Road to the left and Pittwater Road to the right)



Opposite page: Artistry in stone

The construction of stone retaining walls of sandstone or bush rock is a popular feature of landscape gardening and home improvements. In certain major urban road widening projects, the Department uses stone to restore walls or high standard fencing affected by the widening. These proposals are arranged with property owners during negotiations to acquire the portion of land required for roadworks.
To undertake the relocation of property boundaries, the Department employs a number of teams throughout the metropolitan area. Where changes in levels occur, as in deep cuttings or at high fills, these adjustments can be of major proportions.
The photographs opposite were taken along Ring Road 3 (Ryde Road and Mona Vale Road) in the Pymble-St Ives area. They clearly show that old skills have not been forgotten and that functional stone walls can still add a touch of beauty to our roadside environment

Left: Construction of improvements at the intersection of Ring Road 3 (Lane Cove Road—running top to bottom of photograph) and Epping Road (running left to right)—looking west



OTHER WORK ON RING ROAD 3

Punchbowl Road

On the 3 km section of Punchbowl Road, which forms part of Ring Road 3, work on the widening of the present four-lane carriageway commenced in July, 1975, at the intersection with King Georges Road at Greenacre.

King Georges Road

King Georges Road (9·1 km long) is the southernmost link in Ring Road 3, which ends at its junction with the Princes Highway at Blakehurst. From Punchbowl Road to Broad Arrow Road, Beverly Hills, the 3·6 km length is maintained by the Department. Reconstruction and widening work is in progress at Wiley Park Railway Station (started in August, 1975) and at the intersection with Canterbury Road—Main Road No. 167 (started in November, 1975).

From Broad Arrow Road to the railway overbridge at Penshurst, the 2·5 km length is maintained by Hurstville Municipal Council. A 0·5 km length at Beverly Hills Railway Station has been reconstructed to six lanes and it is expected that Council will commence reconstruction and widening through Beverly Hills Shopping Centre, including the reconstruction of the intersection with Stoney Creek Road (Secondary Road No. 2041), before the end of this financial year. A recommendation has been made that the remaining 1·8 km length in Hurstville Municipality and the entire 3 km length in Kogarah Municipality be reconstructed by the Department's forces.●

ARTISTRY IN STONE

. . . along Ring Road 3

UP

UP

The two helicopters on the far left are earlier models used by the Department, while the Department's hangar at Mascot is shown below them. Other illustrations show the roll-out take-off and landing pad in operation and the Executive Pilot at the controls of the Department's current machine.

AWAY AND

The Department's helicopter is only one of a wide variety of interesting items of equipment used in the planning, design and construction of roads and bridges throughout the State. It reflects the "up-to-the-minute" approach of the Department's engineers in obtaining modern machines which allow time and cost saving techniques to be introduced.

The helicopter may still be an *excitement machine* which is outside the usual ambit of most people's experience, but to the men who regularly fly in the Department's machine, it is a versatile and efficient means of getting their job done.

An article on the Department's helicopter and its uses appears on pages 118-120 of this issue.

The Pause That Refreshes

A LOOK AT THE VALUE AND COST OF ROADSIDE REST AREAS

Better roads and greater individual mobility are creating increased traffic flow along the main roads network throughout New South Wales. At the same time, road accidents still mar our motoring with frightening regularity. Cars certainly enrich our lives but our misuse of them so often leads to the most terrible tragedies, that scar our personal and community lives with suffering and grief.

At one time or another, we have probably all been guilty of taking needless risks while driving—often because we were in a hurry and often because we were not concentrating enough. We fill our cars and station waggons with all the comforts (and distractions) of home—radio, cassette players with stereo speakers, heaters, carpets, cushions and even curtains. As comfortable as in our favourite lounge chair, we can so easily detach ourselves subconsciously from the reality that we may be speeding along at over 1½ kilometres a minute. We drift off in thought or conversation, until in an emergency our reactions may be too leisurely.

At other times drowsiness drags at our senses and reduces our responses. Writing about this problem, American researcher Mr S. Hulbert has made the following assessment.

"Falling asleep at the wheel and running off the roadway is merely the unfortunate end-point which makes it obvious that many more motorists are on the highway in a state of drowsiness but they do not run off the roadway far enough to incapacitate their vehicle. Others, who are less fortunate than either of these groups, have collisions with other vehicles. These sleepy drivers may never be recorded as having been drowsy or actually falling asleep. For these reasons, the true magnitude of the problem is not known; however, the data indicate that from 35 to 50 per cent of highway fatalities are directly attributable to fatigue or drowsiness (Kearney, 1966; Forbes, 1958). This may be only the visible tip of a gigantic iceberg constituting a national driving problem about which very little is known."

In his summary, Hulbert concludes that . . .

"Some drivers can and do drive for prolonged periods without mishap or obvious drowsiness; nevertheless research studies . . . indicate that their performance level is bound to be reduced as the trip progresses."

. . . published in article "Effects of Driver Fatigue" included in "Human Factors in Highway Traffic Safety Research", edited by T. W. Forbes (New York 1972).

Part of the solution to this problem is for drivers to stop at reasonable intervals during their journey so that they can get out of their vehicles and stretch their legs. To remain alert at the wheel, it is clearly a good policy not to drive continuously for lengthy periods. This is especially applicable on long stretches of open road where the monotony of the journey and the ease of driving may lull our concentration and accelerate feelings of tiredness. *Death by dozing* is a very real danger to drivers who always insist in covering "another 100 kilometres or so" before giving their overstrained eyes and bodies some well-earned relaxation. It is far better for motorists to pull into a roadside rest area and liven up with some exercise and fresh air, rather than attempt to fight off drowsiness within the comfortable (but confined) cabin of their vehicle. We should make it a habit to stop frequently for a number of short breaks rather than only occasionally for a long period.

In coastal urban areas and in country towns, most of the needs of travellers are catered for by restaurants, milk bars, playgrounds and parks. Outside these areas, there are also large numbers of service stations throughout the State, many of which cater for more than just the mechanical and fuel needs of vehicles, by providing refreshment facilities for motorists.

In addition to these commercial and council provided facilities, there have appeared in recent years extra benefits in the form of *official* roadside rest areas.

Some locations, such as those with an historic background or natural water supply, have served as rest areas for a considerable number of years. Following the severe bush fires of the early 1950's, fireplaces were established by the Department at selected locations along major routes, in an endeavour to minimise fire risks. However, with the continuing increase of traffic, the desirability of providing larger areas and additional amenities was recognised and a programme of providing rest areas was undertaken. The first of these areas was established by the Department (in conjunction with other authorities) on the Hume and Federal Highways between Sydney and Canberra in 1965.

In co-operation with various authorities, including the Department of Local Government, Department of Lands, Forestry Commission, National Parks and Wildlife Service, and Shire and Municipal Councils, the Department of Main Roads has now provided a total of 68 rest areas. The map opposite shows the location of these rest areas, all of which have been provided with shelters, tables, seats, fireplaces, firewood, drinking water and litter bins. Toilet facilities are not provided.

While fireplaces are to be found along many Trunk and Ordinary Main Roads, the more *elaborate* rest areas are generally found only on State Highways. Although rest areas are not intended to compete with the amenities provided at towns, service stations and caravan parks, they do provide a growing network of convenient locations where brief but valuable stops can be made.

The use of the properly constructed fireplaces at all rest areas assists in the prevention of disastrous bushfires, which sometimes result from the attempts of motorists to cook on open fires beside the road.

Roadside rest areas are recognised as part of the total environment of the road reserve and the rural scene. Accordingly, when a site is being selected, consideration is given not only to its location with respect to centres of population but also to natural scenery, such as a river, lake or panoramic view. Furthermore, when selecting sites for rest areas, only those which can provide safe entrance and exit facilities are considered. Particular attention is also paid to the availability of adequate shade and shelter. Where necessary, landscaping of the site, including tree planting, is undertaken as part of the Department's continuing efforts to preserve and enhance the natural beauty of the environment.

The greater percentage of rest areas has been constructed in the eastern section of the State where the highways carry greater volumes of traffic. The Department is also aware of the need for shelter and water along the roads in the flat, dry, sparsely settled outback areas and, consequently, an

Fern fronds frame this lovely scene from yesteryear. The ladies are taking a break from the rigours of travelling down Brown Mountain, towards Bega in 1910. In those days, travelling over rough roads in a crowded, open-sided, heavily-laden vehicle meant that any roadside rests would be welcomed enthusiastically. Photograph by courtesy of New South Wales Government Printer

Opposite page

Top: Roadside Rest Area on the Hume Highway at Derringullen Creek, 6·4 km west of Yass

Bottom: This rest area is attractively situated at Gearys Trig on the Federal Highway, 55·3 km south of Goulburn, overlooking Lake George

increasing number of roadside amenities are being provided on highways which extend into the western regions.

Since most rest areas are in localities without a water service, it has been necessary to provide water storage tanks. Tanks made of concrete are installed to avoid, or at least reduce, the damage caused by vandals, who frequently and unfortunately find some sort of warped pleasure in shooting holes in galvanised iron tanks. Since water wastage could cause a problem, the Department relies on the co-operation and community spirit of visitors, in using no more water than they need. In some instances, in order to provide a constant supply of drinking water at rest areas situated long distances from permanent sources of water, regular trips by water tankers have to be arranged.

The Department arranges for the care of each roadside rest area with maintenance calls up to five times a week in summer and at least twice a week in the off-season months. This work involves emptying the litter bins, ensuring the availability of fresh drinking water, replenishing and stacking fresh wood, and tidying the area. Regrettably, some members of our society do not have a proper respect for these amenities and it is not uncommon to find household garbage and building rubbish dumped in or around the litter bins.

The current establishment costs of a roadside rest area are in the order of $10,000 to $20,000, depending on the location and the amount of bituminous surfacing work involved. In addition, the annual maintenance costs range from about $500 for a site in a remote area to something in the order of $6,000 per year in the most heavily trafficked tourist areas.

Roadside signs in advance of the rest areas direct the traveller's attention to them and another sign is displayed at the entrance. Signs at the exits remind motorists to fasten their safety belts before moving out into traffic again.

As mentioned earlier, many rest areas are situated near a particularly attractive feature of the landscape, such as a river, lake or waterfall. Others have been established at naturally occurring elevated positions and these provide pleasant panoramic views of the surrounding countryside. For this reason, roadside rest areas help to satisfy those motorists who are seeking some quiet, picturesque roadside spot where they can simply relax and enjoy a cup of tea, a picnic lunch or a barbecue.

In summary it can be said that roadside rest areas provide drivers and their passengers with an opportunity to temporarily leave the concentration of motoring behind, to appreciate the shade and pleasantness of the natural setting, to make use of the facilities provided and then to return to the road, refreshed, relaxed and more assured of a safer journey.

The rest areas listed on page 117 and shown on the map are numbered in series along each State Highway. The last two listed are on Main Roads. The location of each rest area is described as being on the motorist's left or right hand side as he is proceeding in the direction specified. For example, rest area No. 1 (which is situated on the Princes Highway 32·3 km south of Wollongong) is on your left when you are driving south. Rest area No. 2 (which is situated on the same highway 8 km north of Batemans Bay) is on your left when you are driving north.

