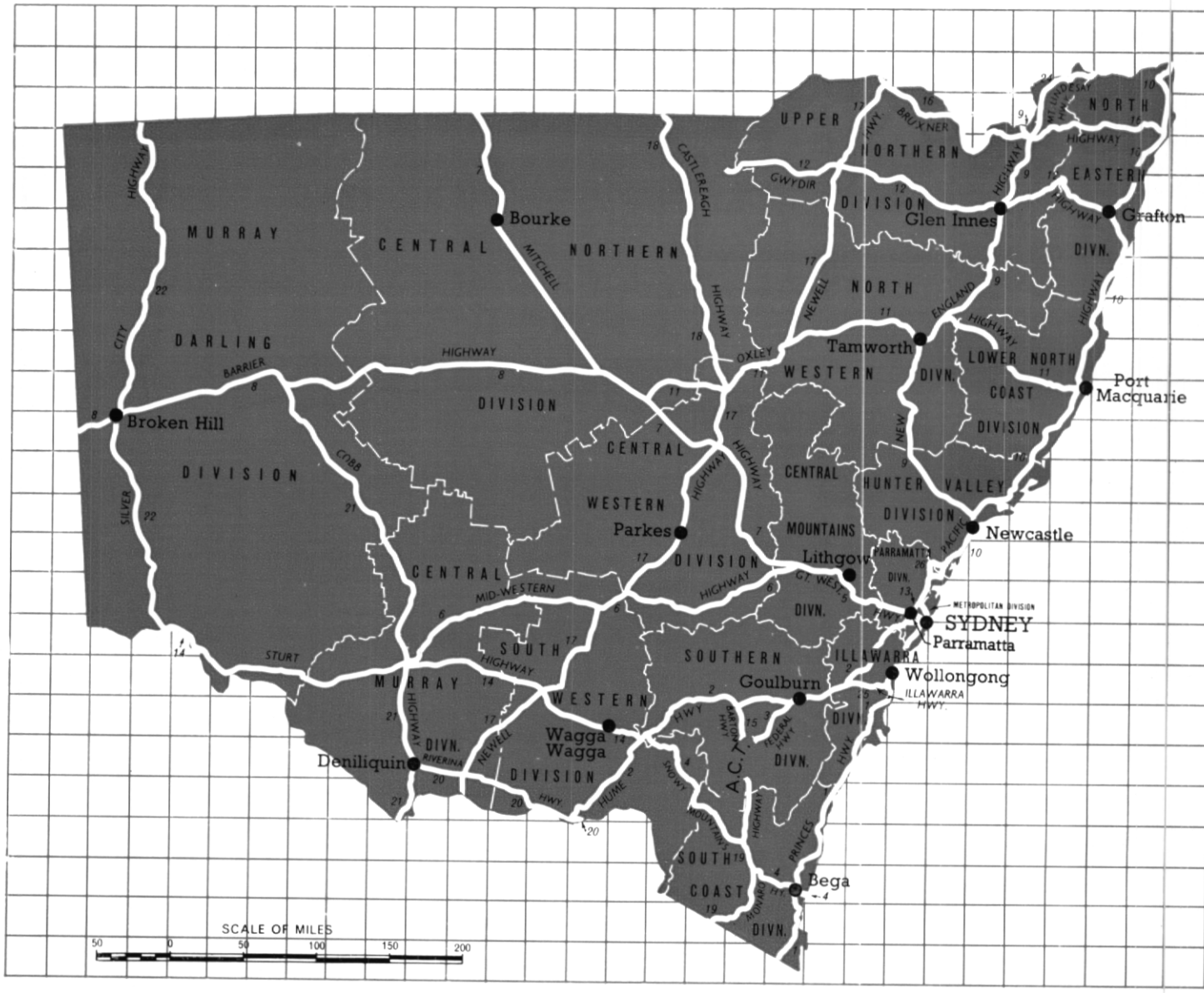
MAIN ROADS

SEPTEMBER 1968



HIGHWAY SYSTEM OF NEW SOUTH WALES

Mileage of Main Tourist and Developmental Roads, as at 30th June, 1968

Expressways	21
State Highways	6,542
Trunk Roads	4,228
Ordinary Main Roads	11,593
Secondary Roads (County of Cumberland only)	159
Tourist Roads	218
Developmental Roads	2,746
	25,507
Unclassified roads, in Western part of State, coming within the provisions of the Main Roads Act	1,529
TOTAL	27,036

Area of New South Wales, 309,433 square miles
Length of public roads within New South Wales, 131,300 miles

Population of New South Wales at 31st March, 1968—4,370,307

Number of vehicles registered in New South Wales at 30th June, 1968—1,741,961

STATE HIGHWAYS
DIVISIONAL BOUNDARIES
DIVISIONAL OFFICES

MAIN ROADS

Journal of the Department of Main Roads, New South Wales

SEPTEMBER, 1968

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Front and back covers: Night lights on the Warringah Expressway

A Year's Achievements

The passing of the year 1967–68 marked another step in the progress being made on the Main Roads of New South Wales.

In this year just completed the Department of Main Roads spent more than $90m on the Main Roads System throughout the State, of which more than $60m were devoted to works in the country areas.

Of major significance during the year was the opening to traffic of the first section of the Warringah Expressway between the Sydney Harbour Bridge and Cammeray. This section of expressway undoubtedly has reduced significantly traffic congestion and the accident rate in North Sydney and on Sydney Harbour Bridge. (A comprehensive article about the construction of this expressway is included in this Journal.)

The energetic bridge building programme continued throughout the year during which no less than 193 new bridges were completed with a total length of 18,414 feet or about 3½ miles. This is 44 more bridges built than in the previous year.

Construction of the Sydney-Newcastle Expressway south of the Hawkesbury River was continued through the year. This new section of expressway will be opened to traffic at the end of 1968 to link with the widened Pacific Highway near Berowra. Plans are also being pushed ahead as quickly as possible towards construction of a new six-lane bridge across the Hawkesbury River to connect the expressway north and south of the River.

Throughout the State the programme of widening, reconstructing and bituminous surfacing Main Roads was continued by the Department and by Municipal and Shire Councils. Year by year considerable progress is being made in improving travelling conditions on this network of major roads. The bituminous surface on these roads is gradually being extended and at present 13,079 miles have been provided with a bituminous or other dustless surface out of a total length of 25,507 miles.

There is still much work to be done but with each year that passes some significant achievements are made in the provision of a first class Main Roads System.


Shell's
More Cups
Finer Flavour
Steel's Service


EGG TRANSPORT

MAIN ROADS AND LEVEL CROSSINGS

by L. R. JAMES, B.E., A.M.I.E.AUST.,
RAILWAYS LIAISON OFFICER
DEPARTMENT OF MAIN ROADS

Since early settlement in New South Wales there has been a continuing programme of road building to provide communication between villages, towns and cities. Later, these road communications were augmented by the construction of railways, the development of which occurred in the latter half of the nineteenth century. Level crossings were provided where the railways crossed the roads, but at that time they were not critical nor were they regarded with disfavour as road transport was by horsedrawn vehicles and traffic was not heavy.