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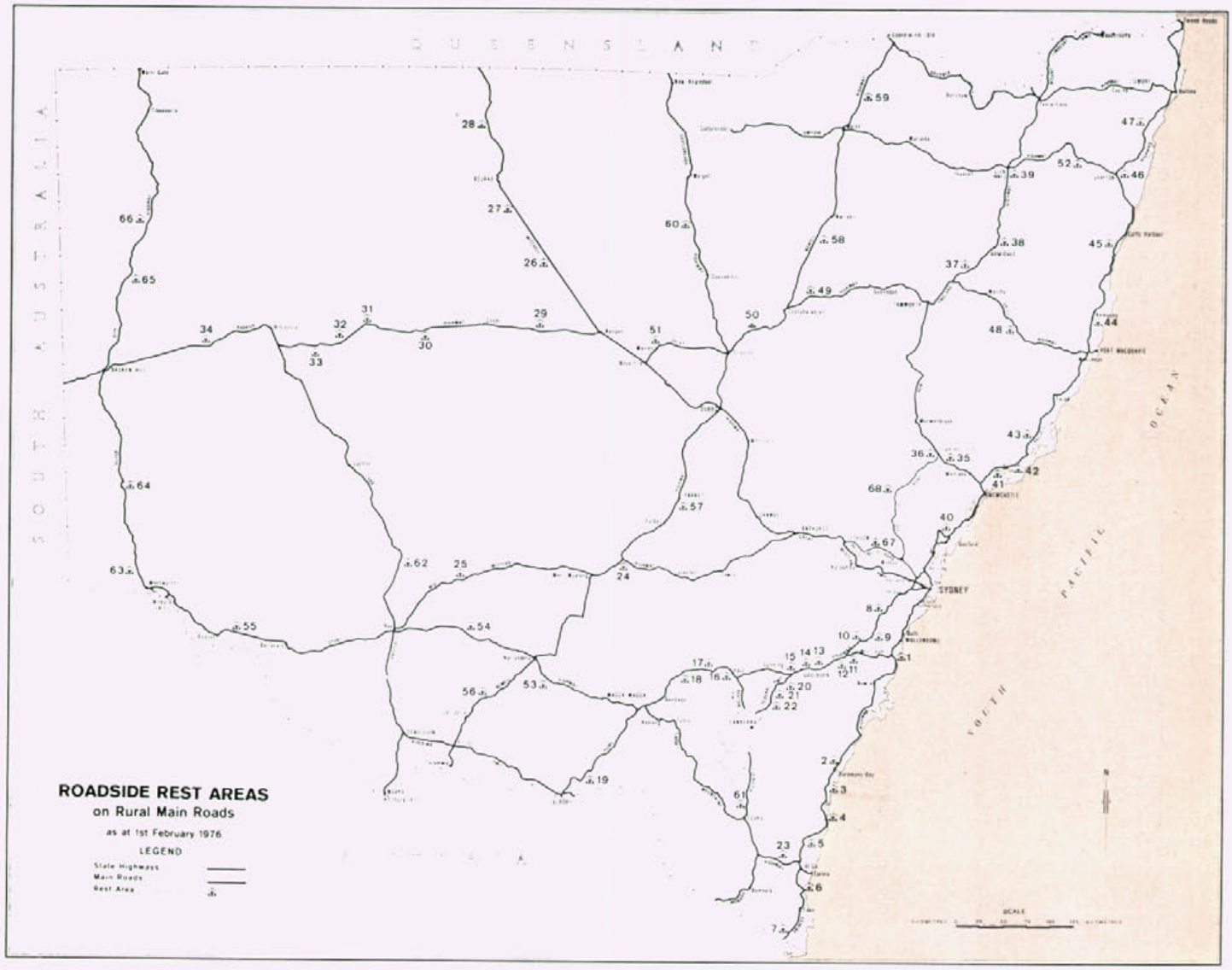
Previous articles on roadside rest areas have appeared in the following issues of "Main Roads".
- *March 1967, Vol. 32, No. 3, pp. 68–9;*
- *June 1969, Vol. 34, No. 4, pp. 112–3;*
- *September 1973, Vol. 39, No. 1, p. 21, and*
- *December 1973, Vol. 39, No. 2, pp. 46–7.*

Colour maps (similar in size to the Department's "Four-in-one" maps of New South Wales) showing the location and listing the sites of roadside rest areas throughout the State have recently been published by the Department and are now available, free of charge. If you would like to receive one to keep in your vehicle's glove-box for handy reference, please contact the Public Relations Section, Third Floor, Head Office.



PRINCES HIGHWAY

1 32·2 km south of Wollongong near Minnamurra River (on the Left).
2 8 km north of Batemans Bay (on the Left).
3 19·3 km south of Batemans Bay at Waldrons Swamp (on the Left).
4 60·5 km south of Batemans Bay (on the Left).
5 31·9 km north of Bega at Quaama (on the Right).
6 30·2 km south of Bega near Millingandi turnoff (on the Left).
7 43·2 km south of Eden at Wallagaraugh River (on the Right).

HUME HIGHWAY

8 42 km south of Liverpool at summit of Razorback Range *(on the Right).*
9 72·2 km south of Liverpool at Yanderra (on the Left).
10 82·3 km north of Goulburn near Wombeyan Caves turnoff (on the Left).
11 63·6 km north of Goulburn at Black Bobs Creek (on the Right).
12 59 km north of Goulburn at Penrose State Forest (on the Right).
13 16·9 km north of Goulburn—"Nattery" Rest Area (on the Left).
14 4 km north of Goulburn at Governors Hill (on the Left).
15 9 km south of Goulburn near Yarra (on the Right).
16 6·4 km west of Yass at Derringullen Creek (on the Left).
17 31·4 km west of Yass at Bogolong Creek (on the Right).
18 38·4 km north of Gundagai at Jugiong Hill (on the Right).
19 33 km north of Albury near Mullanjandra Creek *(on the Right).*

FEDERAL HIGHWAY

20 27·4 km south of Goulburn at Roses Lagoon (on the Left).
21 50·2 km south of Goulburn—"Lakeside" Rest Area (on the Left).
22 55·3 km south of Goulburn—"Gearys Trig" Rest Area (on the Left).

SNOWY MOUNTAINS HIGHWAY

23 33·8 km west of Bega at Bemboka (on the Right).

MID WESTERN HIGHWAY

24 37 km east of West Wyalong at Bland Creek, Marsden (on the Right).
25 106·6 km east of Hay near Goolgowi (on the Left).

MITCHELL HIGHWAY

26 101·7 km south of Bourke (on the Right).
27 21·4 km south of Bourke (on the Right).
28 65·2 km north of Bourke (on the Left).

BARRIER HIGHWAY

29 50 km east of Cobar (on the Left).
30 62·8 km west of Cobar (on the Right).
31 119 km west of Cobar (on the Right).
32 91·7 km east of Wilcannia (on the Left).
33 5 km east of Wilcannia at Maccullochs Range (on the Right).
34 73·7 km west of Wilcannia (on the Right).

NEW ENGLAND HIGHWAY

35 28·5 km west of Maitland (on the Right).
36 38·5 km south of Muswellbrook (on the Right).
37 39·4 km south of Armidale (on the Right).
38 10·8 km north of Armidale (on the Right).
39 5·6 km south of Glen Innes (on the Left).

PACIFIC HIGHWAY

40 13·5 km north of Gosford near Bangalow Creek (on the Left).
41 44·7 km north of Newcastle (on the Right).
42 55·1 km north of Newcastle near Karuah (on the Right).
43 64 km south of Taree at O'Sullivans Gap (on the Right).
44 8 km south of Kempsey at Maria River (on the Left).
45 17·4 km south of Coffs Harbour (on the Right).
46 3·2 km south of Grafton (on the Left).
47 48·3 km south of Ballina near New Italy turnoff (on the Right).

OXLEY HIGHWAY

48 81·1 km west of Wauchope at Stockyard Creek (on the Left).
49 32 km east of Coonabarabran near Rocky Glen (on the Left).
50 40 km south of Coonabarabran near Hickeys Falls—Wallumburrawang Creek (on the Right).
51 4·4 km east of Warren (on the Left).

GWYDIR HIGHWAY

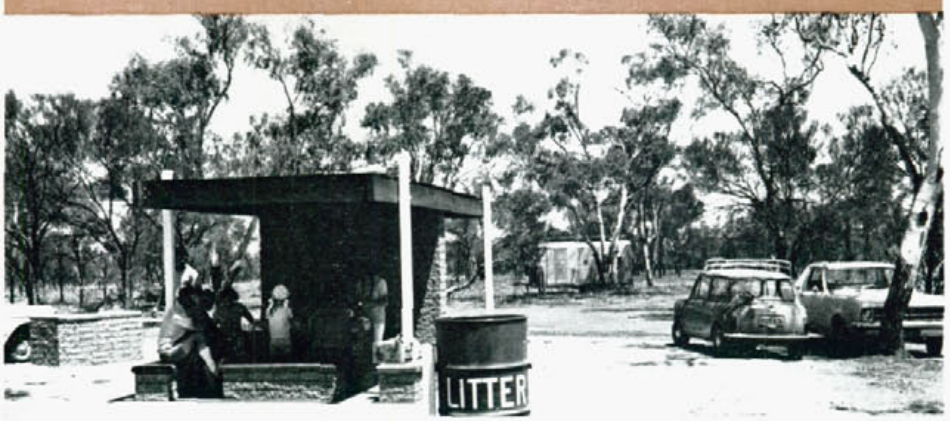
52 43·4 km west of Grafton near Mann River bridge (on the Left).

Top: By the banks of the Numerella River, 19·3 km north of Cooma on the Monaro Highway

Above: On the Mitchell Highway, 21·4 km south of Bourke

Right: On the Newell Highway, 9·7 km south of Parkes near Billabong Creek

Below: On the Barrier Highway, 55 km east of Wilcannia at Maccullocks Range



STURT HIGHWAY

53 23 km east of Narrandera at Sandigo (on the Right).
54 83·8 km east of Hay (on the Left).
55 26·9 km east of Euston (on the Left).

NEWELL HIGHWAY

56 39·4 km north of Jerilderie (on the Left).
57 9·7 km south of Parkes near Billabong Creek bridge (on the Left).
58 24·8 km south of Narrabri (on the Left).
59 40·9 km north of Moree (on the Right).

CASTLEREAGH HIGHWAY

60 52·9 km south of Walgett (on the Right).

MONARO HIGHWAY

61 19·3 km north of Cooma at Numerella River (on the Left).

COBB HIGHWAY

62 77 km north of Hay at Booligal (on the Right).

SILVER CITY HIGHWAY

63 25·7 km north of Wentworth (on the Left).
64 124·3 km south of Broken Hill at Lake Popilta (on the Left).
65 111 km north of Broken Hill at Fowlers Gap (on the Right).
66 160·6 km south of Tibooburra at Packsaddle (on the Right).

Bells Line of Road

67 44·5 km west of Windsor at Berambing (on the Right).

The Putty Road

68 77 km south of Singleton at Boggy Swamp Creek (on the Right).

Flying A Whirly Bird

SOME NOTES ON OPERATING THE DEPARTMENT'S HELICOPTER

There are many special features associated with the operation of an organisation which deals with the planning, design and construction of a statewide road system. Much specialised equipment and machinery is needed for the continued functioning of the many activities which such an organisation has to undertake.

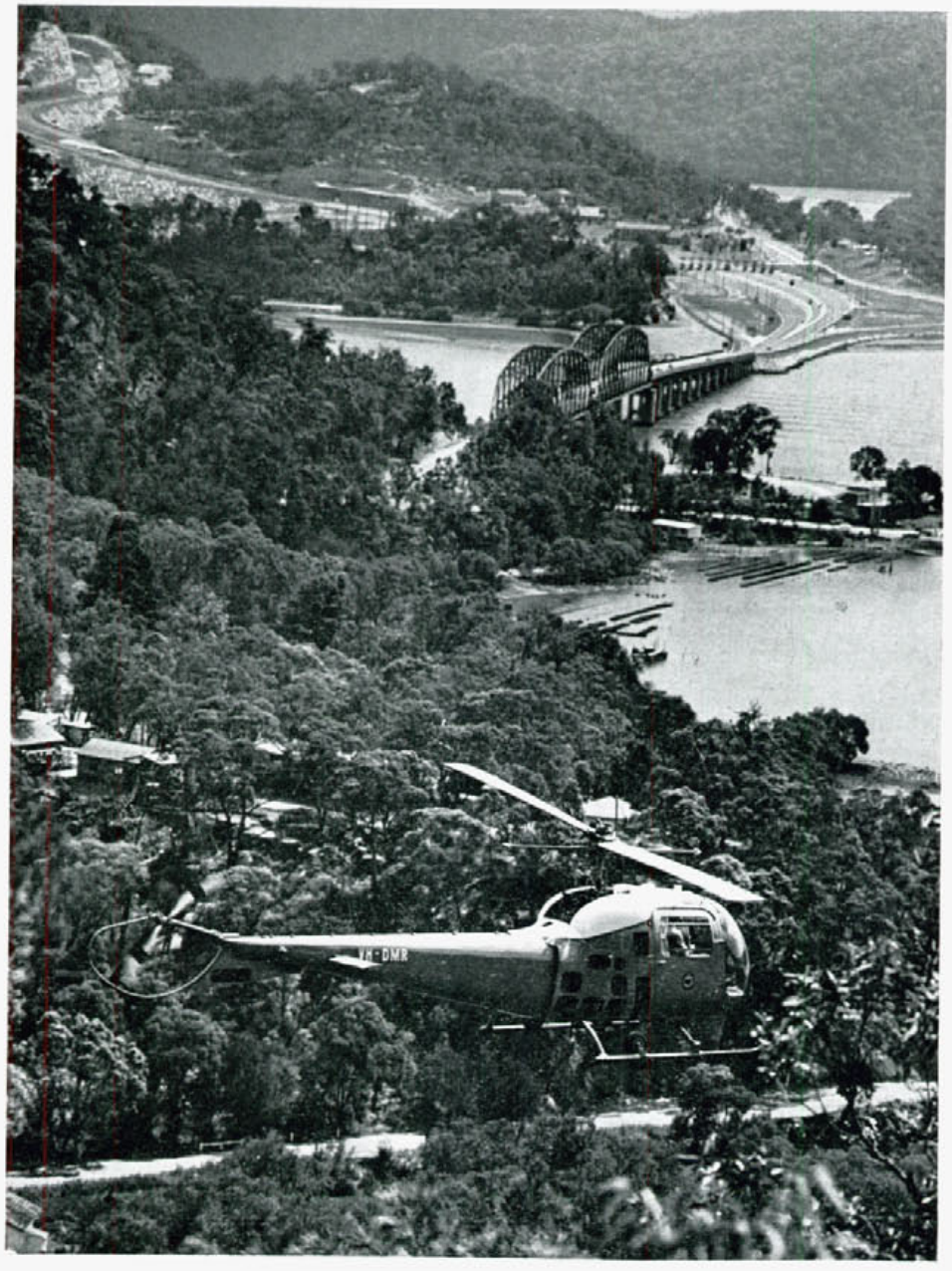
One type of machine purchased by the Department in recent years, which more than saved its cost in its initial period of operation, is the helicopter. This machine is used primarily on new road location investigations and for survey work. Often a 10 to 15 minute flight may save days of arduous climbing through rugged terrain in areas otherwise only accessible to men on foot.

The Machine and What it Does

The Department purchased its first helicopter—a Bell Ranger 47J-2A model—back in 1964 and it was registered appropriately as VH-DMR. A later model—a Bell Jet Ranger Model 206A—was obtained in 1969 to replace the previous machine which was subsequently sold. As the registration number always remains with the aircraft, a new number—VH-PMR—was allocated to the Department's new helicopter. In April, 1973 it was again decided to *update* and the Department's current *whirly bird* was purchased.

The Department's latest helicopter is a Bell Jet Ranger II, Model 206B, a modern 5-seat turbine-powered light utility unit with the registration number VH-TMR. The weight of the unit empty is 800 kg and the maximum take-off weight is 1450 kg. This allows a maximum payload of 650 kg, which includes pilot, passengers, cargo and fuel. Normal cruising speed is about 200 km/h and the normal cruising altitude is about 300 metres. The range of the helicopter varies considerably depending on the load carried and on the weather. The maximum range in still air without re-fuelling, is approximately 600 kilometres. Strong head-winds, will of course, greatly decrease the range. It is also necessary to carry reserve fuel for all flights.

One of the initial major tasks which involved the use of the Department's first helicopter (VH-DMR—purchased in 1964) was the checking of the proposed route of the Sydney-Newcastle Freeway between Berowra on the Hawkesbury River. Improvements to the route resulted in substantial savings in subsequent construction costs



Servicing

Like every other machine used by the Department, only more so, the helicopter must be regularly maintained and checked to ensure continuous serviceability and safety.

As the helicopter is an aircraft, its mechanical maintenance conforms to Air Navigation Regulations and the manufacturer's recommended schedules of servicing.

Daily servicing and inspections are undertaken by the Department's Executive Pilot who has a maintenance authorisation from the Commonwealth Department of Transport to carry out these functions.

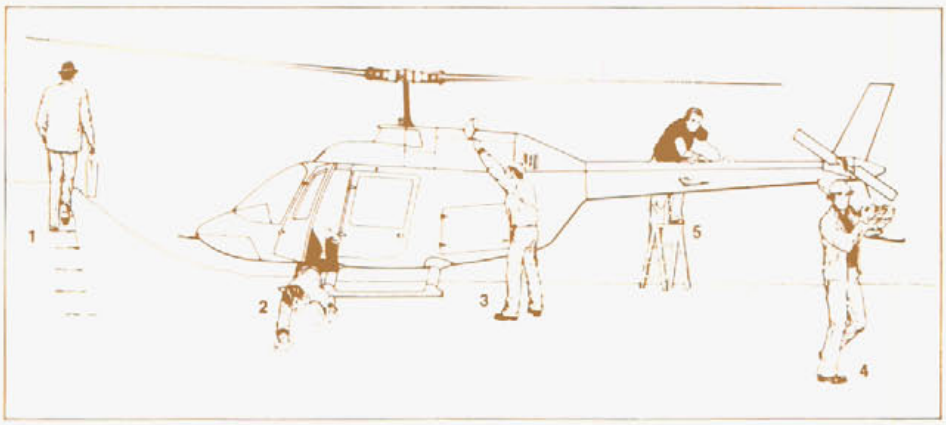
Mandatory services, inspections, maintenance checks and overhauls are required in accordance with the schedules determined by the manufacturer, Bell Helicopter Company.

Regular service inspections are scheduled at 100 hourly (flying time) intervals. Major inspections and overhauls are required to be carried out at nominated intervals from 1 000 hours upwards. These major services include inspection and overhaul of the turbine engine components, main and tail rotors, transmission, air frame components, flight instruments, etc.

The Executive Pilot and certain engineers from the Department's Mechanical Section have undergone a course of instruction in familiarisation and operation of the helicopter's Allison 250-C20 turbine engine. The course was conducted at the Service Training School of Hawker De Havilland Australia Pty Ltd in Sydney.

Fuelling

The type of fuel used by the helicopter is aviation turbine fuel, identical to that used in commercial passenger jet aircraft. Fuelling at airports, including Sydney (Kingsford Smith) Airport, is done by bulk tanker. A reserve supply of fuel (for emergency use) is held at a Departmental Maintenance Depot in the Sydney Metropolitan Area.



Reproduced from "Rotorways" by courtesy of Bell Helicopter Company.

A brief guide to helicopter etiquette: **1** Never approach a helicopter from the rear and use extreme caution when approaching and leaving from the front. **2** Be careful not to knock controls when entering and leaving aircraft. **3** Do not touch engine tailpipe or exhaust. **4** Be extremely careful when carrying long objects. **5** Never touch rotating blades or driveshafts.

Above: In 1969 VH-DMR was replaced by VH-PMR which was a more modern model with better range, speed and overall capabilities

Below: The Department now uses VH-TMR, a Bell Jet Ranger II Model 206B, in a wide variety of activities, particularly in connection with road and bridge location investigations

During extensive country flights or where bulk supplies are not available in outer urban areas, supplementary supplies of fuel in drums may have to be arranged in advance to suit particular flight programmes.

Roll-out Take-off and Landing Pad

The helicopter is based at Sydney (Kingsford Smith) Airport, Mascot, where a prefabricated hangar building (including a waiting lounge and an office for the Executive Pilot) has been erected on land leased by the Department from the Commonwealth Department of Transport.

The hangar is equipped with a unique mobile platform for transporting the helicopter into and out of the hangar. The helicopter takes off from and lands on the platform, which is shown in the colour illustrations on pages 112–113.

The *roll-out pad* speeds up take-off preparation and garaging after flight. The unit was designed and constructed at the Department's Central Workshop, Granville. It is approximately 4 metres square and runs on rails from inside the hangar to the apron in front of the hangar.

The platform can be operated by one person (usually the Executive Pilot) and is powered by batteries which are recharged while the platform is in the hangar. The platform batteries are also used as auxiliaries for starting the engine of the helicopter. The pilot is thus able to conserve the helicopter's nickel-cadmium battery for field operations.

Regulations

The Department is the holder of a current Aerial Work Licence issued by the Department of Transport in pursuance of the Air Navigation Regulations. This licence allows the Department to use its helicopter on the following aerial work operations within New South Wales:

☆ aerial survey;
☆ aerial spotting; and
☆ ambulance functions.

The licence is granted subject to the condition that the helicopter operations must at all times be conducted in accordance with the provisions of the Air Navigation Act and Air Navigation Regulations.

The Department's helicopter is also licenced for night V.M.C. (Visual Meteorological Conditions) operation and the Executive Pilot is qualified for Class 4 Instrument Rating endorsement for night V.M.C. operations.