However with the advent of motor vehicles in the 20th century, undesirable features associated with the level crossings became apparent, namely the risk of serious accident, the delays to road vehicles while waiting for trains to clear the crossing and often the standard of road alignment in the approaches to the crossing was unsuitable for motor vehicles.

Financially practicable programmes for the elimination of level crossings could not fully or quickly solve the problem of road safety at these points. In consequence a joint committee comprising representatives of the Department of Railways and Department of Main Roads was established in July, 1949 to fully investigate the problem. The function of this Committee was to inspect the sites and prepare recommendations for improvement of safety conditions and for elimination projects. This Committee inspected over 550 level crossings and as a result many improvements have since been undertaken.

Early in 1960, an inter-Departmental Level Crossing Committee was established for the purpose of submitting to the Minister for Transport for his approval, recommendations for the improvement, alteration or replacement of facilities at level crossings and for elimination of level crossings where this could be justified. Any such recommendations were made only if the authorities financially concerned in the proposed improvements concurred. This committee consists of representatives of the Department of Railways, Department of Local Government, Public Works Department, Department of Main Roads and the Treasury and is assisted by an officer from the Police Department who advises in regard to matters pertaining to traffic control and safety. A special Level Crossing Fund, administered by the Department of Railways, was established at the Treasury to meet the costs of approved works in the first instance which are later recouped by contributions from the authorities concerned. The normal basis of contribution towards the cost of approved works on Main Roads is:

- The Department of Railways meets one-third of the cost of providing flashing lights and warning bells, etc., or one-third of the cost of constructing two lanes of an overbridge for road traffic and a footway. This latter contribution is made only if a level crossing is eliminated from the route of the Main Road as a result of the construction of the overbridge.
- The remainder of the cost is met by the road authorities and is usually shared by the Department of Main Roads and the Council concerned in the same proportions which normally apply to work on the particular road.

Between 1925, when the Main Roads Board (later the Department of Main Roads) was established and March, 1960, when the inter-Departmental Level Crossing Committee was set up, some 86 level crossings had been eliminated from the Main Roads System. About 60 of these level crossings were permanently closed. In some, but not all, of these cases the Department of Railways contributed to the cost of the work, generally where a bridge was built. When the Department of Railways did contribute towards the cost, the basis of contribution varied, and was invariably determined by the amount of any consequent saving to that Department.

Since March, 1960 and up to June, 1968 a further 74 crossings were eliminated from the Main Roads System. During this period 45 crossings were eliminated by the construction of road deviations, 17 by the construction of railway overbridges or underpasses and 12 as a result of closing sections of railway lines. At the same time, due mainly to the extension of the Main Roads System, five additional level crossings were included in that System.

There were still 400 level crossings on Main Roads in New South Wales at the 30th June, 1968, comprising 339 on New South Wales Government Railways, 50 on privately owned railways and 11 on Victorian Railways which extend into New South Wales. Negotiations between the Railways Department, the Department of Main Roads and Councils are continuing and designs are being prepared for the elimination of further level crossings in the future.

Typical of conditions where level crossings are located on busy main roads. The dangers and frustrations at the Dog Trap Gates on Woodville Road (State Highway No. 13) are eliminated with the building of an overbridge and widened carriageway.

VALUATION OF REAL ESTATE

By J. S. ENDEAN F.I.S. PRINCIPAL LAND SURVEYOR AND PROPERTY OFFICER
DEPARTMENT OF MAIN ROADS

Acquisition of real estate is necessary to implement government policy in all fields of development.

To clear the right-of-way for modern expressway construction, large sums of money must be expended. For example, present day values of the real estate acquired for the first 1½ miles of the Warringah Expressway recently opened, would be in excess of $11,000,000.

ACQUISITIONS BY THE DEPARTMENT

Since the Department's activities range over the whole of the State, real estate acquired ranges from purchases or resumption of properties for administrative offices, residences and depots, gravel pits etc., to properties required for widenings and deviations, wholly or in part, in both rural and highly developed city areas. Valuations of purchases and of residues being sold are valued by Departmental valuers. Claims for compensation received following resumption of land under the Main Roads Act, 1924 as amended, are valued by the Valuer-General.

Agreement on the purchase price or compensation to be paid often follows discussions between departmental valuers and valuers in private practice engaged by the owner.

During 1967–68 the Department's expenditure on acquisition and receipts from sale of real estate were:

Purchase or resumption for administrative purposes	$120,000
Purchase or resumption for road purposes	$5,000,000
Sale of residue real estate	$220,000

The purpose of this article is to outline the broad principles of valuation and policies observed to ensure equitable value to the owner for property acquired or resumed and worth to the Government for the expenditure of public moneys.

COMPENSATION

Compensation paid by the Department is in general made up of the current market value of the real estate plus depreciation of the remainder of the property where appropriate and incidental costs incurred by the owner. Competent assessment of compensation should ensure that the owner after acquisition is in a comparable economic position to that before acquisition.

VALUE

Probably the best known values are those determined for rating purposes by the Valuer-General, being the Unimproved, Improved and Assessed Annual Values. Local Government rating is based on the Unimproved Capital Value whilst the Assessed Annual Value is used in levying rates by such authorities as the Metropolitan Water, Sewerage and Drainage Board.

The Valuation of Land Act, 1916, as amended, provides that the Valuer-General shall make valuations of the Unimproved, Improved and Assessed Annual Values. Such valuations may also include similar values of the estates and interests of all owners including the interests of lessors and lessees in such lands.

Unimproved Value The unimproved value of land is the capital sum which the fee simple of the land might be expected to realize if offered for sale on such reasonable terms and conditions as a bona-fide seller would require, assuming that the improvements, if any, thereon or appertaining thereto and made or acquired by the owner or his predecessor in title had not been made.

Improved Value The improved value of land is the capital sum which the fee simple of the land might be expected to realize if offered for sale on such reasonable terms and conditions as a bona-fide seller would require.

In determining the improved value of any land being premises occupied for trade, business or manufacturing purposes, such value shall not include the

value of any plant, machines, tools, or other appliances which are not fixed to the premises or which are only so fixed that they may be removed from the premises without structural damage thereto.

Assessed Annual Value The Assessed Annual Value of land is nine-tenths of the fair average annual value of the land, with the improvements (if any) thereon, provided that such assessed annual value shall not be less than 5 per cent of the improved value of the land.

In determining this value the same proviso regarding plant etc. applies as in Improved Value.

Fractional Interests The Act also provides that where there are joint owners the sum of the various interests shall not be less than the amount at which the improved value would be assessed if held by the one owner in fee simple and a similar provision applies in leasehold interests.