MAIN USES

While the primary use of the helicopter is as a tool for surveyors and for engineers in determining road location (which can be done most efficiently from the air), it has proven itself to be extremely versatile. Some of the other areas where it has been used effectively and with savings in cost are:

- the transport of geologists and their soil mechanics equipment into inaccessible areas for geological investigations;
- tracing the natural flow of creeks and their overflows;
- the initial selection of the most appropriate sites for bridges (these are later examined in detail on the ground);
- studying the flow of traffic and its movements at intersections;
- assisting in police control of traffic during periods of very high traffic flow, such as during public transport strikes, holiday periods and major sporting fixtures;
- inspections to determine the extent and effects of major flooding as well as the damage caused to roads and bridges inundated by floodwaters;
- vertical and oblique aerial photography for road inventory purposes and as a

permanent record of the progress made with road and bridge works; and
- the rapid movement of executive personnel, where applicable.

Passenger Safety

The helicopter has been accepted as a safe and effective means of transport but passenger accidents can still occur, especially when passengers are unfamiliar with the machine. For this reason, before each flight with new personnel, the pilot holds a *safety briefing*, during which he explains the operational capabilities of the helicopter as well as the hazards of incautious behaviour in approaching or leaving it.

These safety briefings are conducted to ensure that passengers do not walk into rotating main or tail rotor blades; are especially careful when carrying long or bulky objects; never approach the helicopter from the rear; do not touch any controls in flight or when entering or leaving the helicopter; and do not leave the helicopter while it is still off the ground!

MORE THAN A SHOWPIECE

The Department's helicopter is probably thought of by many people, who happen to catch a passing glimpse of it in the air, as more of a gimmick, a showpiece or an expensive *toy*, rather than as a functional tool or as the *work horse*, which undoubtedly it is. In the Department's experience it is certainly a revolutionary piece of equipment but, more importantly, week in and week out, during the whole year, it is unpretentiously performing very valuable work.

The helicopter's versalitity and efficiency have allowed the Department to use many time-saving and cost-saving techniques. It is a case where, although the Department may appear to have its *head in the clouds*, it really has *its feet planted firmly on the ground.*

Previous references to the Department's helicopter have appeared in the following issues of "Main Roads".

* *December, 1964, Vol. 30, No. 2, p. 33;*
* *September, 1967, Vol. 33, No. 1, pp. 8–9;*
* *December, 1971, Vol. 37, No. 2, p. 44;* and
* *March, 1972, Vol. 37, No. 3, pp. 70–4 and 81.*

A WORD FROM OUR PILOT

It has been said that the helicopter exhibits a triumph of ingenuity over common sense. Who would have believed that a flying machine could fly forward, backward, sideways and straight up and down, could sit motionless in the air, perform aerobatics and could achieve forward flying speeds of more than 300 km/h? An engineer could find more sophisticated grounds for scepticism. How, for instance, could the hovering helicopter be controlled or made stable in the absence of restoring aerodynamic forces? How could it be kept from shaking itself to pieces under the stress induced by the various rotating systems?

The concepts of the helicopter can be traced back to early Chinese tops and to Leonardo da Vinci's Aerial Screw machine of 1483. In general, da Vinci claimed that air has substance (now termed density), and that an aerial screw arrangement, if turned at sufficiently high speed, would bore up into the air in the same manner as that of any auger bit boring into wood. By comparison, power driven horizontal air screws or rotors are used on the modern helicopter to provide lift and propulsion.

Early helicopter designs generally utilised multi rotors. A Frenchman, Louis Brequet, had introduced in 1907 a design for a direct lift type aircraft which he called a Helicoplane. This machine used four sets of rotors with each set consisting of four biplane blades. It had the ability to momentarily rise from the ground.

Igor Sikorsky, then of Russia, had built two helicopters in 1909 and 1910 with twin rotors driven on concentric shafts, one shaft revolving inside the other. The second machine could lift its own weight.

The first successful practical approach to a helicopter was not, in fact, a true helicopter, but an evolutionary aircraft that depended on the propulsion system of a conventional aircraft.

In 1923, its inventor, a brilliant Spanish engineer named Juan de la Cierva, built and flew a craft that was driven by a propeller in front but which had no fixed wings; instead, an arrangement of four blades turning on a vertical spindle provided the lift. This rotor was not powered; it was turned by the action of the air flowing on the blades as the plane moved.

The blades were hinged so they could change the in-lane angle and move up or down thus making automatic adjustments to the changing loads during the revolutions and to lifting and banking manoeuvres. The machine could fly as slow as 48 km/h and descend almost vertically, stopping within a few metres on the ground.

This machine was actually a gyroplane, and its type was known in later years by the trade name of *Autogiro*. In 1935, Brequet built a helicopter with two rotors mounted one above the other on a co-axial hub. This new arrangement demonstrated promising characteristics, notably control and stability. However, the machine was extremely heavy with possibility of trouble from interference of the two rotors.

In Germany, Henri Focke designed a helicopter with two rotors mounted side by side that flew from Bremen to Berlin. Meanwhile, in the United States, Sikorsky produced a single rotor helicopter that made extensive cross-country flights. The Focke helicopter is recognised by many authorities as the first practical successful helicopter.

☆ ☆ ☆

What are the essential characteristics of a helicopter? It has been described as an aerodyne deriving its lift in flight chiefly from power driven horizontally rotating rotors. Basically, its rotor blades are wings that provide lift in the same way as the fixed wings of an aeroplane do, but rotor lift is produced independently of the aircraft's forward speed.

As the leading edge of each blade moves forward in the air at a slightly elevated pitch, it produces a pressure increase on the underside of the blade, and a pressure reduction of the upper side. This consequent lifting force can keep the craft suspended in the air without the craft itself moving at all.

In flight, however, the problems of stability and control become more complex than they are on a conventional airplane. The controls of the helicopter are more elaborate and different in principle from the airplane system of ailerons, elevators and rudders.

The helicopter's rotor blades, which in present versions of the craft vary in number from two to five and in length from 9 to 23 metres, are attached to a rotating hub by a complex system of hinges and bearings that allows each blade to be feathered (or changed in pitch), to flap up and down and to swing forward and backward.

These means of giving the blades several degrees of freedom are needed for control and to enable the blades to adjust to the varying loads they encounter as they simultaneously whirl about the rotor shaft and move through the air. To some extent, deflection of the flexible blades also relieves the loads and can substitude for one or more hinges.

This, and other design features, enable the craft to be controlled and also effect its stability or tendency to return to its original position after being disturbed by air turbulence or inadvertent control motions.

The flapping and feathering hinges make it possible for the pilot to tilt the rotor so that the direction of thrust is displaced from the helicopter's centre of gravity, producing a moment or turning force that pitches or rolls the craft. For the control of yaw, i.e., swinging of the nose from side to side, helicopters that are powered by a single main rotor (the prevailing type today) have a small vertical rotor mounted on the tail of the machine.

The pilot can vary the pitch of the small rotor's blades by using foot pedals. Therefore, he is able to employ this rotor as a rudder and to control any yawing motions. The tail rotor also counteracts the torque produced by the main rotor which otherwise would swing the craft around. The pilot has two control sticks for manipulation of the rotor blades. One tilts the rotor by causing the blades to feather differentially; they change their pitch or angle of attack as they advance or retreat so as to give equal lift to the blades in forward flight.

The other control stick causes all the blades to maintain a uniform pitch. By pulling upward on this stick, the pilot increases the pitch so that the rotor produces greater climbing thrust. Pushing it downward he reduces the thrust. As mentioned above, foot pedals control the tail rotor's blades.

The difficulties in handling a helicopter arise from its inherent response to control motions and disturbances. When the pilot moves the control stick to tilt the conventional rotor, for example, there is a discernible lag between his motion and the resulting roll or pitch response. This can lead to over-controlling.

The conventional helicopter is rather unstable in rough air. The instability is not troublesome at cruising speeds but on steep approaches a helicopter is much more subject than the fast moving airplane to buffeting by turbulence and wind gusts. The helicopter has many safety advantages over fixed wing aircraft, in particular its ability to fly slowly and cope with engine failure in confined areas.

☆ ☆ ☆

One of the most valuable commercial uses of the helicopter is the transportation of workers and construction materials to remote locations in mountains, jungles and elsewhere that would take weeks or months to reach by other means, or that would be otherwise inaccessible.●

These notes have been adopted from a paper prepared by the Department's Executive Pilot, Mr Noel Dodwell.

DEPARTMENTAL ORGANISATION

THE ENGINEER-IN-CHIEF'S BRANCH . . . AND HOW IT OPERATES

This is the first in a series of articles which outline what goes on behind the scenes, throughout the Department's organisation. It is hoped that these will give our readers an insight into the administrative structure of the Department as a whole, as well as the functions of various officers and sections.

For the direction and administration of all Main Roads works the Department's organisation comprises a Head Office, Divisional Offices, and Works Offices. The focal point of administration is the Head Office organisation.

The Department's organisation based in Head Office is divided into four branches headed respectively by the Engineer-in-Chief, the Secretary, the Chief Accountant, and the Chief Legal Officer. Each branch is responsible to the Commissioner.

The Engineer-in-Chief is responsible for the activities of all technical staff, that part of the clerical staff working in the various sections under his control, and all staff and employees in the field, with the exception of the three toll offices—(at Sydney Harbour Bridge, Berowra, and Waterfall) which are under the control of the Chief Accountant.

This article outlines the organisation and operations of the Engineer-in-Chief's Branch.

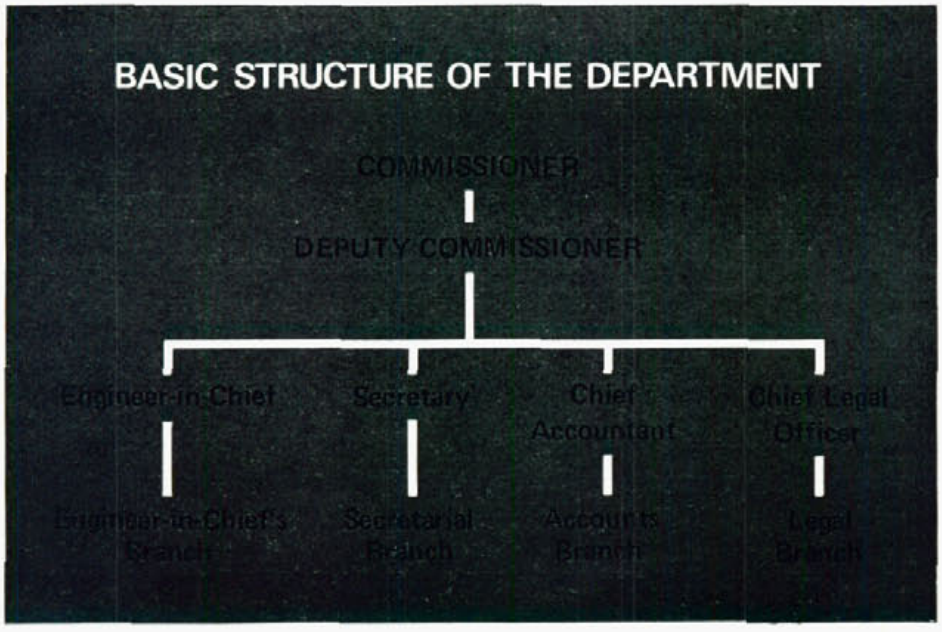
ENGINEER-IN-CHIEF

The Engineer-in-Chief is the principal engineering officer of the Department. He is responsible for recommending the works to be undertaken by the Department and is in charge of the planning, design, and execution of all approved works. In addition, he is responsible for the supervision of work carried out by Councils with financial assistance from the Department.

The Engineer-in-Chief carries out his functions by administration of:

- Head Office sections under his control; and
- eighteen Divisional Offices which control all field operations throughout the State.

The Engineer-in-Chief is assisted in the functioning of his branch by the Deputy Engineer-in-Chief and four Chief Engineers.



Although responsible to the Engineer-in-Chief, the Chief Engineer (Roadworks) and Chief Engineer (Bridges) report directly to the Deputy Engineer-in-Chief on matters relating to maintenance and construction operations. The Chief Engineer (Rural) and Chief Engineer (Urban) report directly to the Engineer-in-Chief on all functions under their control.

DEPUTY ENGINEER-IN-CHIEF

The Deputy Engineer-in-Chief is responsible to the Engineer-in-Chief for all maintenance and construction operations. He acts for the Engineer-in-Chief during his absence. In addition to the Chief Engineer (Roadworks) and Chief Engineer (Bridges), other senior officers responsible for specialist functions report to the Deputy Engineer-in-Chief and these are mentioned on page 122.

CHIEF ENGINEER (ROADWORKS)

The Chief Engineer (Roadworks) is responsible for all field activities and programmes of roadworks financed wholly or partly by the Department. He reports to the Deputy Engineer-in-Chief on all operational matters and to the Engineer-in-Chief on all other matters under his control.

The functional engineers reporting to the Chief Engineer (Roadworks) are:

- Highways Engineer;
- Engineer for Country Councils Works;
- Mechanical Engineer; and
- Asphalt Engineer.

CHIEF ENGINEER (BRIDGES)

The Chief Engineer (Bridges) is responsible for bridge design and technical aspects of the construction and maintenance of bridges. He is also responsible for programmes and priorities for bridge and ferry construction and maintenance where the full cost is met by the Department. He reports directly to the Engineer-in-Chief on all bridge design and administrative matters and to the

Deputy Engineer-in-Chief on all matters related to bridge construction and maintenance.

The Chief Engineer (Bridges) is assisted in the administration of his section by the Assistant Chief Engineer (Bridges) who will also be either Bridge Engineer (Operations) or Bridge Engineer (Design).

CHIEF ENGINEER (RURAL)

The Chief Engineer (Rural) is responsible to the Engineer-in-Chief for all road planning investigations, location and design activities relating to the Main Roads System outside the Counties of Cumberland and Northumberland and the City of Greater Wollongong. He reviews all rural road locations and specifications including those of rural freeways, and is responsible for the acquisition of land necessary for these works. In addition, he is responsible for materials research and established standards and procedures for testing construction materials.

The officers reporting to the Chief Engineer (Rural) and who are responsible for Head Office sections are:

- Rural Investigations Engineer;
- Materials and Research Engineer;
- Principal Architect; and
- Road Design Engineer (for rural works).

Also reporting to the Chief Engineer (Rural) is the Engineer for Environmental Matters. He is responsible for recommending action necessary to meet the Department's responsibilities in implementing Government policy on environmental issues. His tasks include the establishment of the Environmental Study Group, supervision of studies by the Group, briefing of consultants and specialist advisers on environmental issues, and co-ordination of input from these sources.

A further responsibility includes representation on inter-departmental and NAASRA* environmental committees and, where necessary, representation at public inquiries on environmental issues.

CHIEF ENGINEER (URBAN)

The Chief Engineer (Urban) is responsible to the Engineer-in-Chief for all road planning investigations, location and design activities relating to the Main Roads System within the Counties of Cumberland and Northumberland and in the City of Greater Wollongong. He ensures that the Department's plans are developed consistent with statutory town planning schemes in the larger urban areas. He arranges all types of traffic studies and surveys aimed at increasing the capacity of roads and the safety of road users. He prepares programmes of land acquisitions. The Department's library comes under his control.

The officers reporting to the Chief Engineer (Urban) and who are responsible for the Head Office sections are:

- Urban Investigations Engineer;
- Road Design Engineer (for urban works);
- Traffic Service Engineer;
- Principal Surveyor and Property Officer; and
- Librarian.

OTHER SENIOR OFFICERS

The following officers are not responsible to a Chief Engineer but report directly to the Engineer-in-Chief.

Engineer for Programmes and Budgets, who is responsible for co-ordinating all budget activities and preparing programmes involving the budgeting of funds. To assist in this work the Advance Planning Engineer, the Technical Computing Engineer, and the Cost Accountant are under his direction.

Field Inspecting Engineer, who makes regular inspections of roadworks being undertaken by the Department's own forces, and when requested examines future prospects and advises the most effective methods of construction and maintenance. He co-ordinates work between the Divisions and Head Office on special operational problems. He is responsible for the School of Plant Instruction, which is located at the Central Workshop, Granville.

Executive Engineer, who is responsible for matters relating to recruiting, placement, promotions, and counselling of professional and technical staff responsible to the Engineer-in-Chief. He works in association with the Department's Industrial Officer in relation to awards and agreements affecting professional and technical staff. He is also responsible for in-service staff training of technical staff and courses for foreign students sponsored by NAASRA.

Engineer for Standard Specifications and Technical Instruction, who is responsible for the preparation, review, and amendment of the Departments standard specifications, technical forms and instructions. He is also responsible for the control of the Head Office Print Room and the Plan Room.

Divisional Engineers, other than the Divisional Engineer for Inner Freeway Construction and the Divisional Engineer for Outer Freeway Construction, also report to the Engineer-in-Chief and their functions are set out in Part 2 of this article which will be published in the next (September, 1976) issue of "Main Roads".

The following senior officers report directly to the Deputy Engineer-in-Chief.

Contract Administration Engineer, who co-ordinates payments, non-technical claims and queries, procedural reviews, and the training of departmental officers in contract administration.

Divisional Engineer, Inner Freeway Construction, who is responsible for the construction of freeways generally within the area contained by Ring Road No. 3 in the County of Cumberland.

Divisional Engineer, Outer Freeway Construction, who is responsible for the construction of all freeways in the outlying suburbs of Sydney and nearby rural areas.

Supply Officer. The organisation and function of the section under the control of the Supply Officer is set out on page 123.

Officer-in-Charge, Weight of Loads. The organisation and function of the section under the control of this officer is set out on page 123.

Principal Training Officer, who is responsible to the Steering Committee on Training for the development, review, conduct, and co-ordination of all staff training within the Department.

SECTIONS WITHIN THE ENGINEER-IN-CHIEF'S BRANCH

Executive Engineer's Section

The Executive Engineer's Section deals with matters relating to recruitment, placement, promotions, and counselling of professional, technical, and general staff under the control of the Engineer-in-Chief. He works in association with the Industrial Section of the Secretarial Branch

* National Association of Australian State Road Authorities.

in relation to awards and agreements affecting professional and technical staff. The Executive Engineer is responsible for the conduct of in-service training courses for technical staff and courses for foreign students sponsored by NAASRA.

The Executive Engineer is assisted by three engineers in the administration of his responsibilities.

The duties of these officers are:

(i) the administration of matters relating to graduate staff;

(ii) the administration of matters relating to non-graduate staff; and

(iii) the administration of matters relating to technical training.

Standard Specifications and Technical Instructions Section

This section co-ordinates the work of preparation, review, and amendment of the Department's standard specifications, technical forms and instructions. The specific functions of the Section are as follows:

☆ Maintaining an up-to-date record of all standard specifications, standard drawings, and technical instructions relating to design, construction methods, and materials.

☆ Investigating requests for the establishment of new standards and arranging for their preparation if this seems desirable.

☆ Supervising the preparation of draft standards.

☆ Co-ordinating the work of other sections involved with the preparation of standards.

☆ Co-operating with clerical staff, in the Secretarial Branch and Chief Accountants Branch, who are also engaged in the preparation of material for manuals, bulletins, and books of instruction to ensure uniformity and consistency of the contents.

☆ Finally editing and submitting for the Engineer-in-Chief's approval all standards and technical instructions.

☆ Arranging for the printing, distribution, and storage of standards, manuals, and books of instruction (technical), as well as any subsequent amendments.

☆ Control of the Head Office Print Room.

☆ Control of the Head Office Plan Room.

☆ Co-ordinating a programme of metric conversions throughout the Department.

Supply Section

The Supply Section arranges the purchase and distribution of stores, materials, and small plant items to field offices, it is not directly responsible for the purchase and/or distribution of office stores and stationery, tars and bitumen products, and major plant items as the supply of these items is the responsibility of the Stores Officer, the Asphalt Engineer, and the Mechanical Engineer respectively.

Weight of Loads Section

The Weight of Loads Section, under the direction of the Weight of Loads Officer, administers Ordinance 30C of the Local Government Act, 1919 (as amended) which deals with permissible axle loads and the loaded weight of large vehicles operating on the Main Roads System in New South Wales.

The Ordinance imposes limits on the gross weights and axle load of vehicles and the Section undertakes the examination of applications for issue of permits, as appropriate, for non-divisible loads in excess of Ordinance Limits for transport by road on suitable vehicles.

The Section controls the field activities of the Department's team of Weight of Loads Inspectors who are involved in the checking of vehicle loads and the enforcement of the ordinance. Recording all the offences detected and preparing the necessary court papers (including the recording of the fines and penalties imposed on offenders) are also functions of the Section. (Anything of an unusual nature regarding court matters is referred to the Legal Branch.)

Highways Section

The Highways Section is responsible for the administration of all field operations associated with roadworks by the Department and by Councils on:

☆ all State Highways, Main, Secondary, and Tourist Roads in the County of Cumberland; and

☆ all State Highways and a limited number of other Main Roads in the country.

One of the major functions of the Highways Section is to prepare and review annual programmes of construction and maintenance works on these roads, based on considerations of proposals received from Divisional Engineers.

In addition, the Highways Section is responsible for the following work:

☆ Obtaining and advising Divisional Engineers of approvals to plant, acquisitions, and estimates.

☆ Seeking approval to estimates of overheads.

☆ Seeking approval, when necessary, to tenders for work.

☆ Finalising works on completion.

☆ Reviewing programmes at regular intervals (late August and late February for construction programmes).

☆ Supervision of safety arrangements on works.

☆ Seeking approval to programmes, plans, and estimates for depot construction and depot extensions.

☆ The preparation of programmes and seeking approval to plans and estimates of tree planting and the provision of rest areas on main roads as well as giving assistance to Divisions concerning the cultivation and maintenance of trees.

☆ The co-ordination of all works which involve the road crossings of railway tracks, including the preparation of programmes for overbridge construction and level crossing improvements.

Country Councils Section

The Country Councils Section is responsible for the preparation, review and Head Office administration of works programmes by shire, municipal and city councils on Trunk Roads, Ordinary Main Roads and Tourist Roads, in the country as well as on Rural Local Roads, Urban Local Roads, and Development Roads and Works.