Interests of Lessors and Lessees The value of the interest of a Lessor or Lessee in the Improved Value, is the capital sum which such interest may be expected to realize if offered for sale on such reasonable terms and conditions as a bona-fide seller would require.

Valuations as determined by the Valuer-General's Department ensure an equitable overall rating but have no regard for tenancies and town planning restrictions where the existing use does not conform to that planning. The improved capital value is therefore not necessarily the value which would determine the price to be offered by a bona-fide purchaser.

The date of the latest Valuer-General's Department valuation is very relevant as values may vary considerably in rapidly developing areas in the period between valuations, at present six years.

MARKET VALUE

The valuer of real estate must determine the amount of money it would bring in the open market by negotiations between a willing vendor and purchaser, both of whom are acquainted with the property and aware of any circumstances which might affect the value.

The valuation so determined, known as "Market Value", is arrived at following investigation of all recent real estate transactions of comparable properties in the district. In comparing transactions, care must be taken to see that price alone is not regarded as value and that transactions are discarded where it is evident that the price paid resulted from pressing need, special value, transactions between relatives, or extravagance. In brief, valuation practice is directed to an economic assessment of the basic difference between real estate recently sold and that, the subject of the valuation.

HIGHEST AND BEST USE

To ensure that valuations are made from a common basis it must be assumed that the property being valued will be used to its "highest and best" or optimum use. To this end, examination must be made of prescribed planning schemes and inquiries made of local government councils as to the highest form of development that would be approved. However, where the use does not conform to the zoning, e.g. light industry in a residential area, the valuation should be made with relation to the existing use.

In cases where an owner requests the Department to purchase whole properties on the grounds of hardship caused by inability to sell on the open market, because the property is affected by the Department's road proposals of a long range nature, the purchase price is limited to the current fair market value.

LACK OF COMPARABLE SALES

Sales information of comparable properties is not always available and it becomes necessary to separate the two components of a valuation, i.e. land and buildings. Land value may be obtained by deducting from the total sales price the replacement cost of the improvements depreciation. Alternatively, if the land value can be obtained, the value of the improvements may be determined and a unit value obtained for improvements of a certain age. This approach is known as the "Summation Method" and is particularly suitable for valuation of schools and churches.

However, in many cases, the buildings on the property may not accord to the principle of highest and best use and could result in the land value being reduced by the estimated cost of demolition. This is a common occurrence where the land may be developed for flats or factories and the improvements consist of cottages.

BEFORE AND AFTER METHOD

The valuation of partial acquisitions may be assessed from the difference between the market value before the acquisition and related physical adjustment to fencing and access and that after the acquisition.

It will be appreciated that this method is unsuitable where the value of compensation is small related to the value of the whole property such as small strips from large rural properties. Valuation of these strips may be satisfactorily determined by comparison with the current market valuation of similar properties on an acreage basis.

SUBDIVISIONAL LANDS

In developing areas, both urban and rural, it is often necessary to value the real estate with relation to the subdivisional potential of the property.

A hypothetical subdivision is prepared using the land to the best advantage and an analysis made of the gross realization of the subdivision based on sales of comparable lands.

The nett realization is obtained by deducting from the gross realization the expenses of the development, i.e. survey, road construction, etc., plus amounts for interest, rates and taxes, etc. over the period during which the subdivision may be sold and risk on realization of lower than the expected prices or other contingencies. The resulting valuation is known as the "en globo" value.

Where a strip is being acquired for widening or deviation the compensation is determined as the difference between the nett realization for a subdivision of the whole property and that of the residue of the property after excision of the area required for road purposes.

RURAL LANDS

The value of rural lands may be arrived at from comparison of sales of comparable properties. Again, care must be taken to determine that the real estate is comparable but the factors are different to those of urban real estate.

The highest and best use may not be determined from zoning under a Planning Scheme but rather the optimum development as a rural property, be it used for grazing, dairying or crops.

Factors to be considered are climate, productive capacity, potential use and present stage of development. In the case of properties best suited to sugar cane cultivation, the area of the cane permit received from the local sugar mill must be considered.

Comparisons of properties similar with respect to soil and fertility, are made on

the basis of optimum development with deductions for depreciation on improvements and/or estimated cost to bring the properties to optimum development.

BUSINESS VALUATIONS

Similar principles apply to the valuation of a business or an undertaking such as a golf club, as apply to real estate. However, whereas valuations of real estate may be determined by analysis of current sales, it is necessary in the case of businesses to examine in detail the accounts of the undertaking to determine its profitability.

Since this may vary from causes such as general prosperity, competition or fashion trends, it should be determined over a number of years. The results should be examined to see that the whole of the profit was derived from the business, non-recurring items were not included, provision was made for replacements of equipment and vehicles, and in the case of small businesses, that the owner had retained a reasonable remuneration for his services.

Expert advice may need to be sought by the valuer of accountants, architects engineers to assist in the valuation of the business or undertaking, costs of alterations to improvements or relocation of plant and equipment. Currently the installations of a radio station are being relocated to allow for road widening and technical advice and costing was an essential part of the compensation determined.

TENANTS' INTERESTS

Tenants' interests are of many types varying from weekly tenancies to indeterminate periods for alienated land, whilst some 100 different types of tenures are available for Crown lands under the provisions of the Crown Lands Consolidation Act, Closer Settlement Act, War Service Land Settlement Act and Western Lands Act and other Acts relating to land settlement.

It is important therefore, that all relevant documents relating to the tenancy be carefully examined to ascertain the nature and terms of the lease and whether such items as furniture, power and light etc. are included. The affect of the Landlord and Tenant Act must also be considered.

Tenants' interests may vary in each case and must be considered on their particular merits.

Information concerning the Crown's interest in Crown Tenures may be obtained by reference to the Accountant, Department of Lands.

DIMINUTION OF VALUE OF RESIDUE

The majority of acquisitions by the Department of Main Roads are partial acquisitions for widenings. In many cases the acquisition results in reduction in value of the residue and this must be considered in the valuation assessed.

BETTERMENT

There is no doubt that in many instances the residue of the real estate increases in value because of the Department's activities. The increase in value or betterment may only be offset against the total compensation if authority to do so is given by Statute.

FACTORS OTHER THAN REAL ESTATE VALUE

The Public Works Act, 1912, as amended, in dealing with compensation provides that in ascertaining purchase money or compensation to be paid, regard shall be had not only to the value of the land but also the damage (if any) caused by the severing of the lands from other lands of the owner.

SEVERANCE

Apart from valuation of the real estate, it is necessary therefore, to assess the compensation to be paid for other losses suffered by the owner which result from severance in the case of deviations of an existing road.