The checking and subsequent approval of plans and estimates for council works on these classifications of roads is also a function of this Section.

Specific functions of the Section are as follows:

☆ Preparing and recommending annual works programmes based upon proposals made by Divisional Engineers and in conformity with approved allocations of funds.

☆ Reviewing detailed estimates submitted by Divisional Engineers and making recommendations regarding acceptances.

☆ Reviewing and comparing tenders for works which are outside the authority of Divisional Engineers and making

recommendations regarding their acceptance.

☆ Reviewing the actual costs of council works and comparing them with the estimates. Recommending the approval of extensions, variations, and excess expenditures which cannot be approved by Divisional Engineers.

☆ Keeping records of all grants made and the progress of all works. Drawing attention to deviations from the programmes and recommending additions or variations as deemed desirable.

☆ Reviewing and making recommendations on all matters connected with country councils' works which are referred to Head Office by Divisional Engineers.

Mechanical Engineer's Section

The Mechanical Engineer's Section is a service section responsible for the provision and maintenance of all mechanical, electrical, and allied services to Head Office sections and Divisional Offices (including Works Offices).

The particular functions of this Section include the following:

☆ Purchase and disposal of plant and motor vehicles.

☆ Administration, in Head Office, of plant and motor vehicle repairs.

☆ Inspection of workshops, plant, and motor vehicles in the field.

☆ Studying developments and disseminating relevant information about plant and motor vehicles and their maintenance.

☆ Investigating occupational health matters relating to plant and vehicles and their operation.

☆ Investigating special purpose plant, trailers, mobile sleeping accommodation, etc.

☆ Provision of electrical and electronic services (including power supply, street, tunnel and bridge lighting, radio, special instruments, automatic toll collection, closed circuit TV, etc.).

☆ Estimates for compensation relating to any mechanical features of properties which have been resumed or purchased for future roadworks.

☆ Administration of Head Office Garage; helicopter operations; Head Office building maintenance; air conditioning; lift installation and their maintenance contracts; and plant hire including the rates and conditions for the use of Departmental, Council, and Contract plant items.

☆ Training of Plant Inspectors and Plant Foremen.

☆ Preparation of papers relating to the functions of the Mechanical Engineer's Section, for in-service staff training.

☆ Registration, insurance (including accident claims) and stocktaking of plant and motor vehicles.

☆ Arranging special permits for the operation of oversize or overweight plant.

☆ Keeping plant operation records.

☆ Allocation and transfers of plant and motor vehicles.

☆ Replacement of vehicles by trade-in.

☆ Direct control of the Department's Central Workshop, at Granville, which performs the following:

—Repairs to plant—including service exchange components.

—Manufacture of road signs and supporting structures; furniture; special plant, equipment, and instruments not available from normal trade sources; bridge components, etc.

—Inspection and maintenance of residences owned by the Department.

—Inspection and repairs to vehicular ferries, bitumen sprayers, etc.

—Administration of apprentice training.

—Design and construction of special projects, such as toll plazas, prefabricated offices and laboratories.

—Organising of auction sales of plant, vehicles, and surplus stores.

Through representation on NAASRA and SAA* Committees, this section is also concerned with the development of uniform practices and policies throughout Australia for plant, vehicle and allied matters.

Asphalt Section

The Asphalt Section is responsible for the co-ordination and technical control of all bituminous work throughout the State. The main functions of the Section are listed below:

☆ Provide technical advice to Divisional Engineers during the preparation of proposals for bituminous works, examine such proposals, and make recommendations regarding their adoption.

☆ Advise and assist Divisional Engineers in preparing specifications and instructions for bituminous surfacing works.

☆ Co-ordinate the work of all of the Department's sprayed bituminous surfacing units, asphalt mixing plants, and asphalt paving teams.

☆ Control the operations of Central Asphalt Depot, including the Sydney-based sprayed surfacing unit and three asphalt paving teams.

☆ Administer contracts for supplementary supply and delivery of asphalt in the Sydney area.

☆ Control the operations of the Mobile Asphalt Unit for country works.

☆ Administer annual contracts for the supply and distribution of all bituminous materials used by the Department.

☆ Inspect bituminous works in progress and advise Divisional Engineers with regard to the composition of units, quality of workmanship, efficiency, suitability of materials, methods, plant, personnel, etc.

☆ Maintain records of bituminous surfacing works.

☆ Develop and improve technical and administrative procedures for the design, execution, and recording of bituminous works.

☆ Train field engineers and foremen in bituminous matters by the issue of technical circulars, lectures to in-service training courses, inspections, preparation of manuals, and dissemination of information on new products, techniques, etc.

☆ Recommend purchase and deployment of specialised plant for bituminous works.

☆ Initiate research into new materials and methods, and co-operate in field trials.

☆ Prepare standard specifications for bituminous materials and works.

☆ Represent the Department on the technical committees of NAASRA, SAA, and ARRB.†●

*Standards Association of Australia.

† Australian Road Research Board.

FLASHBACK—75 Years Ago

FIRST DE BURGHS BRIDGE OPENED

On Saturday, 23rd February, 1901, the first bridge over the Lane Cove River, on what is now Ring Road 3 (see article on pages 107-10), was officially opened. The Sydney Morning Herald of 25th February, 1901, gave a vivid description of the proceedings.

"On Saturday the Minister for Works (Mr E. W. O'Sullivan) visited Ryde and performed a dual function. First, he officially opened the new bridge across the Lane Cove River at the Head of Navigation. Then he turned the first sod of the Field of Mars tramway at Gladesville. The people of Lane Cove, Ryde, Drummoyne, and adjacent districts had combined to carry out the day's programme, and everything passed off successfully, no hitch of any kind occurring. (A list of committee members and officials present then follows.)

OPENING THE BRIDGE

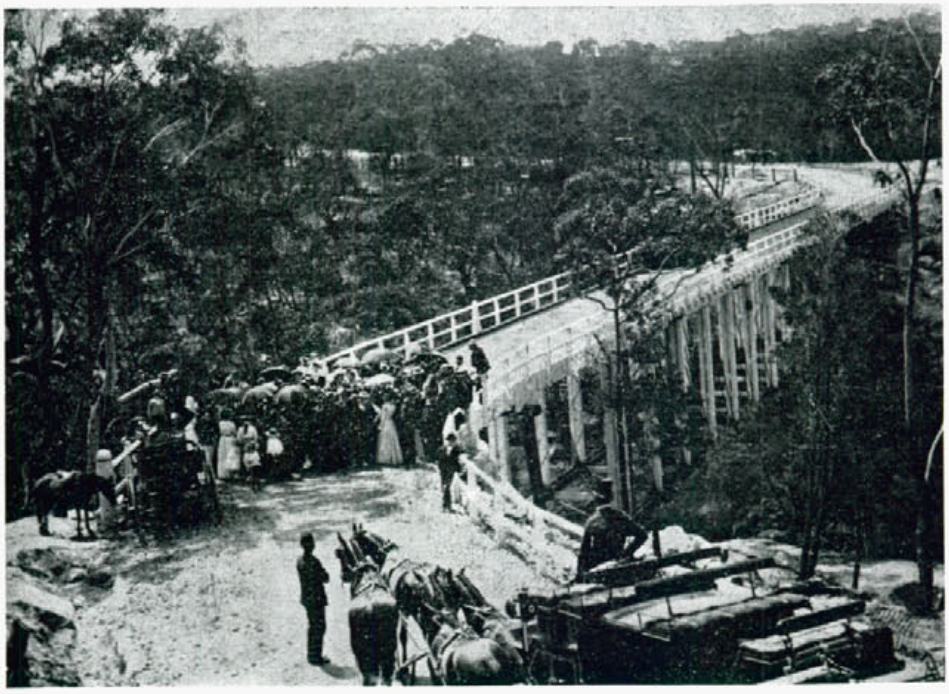
As the party from Lane Cove and the visitors from the city approached one end of the bridge in drags, a procession of drags and vehicles containing the people from Ryde, headed by Mr Terry, who was driving a splendid four-in-hand, approached the other end of the structure. The day was perfect. Lines of ribbons were strung across each end of the bridge, and the ceremony consisted of the cutting of the ribbons. Mr O'Sullivan was loudly cheered. Before proceeding with the ceremony he said he had to apologise for the absence of his daughter, who was to have cut the ribbon. They knew that the ceremony was to have taken place on the previous Saturday and had been postponed. That day was his daughter's birthday, and before the postponement she had issued invitations to her friends, and consequently she could not leave her guests to be present that day. He trusted they would accept the apology.

Master Frank O'Sullivan, Mr O'Sullivan's son, then, by request, cut the ribbon, with a beautiful pair of scissors which he was asked to present to his sister.

Mr O'Sullivan then addressed the gathering. He said he was pleased to congratulate the people of the district upon the completion of the bridge, which would be an important road to the people of New South Wales generally. This road and bridge would be largely availed of for conveying produce to market and it would be valuable for military purposes. He did not originate the proposal for the bridge. It was only fair to give credit to Mr C. A. Lee, the previous Minister for Works, for being the chief author of the bridge. (Cheers.) They were largely indebted to that gentleman. All he (Mr O'Sullivan) had done had been to push on with the bridge. (Cheers.) In addition he had had o little satisfaction in building the approaches to it. He hoped to have something more to do in this direction. (Cheers.) Though the bulk of the credit was due to Mr Lee, much was due to those who had agitated for the work. (Cheers.) It was originally proposed to build the bridge lower down the river. The estimated cost was £10,000. They had carried the present fine structure out as well as the approaches for the sum of £4,000. Therefore the country had gained fully £6,000 by the little delay that had taken place. He was glad to have had a part in this work. Apart altogether from any controversy about fiscal issues, the country would never be great or prosperous if it had not good communication so that the producers might have access to the markets. (Cheers.) Roads and bridges therefore became the lifeblood of the country. It therefore seemed to him unfair for their friends of the press to jibe at 'roads-and-bridges members'. Even their very highest politicians could occasionally unbend and go in for roads and bridges. One well-known member had made the remark, 'Who will stand on my right hand and build the bridge with me?' (Laughter.) He

Top hats, bowler hats and boaters, amid a cluster of umbrellas to give shelter from the sun—such was the scene on the official opening day at De Burghs Bridge on 23rd February, 1901

Photograph reproduced by courtesy of the Ryde and District Historical Society.



saw that some of the federal candidates were talking about public works, but they had nothing to do with them. But it showed they must have sound roads and bridges to develop the country. (Cheers.) It was by roads and bridges as well as by her armies that Rome conquered and civilised the world. The British people had always made the building of roads and bridges a great part of the scheme of colonisation. They must be prepared to meet the requirements of the people in the direction of roads, bridges and improvements. (Cheers.) He was endeavouring to do this in other directions. Some people said he was too rapid, but he was carrying out public works in safe gradations. When the first lot was done the second lot would be ready. Parliament had voted the money generously, and he had been able to keep these works going. Under the Braddon clause they would get back for New South Wales £1,000,000 a year. They could not put that money back into the pockets of the people, but he thought it would be spent in a proper way if it was expended upon public improvements, which would open up the country. He believed it would bring back the money a hundred-fold. He would leave it to the committee to decide on the name of the bridge. They could inform him and he would adopt their decision. (Cheers.)