Severance of part of a property may affect it in many ways. Drainage and access may be affected, the shape of the property may lead to difficulties in management resulting in economic loss, whilst difficulties may arise from loss of access to water supplies. It is often necessary to include also compensation for re-fencing of paddocks to economic shapes and sizes and the sowing of improved pastures which may have been lost as a result.

DISTURBANCE

There is a great variety of losses which may be suffered by an owner as a result of compulsory total or partial acquisitions in both urban and rural areas. Compensation for these losses is considered under the classification of disturbance.

In rural areas, loss of crops on the acquired areas is a common claim as well as loss of future profits brought about by increased management costs. A reduction in area may result in forced sale of stock and render farm machinery of less value to the property.

Disturbance in commercial and urban areas may occur under one or all of the following items:

- ☐ Loss on forced sale of stock, plant and trade fixtures or depreciation in their value upon removal.
- ☐ Goodwill.
- ☐ Costs of removal or storage fees.
- ☐ Cost of adapting new premises.
- ☐ Loss of profits during reinstatement.
- ☐ Incidental expenses, e.g. new stationery, telephone removal costs, signs.
- ☐ Loss of rents during relocation or reconstruction of the improvement.
- ☐ Valuation fee where independent valuation is obtained.
- ☐ Stamp duty and legal expenses incurred by the purchase of a comparable property.

ADJUSTMENT OR RELOCATION OF IMPROVEMENTS

Where it is an economical proposition to relocate or adjust cottages, shops etc., the following costs would be included in the compensation:

- ☐ Preparation of architectural plans.
- ☐ Fees associated with Council's approval to plans.
- ☐ Cost of adjustment or relocation.
- ☐ Costs of alternative accommodation during relocation.

CONCLUSION

An experienced valuer trained in sound basic principles of valuation and guided by the court decisions arising from appeals to such courts as the N.S.W. Land and Valuation Court, provides expert impartial evidence of value without advocating the cause of either party in negotiations.

The construction of the first 1½ miles of the Warringah Expressway at North Sydney involved the acquisition of 508 properties and negotiations with 418 owners and 703 tenants or sub-tenants. The Housing Commission rehoused 296 tenants.

Real estate acquired ranged from individual dwellings, flats and small commercial premises to a large service station, a hotel and picture theatre.

Valuations and negotiations were conducted by officers of the Valuer-General's Department and the Department of Main Roads involving in many instances the services of valuers in private practice on behalf of owners.

It is gratifying to record that as a result of the observance of the principles and policies outlined above, it was possible to conclude the acquisitions without the need to refer any valuations to the N.S.W. Land and Valuation Court.

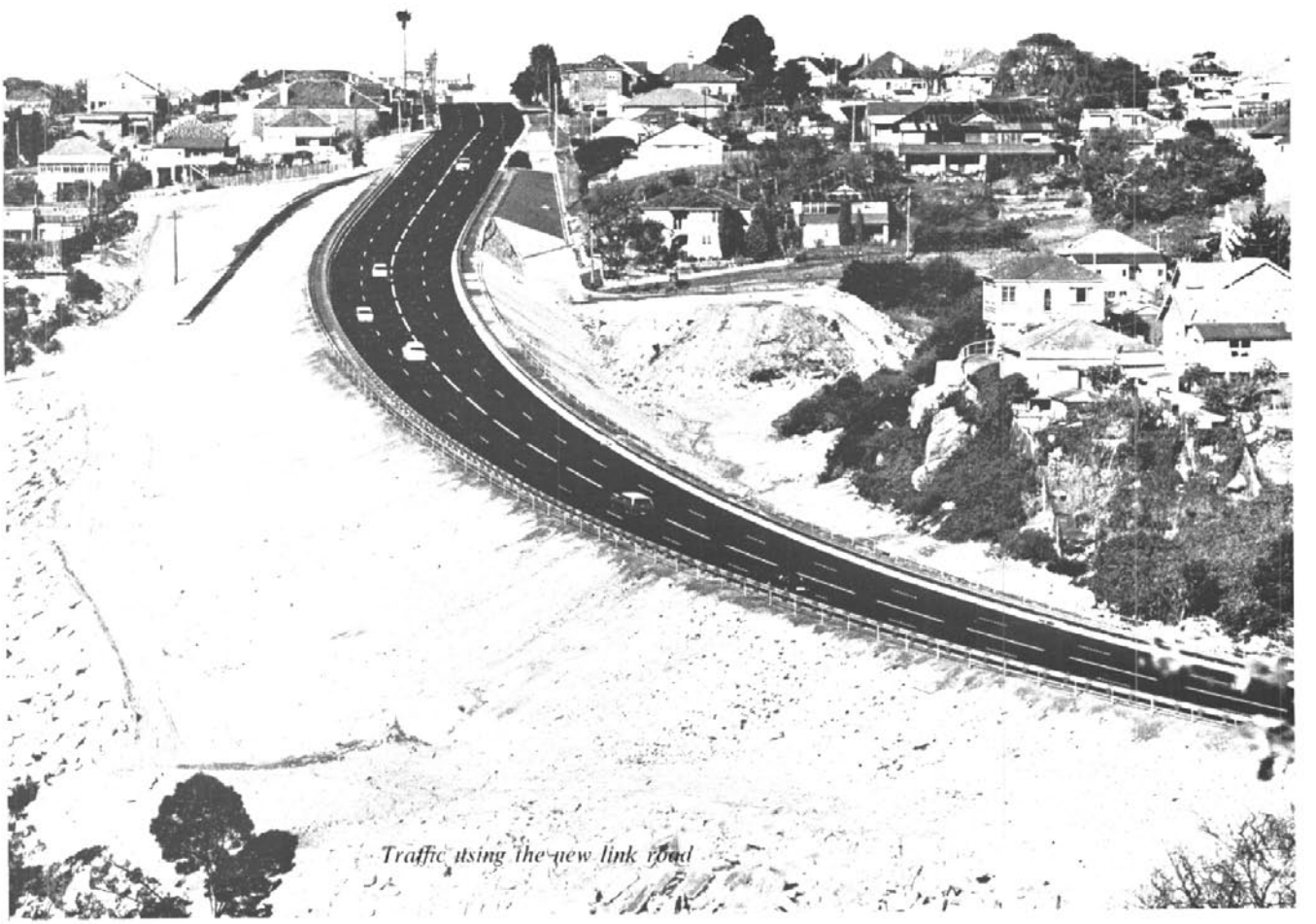
An alternative outlet for traffic, adjacent to the northern end of the completed section of the Warringah Expressway, was provided by a new road built across Flat Rock Creek, connecting Brook Street, Naremburn with Alpha Road, Willoughby.

This new road connection was opened to traffic to coincide with the opening of the Warringah Expressway on Tuesday, 18th June, 1968.

The road constructed across Flat Rock Creek is 0.4 miles long.

A footpath has been provided on each side of the new road. In conjunction with this work, the Department reconstructed and widened the existing pavements in Chandos and Brook Streets, Naremburn, a further 0.7 miles. This expressway outlet, 1.1 miles long, provides four traffic lanes on a 42-feet wide carriageway.

NEW ROAD ACROSS FLAT ROCK CREEK



Traffic using the new link road

The new road was built on an embankment up to 100 feet high with a maximum grade of 11 per cent. Surplus material excavated from the Warringah Expressway was used as filling for the embankment. It was transported to the site by trucks and spread with tractor dozers and graders. A rock rake separated the larger stones from the material, pushing them to the outer face of the embankment. The removal of these large stones facilitated compaction of the fill material and also provided a scour resistant face on the batters. Smooth steel wheel rollers and vibrating rollers were used to compact the material. Approximately 650,000 cubic yards of filling were placed in the embankment.

The pavement consists of a 2-inch asphaltic concrete surface course. It was laid on a base of 8 inches of fine crushed rock and a sub-base of 12 inches of selected sandstone.

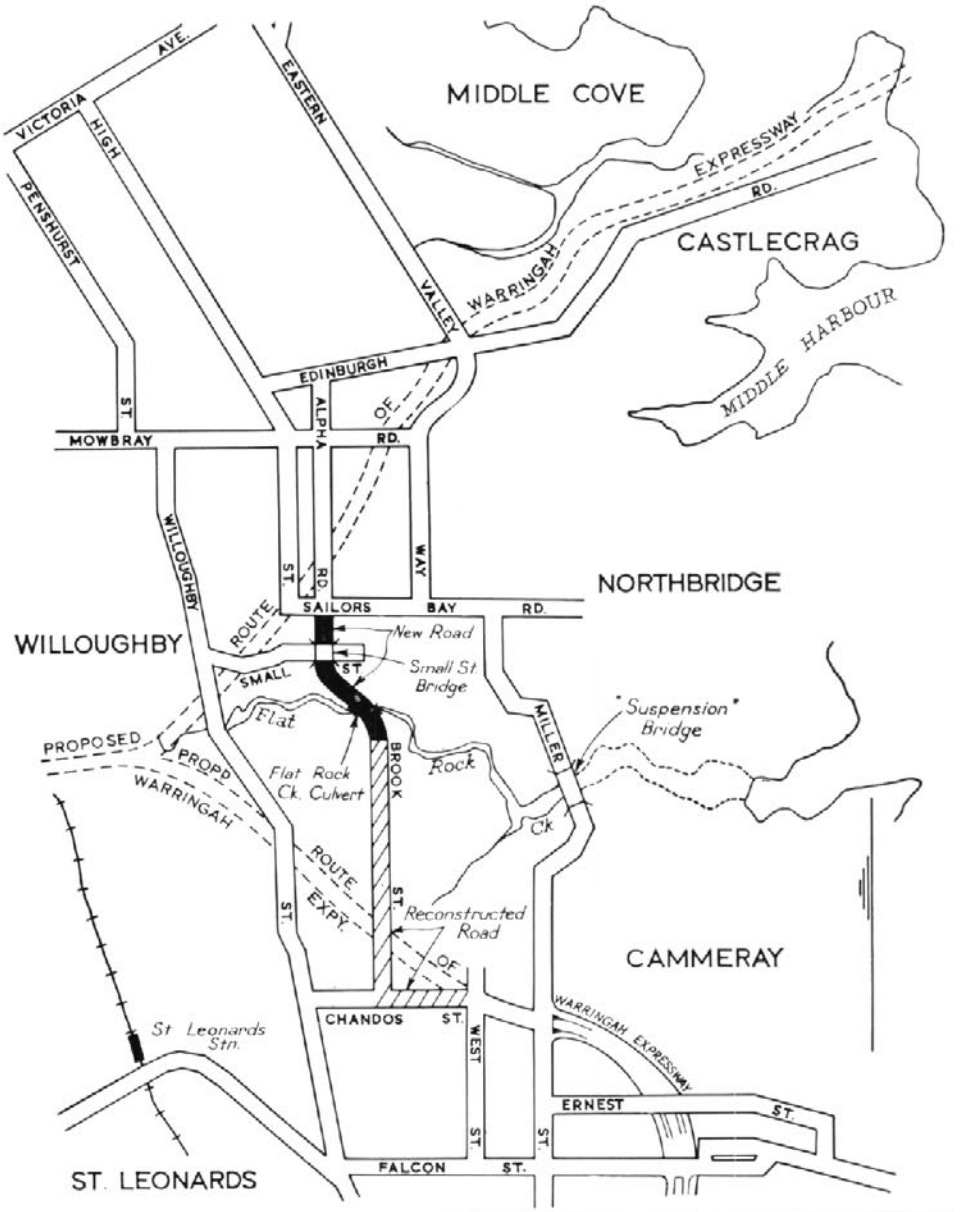
Tubular steel fencing was erected at the outer edges of the footpaths and galvanized steel guard rail at the kerb.

Two structures were required in the embankment, one, an extension of the culvert in Flat Rock Creek and the other, a bridge to carry the new road over Small Street, Willoughby.

Flat Rock Creek is carried in a culvert under Hallstrom Park and it was necessary to extend this culvert by 515 feet to carry the creek through the embankment. The work was carried out by M. R. Hornibrook (N.S.W.) Pty Ltd under contract to the Department. It involved the placement of 1,700 cubic yards of concrete (class 4.5K) in the walls, 22 inches thick, and the roof, 27 inches thick. Internally, the culvert is 14 feet high and 12 feet 6 inches wide. The structure is anchored to the rock by means of 370 rock bolts.

The bridge over Small Street was constructed by the Department's own forces. It is a prestressed concrete structure, 127 feet long, consisting of two 40-feet end spans and a centre span of 45 feet. Its overall width is 59 feet providing four traffic lanes and two footways. This bridge is the first constructed by the Department using lightweight concrete.