DESCRIPTION OF THE BRIDGE

The following is the official description of the bridge, which crosses the Lane Cove River at the Head of Navigation. Although the road from Sydney to Pittwater and Broken Bay via Gladesville and Pymble has not been much improved, except so far as clearing and small lengths of forming are concerned, the chief hindrance to its use has always been the crossing of the Lane Cove River at the Head of Navigation. At this point, about 3 miles on the Ryde and Gladesville side of Pymble, the Lane Cove River runs in a gorge some 200 feet below the level of the surrounding country, and the fact that here the tidal waters meet the fresh water in the river, and that it is accessible to small boats from Sydney, has given it the name of 'Head of Navigation'. Indeed, long before the Field of Mars was subdivided, and the extensive settlement along the Gordon-road began, there was a sawmill at this place, whence firewood was taken in boats to the Sydney wharfs. The crossing of the river at this place, by means of an exceedingly steep and rough track, was sufficiently bad to deter all but horsemen using it, while any rise in the river due to local rains rendered it impassible.

Following on the subdivision of the Field of Mars, and the rapid extension of the suburbs of Chatswood, Lindfield, Gordon, Pymble, Turramurra, and Hornsby, along the Gordon-road, which was the natural sequence to the construction of the Milson's Point to Hornsby railway, the necessity of a bridge over the Lane Cove River at the Head of Navigation was strongly urged on the Public Works Department, and the matter went so far that a sum of money was voted for the work and tenders were called for a steel arch bridge in 1891, when the lowest tender received for the bridge and immediate approaches was £10,050. It was not considered, however, that such a large expenditure was justified, and the matter remained practically in abeyance till 1897, when the continued extraordinary development of the suburbs on the Milson's Point-Hornsby line, and the establishment of a ferry across the Parramatta River at Ryde emphasised the necessity for bridging this obstruction to traffic from the suburbs named, not only to Ryde and Gladesville, but also to Strathfield, Granville, and other districts south of the Parramatta River.

A new element was also introduced in the necessity for the establishment of a cemetry for those new suburbs, which, it was considered, should be on Crown lands on the Field of Mars, and at the instance of the then Minister for Works, Mr Lee, three officials, Mr Twyman, Chief Metropolitan Surveyor, Lands Department, Mr De Burgh, assistant Engineer for Bridges, and Mr W. A. Smith, Metropolitan District Road Engineer, were deputed to report on the best site for a bridge on the Lane Cove River, keeping the matter of the cemetery specially in view. The report made to the Minister showed that to serve all interests two bridges would ultimately be required—one at the Head of Navigation to connect with the more northern suburbs, and the other nearer Chatswood to connect with those lying more to the east, and in 1899 Mr Lee gave instructions that the bridge now completed at the Head of Navigation should be built at once, every effort being made to keep the cost of the structure as low as was consistent with efficiency. The work of constructing the abutments and approaches to the bridge started in September, 1899. The steel required for the structure was at once ordered, and there is no doubt that the bridge would have been available for traffic in June last had this arrived promptly. Owing, however, to the state of the European market, the whole of the steel did not come to hand till October 26, 1900, when the work of manufacturing the various portions of the super-structure was put in hand, and the bridge informally opened for traffic on December 22, 1900. The bridge is 300 feet in length, the deepest part of the gorge being crossed by a single span of 165 feet, the largest of its kind in the colony, or, indeed, in Australia. This span is an under truss, a type of construction familiar to travellers in America, but unusual here. In its construction a combination of steel and ironbark timber has been used to produce a combination of great strength, rigidity, and lightness; and as the roadway is close on 100 feet from the bed of the river, the effect when viewed from below is very striking. The estimated cost of the bridge and immediate approaches was £3,500, but the approaches have, since the work started, not only been much extended, but metalled and fenced, bringing the total cost of the bridge and works in its vicinity to close on £4,000. It is thought that the additional facilities for communication afforded will justify the expenditure incurred. The bridge was designed and erected by the officials of the Bridges Branch of the Public Works Department, the only contracts let in connection with it being for the supply of steel and timber, and manufacturing of the steel and iron work, which later was placed with Messrs Pope, Maher and Co., of Darlington.

Refreshments were then partaken of on the bridge, and the party drove to Gladesville."

In its shorter report, the Daily Telegraph of the same date (25th February, 1901) said: *"Light refreshments were then served, and the toast of 'The Ministry and Parliament', coupled with the name of Mr O'Sullivan, was proposed by Alderman Worthington. The bridge was christened 'De Burgh' after the name of the engineer."*

* * *

Articles on the design and construction of the **new** *De Burghs Bridge appeared in the June, 1967 issue (Vol. 32, No. 4, pp. 115–119) and in the December, 1967 issue (Vol. 33, No. 2, pp. 51–54) of "Main Roads".*

A DESCRIPTION FROM THE TWENTIES

In his "Book of the North Shore", Mr C. Witham takes us back to the twenties

when he walked from Pymble to De Burghs bridge and was only passed by three cars!

"The tidal waters of the Lane Cove extend as far as De Burgh's bridge. A lot of water passes across De Burgh's bridge . . . very little passes under it, for the Lane Cove is no river, just a fair sized brook. But the bridge serves two purposes. It is an aqueduct, and carries three iron pipes along the steel girder that supports the road bridge.

. . . this road (from Pymble) *descends rapidly into the sylvan region that is seen to the west from the train—it has very few straights—twisting and winding past infrequent cottages and a few old fashioned homesteads until it crosses De Burgh's bridge. Most of the way it is through deep forest, but there are some clearings, chiefly of grass lands, with one paddock of cabbages, fronted by fruit trees. There are some orchards in the district but they look as if they have seen better days.*

. . . this time I was of the base pedestrian class, and thanked God that few pestilent motorists scattered dust and smell. For I saw only three cars between Pymble and the bridge. This is the uppermost of three bridges across the Lane Cove, the first being at Fig Tree, where the steamers stop, the second is Fuller's bridge, reached by road from Chatswood.

I came upon De Burgh's bridge unexpectedly, round a sharp turn, and at first sight, it seemed a very ordinary crossing, just a white railing and a timber floor. But it proved to be one of the many surprises and delights I have come upon in this delightful Sydney country. The gorge is so deep that tall trees growing on the sides do not reach to the decking. It is a double decker, the water pipes being carried on a steel girder which crosses the chasm at the point where the walls cease to be precipitous and spray outwards to the road level. This steel girder is of one span, cunningly braced with steel rods, and it supports wooden trusses which take the weight of the road decking above. The top bridge is wider than the girder beneath, and the approaches are supported on steel abutments. Seen from below, it is a handsome structure, a happy combination of grace and strength. The job of putting the girder across that deep cleft must have been a ticklish one."

. . . from a copy held in the Mitchell Library, Sydney.

THE MAN BEHIND THE NAME

E. M. De Burgh

ERNEST MACARTNEY DE BURGH (1863–1929), was born at Sandymount, Ireland, on 18th January, 1863, the son of an Anglican Minister, Rev. William De Burgh, D.D. He was educated at Rathmines school and the Royal College of Science, Dublin, Ireland, and worked for some time on railway construction.

Reaching Sydney in 1885, Mr De Burgh immediately obtained a position in the New South Wales Department of Public Works. Two years later he was sent to the country to supervise the construction of steel bridges and eventually he became Engineer-in-Charge of Bridges. In this capacity he was responsible for bridges over the Murray, Murrumbidgee, Lachlan, Hunter and many other rivers. In 1903 he transferred to the Department of Water Supply and Sewerage and a year later he visited Europe to study dam construction and water-supply. After his return he did important work in connection with the Burrinjuck Dam and the Murrumbidgee Irrigation Scheme. He was appointed Chief Engineer for Harbours and Water Supply in 1909 and Chief Engineer for Water Supply and Sewerage in 1913.

In 1908, he recommended to the Minister for Public Works that a dam be built across the Warragamba River. He made a similar recommendation in 1918, submitting specifications for a dam estimated to cost $6,750,000. He never lived to see the $80,000,000 Warragamba Dam built in 1960 but his name is linked with many others. He designed and supervised the construction of large reservoirs for Sydney's water-supply (Cataract, Cordeaux, Avon, and Nepean Dams), the Chichester scheme for the Newcastle district, and the Umberumberka scheme for Broken Hill.

De Burgh also played a part in the decision to locate Australia's capital city at Canberra. With his experience, he foresaw that water would be of critical importance and he estimated that in this regard five other sites were unsatisfactory. His measurements of streams within the proposed site near Queanbeyan showed adequate capacity to cope with future developments.

Mr De Burgh retired in 1927 and died in Sydney on 3rd April, 1929. His wife, two sons and a daughter survived him.

References include the Australian Encyclopaedia, Vol. 3, p. 218 (Grolier Society) and the Sydney Water Board Journal, April 1968, p. 31.

E. M. De Burgh (from Sydney Water Board Journal, April 1968, p. 31).

TENDERS ACCEPTED BY THE DEPARTMENT OF MAIN ROADS

The following tenders (in excess of $20,000) for road and bridge works were accepted by the Department for the three months ended 31st March, 1976.

Road No.	Work or Service	Name of Successful Tenderer	Amount
			$
State Highway No. 2	Hume Highway. Shire of Kyeamba. Construction of bridge over Comatawa Creek 4·2 km south of Tarcutta.	Messrs W. A. Winnett & Sons	69,138.10
State Highway No. 2	Hume Highway. Shire of Gundagai. Construction of new bridge over Jones Creek in Sheridan Street, Gundagai.	Siebels Concrete Constructions Pty Ltd	117,215.66
State Highway No. 2	Hume Highway. Shire of Gunning. Construction of new bridge over Fish River at 45·1 km west of Goulburn.	The Hornibrook Group	353,302.00
State Highway No. 2	Hume Highway. Shire of Goodradigbee. Construction of new bridge over Derringullen Creek, at 6·6 km south of Yass.	The Hornibrook Group	286,865.00
State Highway No. 9	New England Highway. City of Maitland. Haulage of slag products from B.H.P. to construction site for dual carriageways between 25·9 km to 28·5 km west of Newcastle.	E. J. Ashman	36,000.00
State Highway No. 10	Pacific Highway. Shire of Maclean. Protective treatment and repainting of steelwork on bridge over Clarence River at Harwood.	R. V. H. Middlemass & Co. Pty Ltd	124,975.00
Main Road No. 315	Municipality of Kogarah. Construction of new pedestrian overbridge near Hurstville South Public School.	E. M. Moore Pty Ltd	154,980.10
Main Road No. 328	Municipality of Ku-ring-gai. Extension of "New Jersey" kerb on northern approach to Roseville Bridge.	Squeez-Crete (Aust.) Pty Ltd	23,868.00
Main Road No. 535	City of Penrith. Reconstruction of pavement between 3·5 km and 5·5 km east of Main Road No. 154—foamed bitumen stabilisation.	Stabilex Pty Ltd	35,220.13
Various	Within North Eastern Division. Supply and delivery of hot mixed cold laid bituminous plant mix.	Bitupave Ltd	46,697.00
Various	Within South Coast Division. Supply and delivery of up to 1 000 tonnes of 10 mm bituminous coldmix to various locations under the control of Cooma Works Office, including the Snowy Mountains Area.	Department of Housing and Construction	25,445.00

TENDERS ACCEPTED BY COUNCILS

The following tenders (in excess of $20,000) for road and bridge works were accepted by Councils for the three months ended 31st March, 1976.