The bridge is supported on two piers, each consisting of four columns of precast lightweight concrete blocks. These columns were stressed to in-situ footings by Macalloy bars. Counterfort type abutments, supported by beams and columns, together with the headstocks were poured in-situ. The precast and pretensioned deck beams, each weighing



Left: Aerial view of the road nearing completion

Right: Locality Sketch

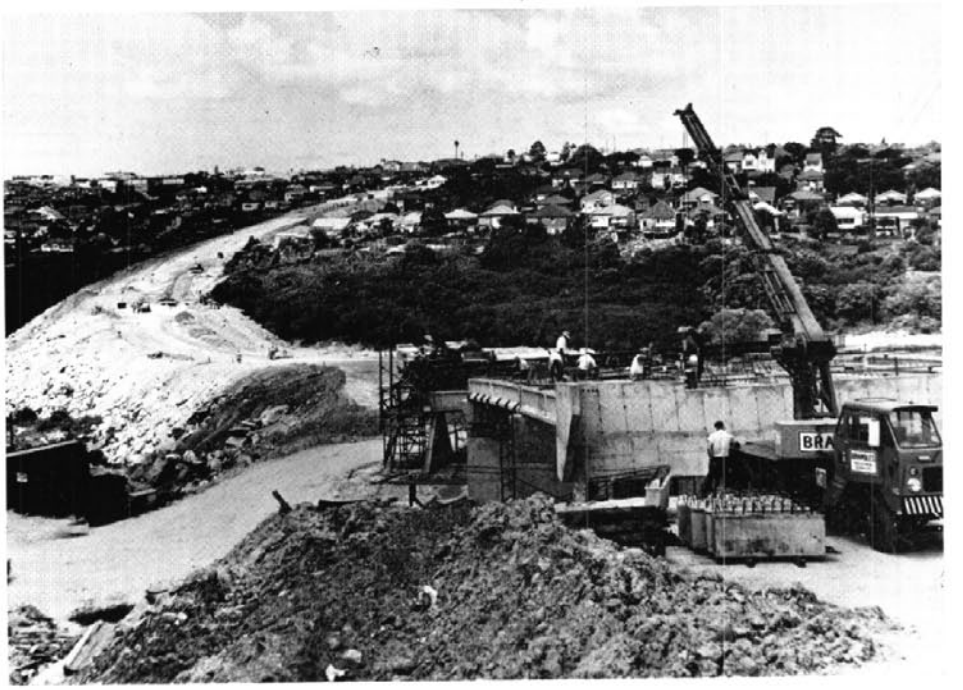
Below right: Construction of the embankment on which the new road is built. The bridge to carry the new road over Small Street, Willoughby, is being built in the foreground

4½ tons, were lifted into position by a 20-ton crane.

The unusual geometry of the bridge, situated on a 1,100 feet radius curve, at a skew of 23½° and on a grade of 11 per cent, complicated the deck construction. Hog in the prestressed lightweight beams was greater than expected.

Standard size formwork panels were used extensively in the in-situ concrete work, facilitating rapid forming and stripping. A satisfactory concrete finish was obtained by using hardboard sheets on the formwork panels. Apart from the outer handrails, crash rails were provided at the kerbs. The footways consist of precast concrete slabs. The asphaltic concrete surface course on the road was also provided on the carriageway of the bridge.

The cost of the new road including both structures and the reconstruction of Chandos and Brook Streets was of the order of $850,000.



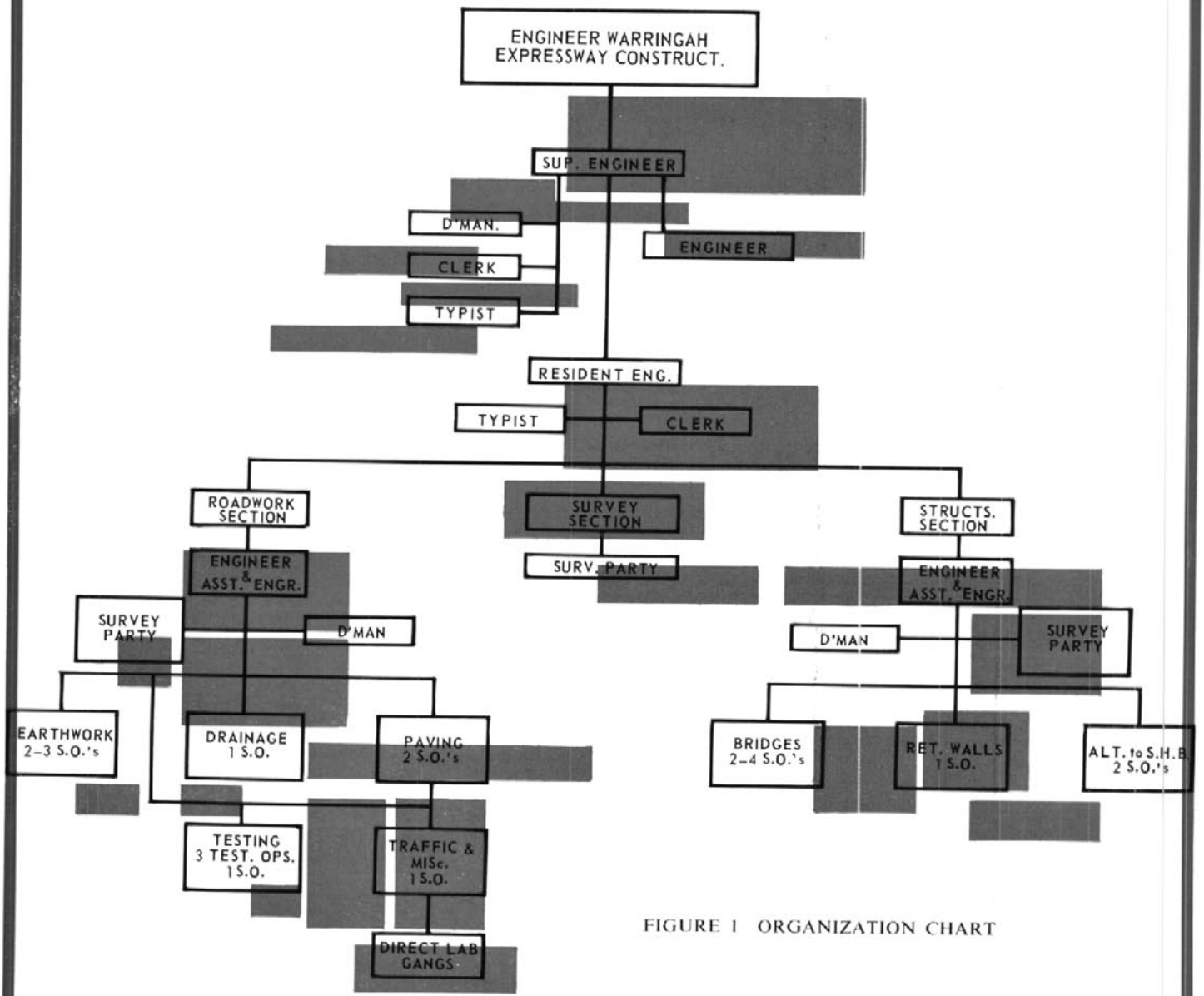


FIGURE 1 ORGANIZATION CHART

Warringah Expressway Construction

The first section of the Warringah Expressway, which is 1.5 miles long and extends from the northern end of the Sydney Harbour Bridge to Miller Street, Cammeray, was opened to traffic on Tuesday, 18th June, 1968. His Excellency, The Governor of New South Wales, Sir Roden Cutler, V.C., K.C.M.G., C.B.E., and Lady Cutler were the first to drive over this new multi-lane road. The occasion was suitably commemorated when His Excellency later unveiled a plaque, located in the special observation area at the western end of the Ridge Street pedestrian overbridge. Although the expressway was made available to traffic in June, it was not then fully completed. The remaining work including landscaping, is now being carried out and is expected to be completed later this year. Between the Sydney Harbour Bridge and Ernest Street, the expressway has four carriageways providing for eight lanes of traffic and there is a climbing lane for slow-moving traffic.

Each lane is 12 feet wide. The two outer carriageways provide permanent traffic flow in each direction. The traffic flow on the two centre carriageways is reversible, permitting three carriageways to carry traffic in the same direction during peak periods. In off-peak periods two carriageways carry traffic in each direction. The reversible traffic flow ends between Ernest Street and Bellevue Street, where the four separate carriageways merge to two carriageways each of four lanes. A temporary connection joins the end of the first section to Chandos Street at West Street, Cammeray.

Following the acquisition and demolition of the necessary properties, preliminary work which consisted of the construction of four reinforced concrete tunnels to carry public utility services across the route of the expressway and the reconstruction of two reinforced concrete box drainage structures, commenced in July, 1964. The main expressway construction work commenced in May, 1965.

Construction of the major portion of the work was carried out under contract to the Department. The remaining work, including the supply and placing of asphaltic concrete, traffic linemarking, signposting, and other ancilliary work was undertaken by the Department. Other specialist services, i.e. lighting, traffic signalling etc., were carried out by the authority concerned.

The contract for the main construction work was awarded to Reed and Stuart Pty Ltd for the contract price of $9,972,363.02 although the final cost has been varied by virtue of extras and deductions to the contract as work proceeded.

ORGANIZATION

In order to maintain effective control over this major work, the Department established a separate organization to supervise and co-ordinate all phases of the work. The Warringah Expressway Construction Office, with Divisional status, was set up with headquarters in Head Office. The Engineer in charge, Mr L. R. Derrin, exercised overall control of the project under the direction of the Engineer-in-Chief. A special Works Office, under the control of a Resident Engineer, was established at Milsons Point to supervise the contract work and carry out day labour work. This office divided its activities into two spheres—roadworks and structures.

The organization chart, Figure 1, shows the staff engaged on this project. There were six engineers engaged on the work in the early stages and a maximum of eight as the work progressed. The organization included surveyors, draftsmen testing operators, superintending officers and office staff.

The construction of all structures was carried out directly by the contractor, whilst such items as earthworks, pavement construction and the demolition of existing structures on the approaches to Sydney Harbour Bridge were undertaken by sub-contract to the main contractor. Thirteen engineers were, at one stage, employed on the project by the contractor and his sub-contractors.

At the peak of activities a total labour force of 507 was employed, comprising 34 staff officers, 28 foremen, 96 tradesmen, 298 labourers and 51 plant operators and truck drivers. The average work force was 380.

At all times only a single shift was worked, but working hours were extended to nine hours per day for six days per week.

PUBLIC UTILITY SERVICES

Before actual road construction could commence it was necessary to relocate the extensive public utility services in this high density residential area.

It was essential that the public utilities services be maintained at all times. In consequence considerable liaison and co-operation between the Department, the utility authorities and the designers were necessary in planning the relocation of these services.

When the site had been cleared of all buildings the Department let a contract to Theiss Bros Pty Ltd for the construction of four reinforced concrete box structures under the expressway. These structures, each 10 feet by 8 feet, were to accommodate public utility services. All services crossing the expressway were either placed in these structures or within the deck system of the overbridges. Thus any subsequent work associated with the public utilities, broken mains, maintenance etc., can be carried out without interruption to expressway traffic.

The magnitude of the work involved in relocating these services is indicated by the work carried out by the following individual bodies:

Sydney County Council

Re-equipped two new sub-stations.
Provided 6 miles of permanent diversions of 415V, 11,000V and 33,000V mains.
Transferred 2 miles of overhead low voltage mains underground.
Carried out 8 major temporary diversions of aerial construction during the progress of the work on the expressway.
Provided 43 miles of underground street lighting cable to connect the 460 light standards on the expressway.
On 24 different occasions provided a total of 170 temporary poles and lamps for the lighting of temporary traffic detours.

Postmaster General's Department

Temporarily relocated 4 major cable routes.
Provided 14.5 duct miles of new route.
Laid 6,500 pair miles of new cable, which consisted of a total of 38,500 cable pairs.

The North Shore Gas Company Limited

Disconnected approximately 500 services (700 consumers).
Constructed 11,400 feet of new 15-inch and 24-inch diameter high pressure mains.
Constructed 10,400 feet of new 2-inch to 12-inch diameter mains.
Lowered numerous service mains.

Metropolitan Water, Sewerage and Drainage Board

Laid 13,200 feet of new 4-inch to 10-inch diameter cast iron water mains.
Laid 7,300 feet of new 12-inch to 30-inch diameter cast-iron and mild steel water mains.
Provided 9,100 feet of new 9-inch to 16-inch diameter sewer mains.

PROVISION FOR TRAFFIC

It was necessary to maintain unrestricted traffic flow to and from the Sydney Harbour Bridge during the construction of the expressway. To enable about 110,000 vehicles per day to pass through the working area no less than fifteen major and fifty minor temporary traffic detours had to be constructed and maintained. In each case special signposting and street lighting had to be arranged and at five major temporary intersections the installation of traffic control signals was required.

The Department's Central Workshop, at Granville, produced more than 150 temporary retro-reflective direction and warning signs and about 110 miles of traffic line-marking were provided to direct traffic through the ever changing pattern of detours.

The successful implementation of these changing routes for the heavy traffic volumes involved the close co-operation of a number of the Department's organizations as well as outside bodies.

☐ The Department's Works Office organized and co-ordinated the work and provided labour to undertake matters outside the responsibility of the contractor.

☐ The contractor was involved in the provision of standard traffic control requirements and the completion of contractual work by the day nominated for changeover of traffic.

☐ The Police Traffic Branch was involved in the approvals and requirements for temporary traffic arrangements and closure of streets, etc. The local police were involved in the control of traffic movement.

☐ The Sydney County Council designed and erected all temporary street lighting.

☐ The Department of Motor Transport designed and erected traffic signals and provided and erected regulatory signs.

☐ The Department of Government Transport re-organized bus routes, relocated bus stops and adjusted timetables.

☐ Within the Department, temporary traffic arrangements, signposting, asphaltic surfacing, traffic line-marking, sign making and publicity arrangements required considerable organization.

The close co-operation of all these bodies resulted in a smooth pattern of changes with little disruption and inconvenience to the travelling public.

CLEARING

With all buildings and other property improvements removed from the right-of-way, the clearing was a comparatively minor operation involving the removal of isolated trees and low-growing scrub. All trees in the area had been located by prior survey and trees which could be saved were preserved to fit in with the subsequent landscape treatment.