Council	Road No.	Works or Service	Name of Successful Tenderer	Amount
				$
Baulkham Hills	C.R. 5033	Construction of 4 cell 1·5 metre x 1·5 metre reinforced concrete box culvert 1·75 km north of Seven Hills Road.	Mitchell Civil Engineering and Plant Hire	29,166.73
Coffs Harbour	M.R. 151	Construction of new Moreton's Bridge over Duckan Duckan Creek, 65·4 km south of Grafton.	P. Cropp Constructions	49,935.80
Hay	Various Main and Rural Roads	Bitumen spraying	Emoleum (Aust.) Ltd	31,403.30
Holroyd	S.R. _071	Construction of bridge over Prospect Creek at Smithfield	Road Constructors Pty Ltd	148,492.00
Liverpool	M.R. 154	Construction of new bridge over Thomson's Creek	Rimpa Construction	55,752.81
Nymboida	T.R. 74	Construction of new bridge over Koukandowie Creek, 19·0 km south of Grafton.	M. O. & P. J. Kautto	70,173.80
Oberon	M.R. 255	Construction of 2 cell 3·66 m x 3·66 m reinforced concrete box culvert 2·7 km north of Oberon.	M. F. & A. A. Brien and N. A. Rogers	48,820.00
Parry	S.H. 11	Reconstruction from 42·45 km to 44·4 km west of Tamworth including approaches to new bridge over Menedebri Creek at 44·3 km west of Tamworth.	Dayal Singh Construction (Tamworth) Pty Ltd	51,310.00
Parry	Rural Local Road —Back Kootingal Road	Construction of bridge over Sandy Creek (Hyson's Bridge) at Kootingal.	Mario Campese and Rocco Bruno	47,703.00
Wakool	Various Main and Rural Roads	Bitumen spraying	Allen Bros Pty Ltd	34,387.81

MAIN ROADS STANDARD SPECIFICATIONS

Note: Imperial drawings are prefixed by letter A, metric drawings by the letters SD, instructions are so described, all other items are specifications.

ROAD SURVEY AND DESIGN

	Form No.
Design of two-lane rural roads (Instruction—1964)	355
Data for design of two-lane rural roads (1973)	892 (Metric)
Flat country cross sections—bitumen sealed pavement (Instruction—1972)	A 6132
Plan and longsection—Two lane rural roads	SD 6215
Standard cross sections for bitumen surfaced two-lane rural roads (1973)	SD 6056

URBAN DRAINAGE

Concrete converter	A 1418
Concrete work other than bridges	738 (Metric)
Design of subsoil and subgrade drainage (Instruction—1973)*	513 (Metric)
Gully grating (1969)	A 190
Gully pit with grating	A 1042
With kerb inlet only	A 1043
With grating and extended kerb inlet	A 1352
With extended kerb inlet only	A 1353
With grating for mountable kerb	A 4832
Kerb and gutter shapes (1975)	SD 6246
Perambulator ramp	A 3491
Vehicle gutter crossings (1974)	SD 6247
Waterway calculations for urban drainage (Instruction—1963)	371B

CULVERTS

(a) Cast in place reinforced concrete box culverts—	
Box culverts with wearing surface	SD 6270
Single cell box culvert under fill from 1 m	SD 6271
Single cell box culvert under fill from 0·3 to 1 m	SD 6272
Multiple cell box culvert under fill from 1 m	SD 6273
Multiple cell box culvert under fill from 0·3 to 1 m	SD 6274
(b) Precast reinforced concrete box culverts—	
Erection of precast concrete box culverts	138B (Metric)
Supply of precast concrete box culverts	138A (Metric)
(c) Pipe culverts—	
Construction of concrete pipe culverts (1974)	25 (Metric)
Design of concrete pipe culverts (1974)	25A (Metric)
Headwalls for pipe culverts—	
Single row—	
600, 750, 900 mm dia.	SD 139
375, 450, 525 mm dia.	SD 143
1 050 mm dia.	SD 172
1 200 mm dia.	SD 173
1 350 mm dia.	SD 174
1 500 mm dia.	SD 175
1 800 mm dia.	SD 176
Supply and laying of asbestos cement drainage pipes (1972)	861

BRIDGES

	Form No.
Concrete work for bridges (1974)	350 (Metric)
Data for bridge design (1973)	18 (Metric)
Erection of precast, prestressed concrete bridge units and planks (1975)	557 (Metric)
Erection of precast, prestressed concrete piles (1966)	558
Erection of precast, prestressed concrete bridge girders	561 (Metric)
Excavation for bridges (1974)	563 (Metric)
Extermination of termites in bridges (Instruction—1958)*	326
Erection of structural steelwork	262 (Metric)
Manufacture of precast or cast-in-situ, prestressed concrete bridge members (1970)	556
Manufacture of elastomeric bearings for bridge units and girders (1967)	562
Preparation and pretreatment of metal surfaces prior to protective coating or painting—Method Selection Guide	1032 (Metric)
Protection angles for bridges or culverts with concrete wearing surfaces (1960)	A 1272
Prestressed concrete bridge drawings—	
(a) Prestressed concrete piles—	
12 in x 12 in—35 tons	A 4764
14 in octagonal—45 tons	A 4943
16 in octagonal—50 tons	A 4944
(b) Test load diagrams for prestressed concrete piles—	
12 in x 12 in	A 5601
14 in and 16 in octagonal piles	A 5828
Reinforced concrete piles 35 and 45 tons (1963)	A 1207-8
Reinforced concrete piles (precast) for bridge foundations	564
Superstructure for bridges	568
Supply of high strength steel bolts (1968)	261
Supply of ready mixed concrete, for bridgeworks (1975)	895 (Metric)
Timber for bridges	140
Waterway diagram (0 to 200 acres)	A 26

BITUMINOUS SURFACES

Bituminous emulsions (cationic) (1973)	304 (Metric)
Bituminous emulsion (anionic) (1973)	305 (Metric)
Bituminous surfacing daily record (1974)	400 (Metric)
Bituminous surfacing job summary (1974)	1011 (Metric)
Cutback chart for bitumen seal coats (1973)	466 (Metric)
Performance requirements for mechanical sprayers	272 (Metric)
Sprayed bitumen surfacing (1974)	93 (Metric)
Sprayer loading slip (1974)	401 (Metric)
Supply and delivery of bitumen (1974)	337 (Metric)
Supply and spraying of bitumen (1973)	898 (Metric)
Supply and delivery of aggregate for use in bituminous plant mix (1975)	952 (Metric)
Supply and delivery of asphaltic concrete (1975)	953 (Metric)
Supply and laying of asphaltic concrete (1975)	612 (Metric)
Supply and laying of dense graded tar plant mix (1975)	954 (Metric)
Supply and delivery of dense graded tar plant mix (1975)	955 (Metric)
Supply and laying of open graded bituminous plant mix (1975)	956 (Metric)
Supply and delivery of open graded bitumincus plant mix (1975)	957 (Metric)
Supply of prepared cutback bitumen for sealing purposes (1966)	740
Supply and delivery of cover aggregate for sealing and resealing with bitumen (1975)	351 (Metric)
Tar	296

FENCING

Chain wire guard fencing—erection (1974)	144 (Metric) SD 149
Chain wire—supply—(1974)	132 (Metric)
Corrugated steel guard rail—supply—(1975)	SD 5595
Corrugated steel guard rail—erection (1975)	680 (Metric) SD 5829
Drawings: Sheep fence (1974)	SD 494
Rabbit-proof fence (1974)	SD 498
Cattle fence (1974)	SD 1705
Floodgate (1974)	SD 316
"Manproof" pipe and chainwire boundary fence	611 (Metric) SD 6278
Ordnance fencing	143, A 7
Post and wire fencing (1974)	141 (Metric)
Removal and re-erection of fencing (1974)	224 (Metric)
Warrants for use of guard fences (Instruction—1973)	246 (Metric)

FORMATION, INCLUDING EARTHWORKS AND RURAL DRAINAGE

	Form No.
Corrugated PVC subsoil drainage pipe (1972)	907 (Metric)
Earthworks and formation including surface drainage (1974)	70 (Metric)
Installation of lateral drains (1974)	1013 (Metric)
Shoulders and table drains (1973)	827 (Metric)
Standard rubble retaining wall (1941)	A 114
Standard mass concrete retaining wall (1959)	A 4934
Standard cantilever retaining wall (1959)	A 4935
Subsoil drains (1973)	528 (Metric)
Waterway calculations for bridges and culverts (1964)*	371 A

PAVEMENTS

Cement concrete pavement (1960)	A 1147
Construction of natural gravel or crushed rock road pavement (bitumen surfaced) (1975)	743 (Metric)
Construction or resheeting of natural gravel or crushed rock road pavement (not bitumen surfaced) (1975)	800 (Metric)
Preformed expansion joint fillers (1962)	610
Supply of natural gravel or crushed rock for road pavement (bitumen surfaces) (1975)	744 (Metric)
Supply of natural gravel or crushed rock for road pavement (not bitumen surfaced) (1975)	801 (Metric)
Supply of ready mixed concrete (1973)	609 (Metric)

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Roadside fireplace (1974)	SD 4671
Roadside litter bin (1975)	SD 5841

TRAFFIC PROVISIONS AND PROTECTION

Control of traffic at Roads and Bridgeworks (1975)	121 (Metric)
Guide posts—supply (1973)	252 (Metric)
Guide posts—erection (1973)	253 (Metric)
Manufacture of warning signs (1971)	682
Motor grids—24 ft (1964)	A 5770
Plastic guide posts (1972)	880
Roadmarking paint (1966)	671

CONTRACTS

Bulk sum tender form, Council contract (1966)	39
Bulk sum contract form, Council contract (1975)	38
Cover sheet for specifications, Council contract	342
Caretaking and operating ferries	498
General conditions of contract, Council contract (1966)	24B
Schedule of quantities (1966)	64

MANUALS *

Manuals, No. 1—Plant; No. 3—Materials; No. 4—Roadside Trees; No. 5—Explosives; No. 6—Bridge Maintenance; No. 7—Road Maintenance.

D.M.R. BOOKLETS

Guide to Main Roads Administration.
Duties of a Superintending Officer.

N.A.A.S.R.A. BOOKLETS

Guide to Publications and Policy of N.A.A.S.R.A.
List of current publications.

All standards may be purchased from the Plan Room at the Department's Head Office, 309 Castlereagh Street, Sydney. Single copies are free to Councils except those marked *. A charge will be made for sets of standards.

G 10468 D. West, Government Printer, New South Wales—1976