EARTHWORKS

The total volume of excavation was approximately 1,400,000 cubic yards of which only 710,000 cubic yards were required for embankment or fill. The surplus material was used in the construction of a new road extension to Brook Street, Naremburn, over Flat Rock Creek. This provided an alternative outlet for traffic from the expressway to the Forestville, East Lindfield and Willoughby areas.

The excavated material was predominantly good quality sandstone with varying degrees of jointing and hardness. Approximately 60 per cent of it was ripped. The remainder was loosened by drilling and blasting.

CUTTINGS

All cuttings were in rock. Batter slopes were varied depending on the nature of the material and limitations of width. To provide an harmonious blend with the adjacent urban area and the geometric shapes and layout of the expressway, the cuttings were finished with an even striated surface. This effect was achieved by closely spaced multiple drilling. Bulk excavation, whether by ripping or blasting, was completed to a minimum of 2 feet within the limit of the final batter line. The batter was then finished or trimmed with light explosive charges.

Batters were drilled with track mounted drilling rigs, using 2½-inch X-bits and 10 feet extension steels. The average spacing of drill holes was 6 inches centre-to-centre and the deepest holes approximately 40 feet. Instead of using the conventional Channel Bar and Broaching Machine, the contractor used crawler-mounted drilling rigs on special platforms as illustrated in Figure 2. The platforms were located accurately on the batter line and levelled by means of foot screws. Holes drilled at 6-inch centres in the channel in the middle of the platforms located the foot of the feed tower which was then set at the batter slope by means of a template with a level bubble attached. Although the final setting up depended entirely on the operator's skill, drill wander was usually less than 6 inches resulting in consistently uniform batters. Batter drilling accounted for 71 per cent of the total drilling on the job and amounted to just over 495,000 lineal feet. A tolerance of +6 inches and −12 inches was allowed for the finished batters.

Figure 2 Batter drilling using crawler mounted drilling rig and special locating platform

Dust from the drilling operations created a problem which was overcome by injecting a water/detergent solution into the air jet to moisten the minute dust particles. The solution was contained in special tanks fitted to the drilling machines.

Ripping, where it was economically warranted, was carried out with heavy tractor-dozers with hydraulic rippers. After ripping, the material was dozed into stockpiles and picked up with front end loaders and shovels. Hired lorries, of an average capacity of 10 cubic yards, were used to haul the material to the disposal sites.

More than half a million cubic yards were excavated by drilling and blasting. Track mounted pneumatic drills were used for the drilling, the diameter of the holes being 2½ inches. The drilling pattern was generally small—of the order of 5 feet by 5 feet—with depths of lifts from 10 to 15 feet. Blasting mats were used and only a limited number of holes were fired at the one time, usually 12 or 13. Explosives used were ammonium nitrate—fuel oil mixture with AN60 gelignite for priming. Electric half second and milli-second delay detonators were used. The average loading factor was 0.3 lb of explosives per cubic yard.

Due to the close proximity of buildings etc., drilling operations were strictly controlled to limit vibration, noise and flying rock. The number of holes fired together was limited, each hole being fired by a separate delay detonator and cordtex was used inside the holes only. As an added precaution, in the case of deep holes which were deck loaded, two detonators were used.

The vibrations caused by the blasts were required to be kept below 0.008 inches in amplitude. This was constantly checked by Departmental Officers, and over 300 vibragraph readings were taken. Half second delay detonators were found to be superior in keeping vibration to a minimum.

A pre-blast survey of all buildings within 400 feet of the blast area was made prior to commencing blasting operations.

After completion of the bulk excavation, the 2 to 4 feet burden remaining on the batters was removed. Every third hole along the batter was loaded with an explosive charge of one stick of AN60 gelignite as the primer at the bottom and a 1-inch diameter plastic stocking containing ANFO to within 4-feet of the top. A cordtex line also extended the full depth of the hole and was actually placed inside the plastic stocking. The top 4 feet of the hole was stemmed with sand. Milli-second delay detonators were used, with two to three holes connected to one detonator.

This type of batter blasting gave a loading density of $2\frac{3}{4}$ ounces of explosive per square foot or 0.5 pounds per cubic yard.

EMBANKMENTS

In preparing each fill site, all topsoil was removed and stockpiled for later use in landscaping. Unsuitable or unstable material was also removed and the embankment subgrade rolled. The fill material was placed in horizontal layers, each layer having a compacted thickness of not more than 8 inches. Where the fills joined existing slopes, the latter were continuously stepped in benches of at least 2 feet in width.

The minimum degree of compaction required in each embankment layer was 95 per cent of that obtainable by using D.M.R. Test Method MR-T112 (Modified AASHO Compaction Test). This was checked constantly and the subsequent layer was not placed until the specified degree of compaction was obtained.

The material was brought to the fills in lorries and spread with 120 hp and 235 hp bulldozers. The initial breakdown of oversize rocks was accomplished with 14-ton tamping and grid rollers. The final compaction was by 4-ton smooth wheel vibrating and 11–15 ton pneumatic-tyred rollers.

A reinforced concrete cantilever type retaining wall (up to 20 feet high) had to be constructed on one of the fills. To ensure that satisfactory compaction of the material on which this wall was founded had been obtained, the degree of compaction was checked at intervals of 10 feet along the length of the wall and special care was taken to ensure that the thickness of fill layers did not exceed 8 inches.

The batter slopes on fills were generally finished in the ratio of two horizontal to one vertical, but flatter slopes were provided where required for landscape treatment. Batters were finished to a tolerance of plus or minus 6 inches. All batters, will be planted with either grass or ground cover foliage plants, depending upon their slope.

DRAINAGE

Situated as it is in an urban area, the existing drainage system had to be maintained until the new drainage system was constructed and brought into service. This created some problems not normally encountered on roadworks. The problems were accentuated because the existing system, adjacent to the work, had to be integrated with the new system to function as a combined service upon completion of the work.

During the early stages, it was necessary to relocate two large stormwater drains under the route of the expressway. These drains are the main stormwater arteries, and carry water across the expressway and also serve the expressway drainage system.

The construction of these two drains was included in the contract awarded to Thiess Bros Pty Ltd for the construction of the structures to carry the public utility services under the expressway referred to earlier.

The expressway drainage system consists of some 25,300 feet of reinforced concrete pipe culverts, varying from 12 inches to 54 inches in diameter. This is equivalent to 3.2 miles of pipe per mile of expressway. The pipes used were of Classes S, X, Y, and Z as specified by the S.A.A. Code No. A35-1957, and had rubber ring spigot and socket joints. All pipes were laid in trench condition with various standard beddings specified. In particular cases, negative projection bedding and imperfect trench conditions had to be employed. The back filling consisted of sand around the pipes and minus 6-inch material within 2 feet of the pipe. All pipe-laying was carried out under strict survey control.

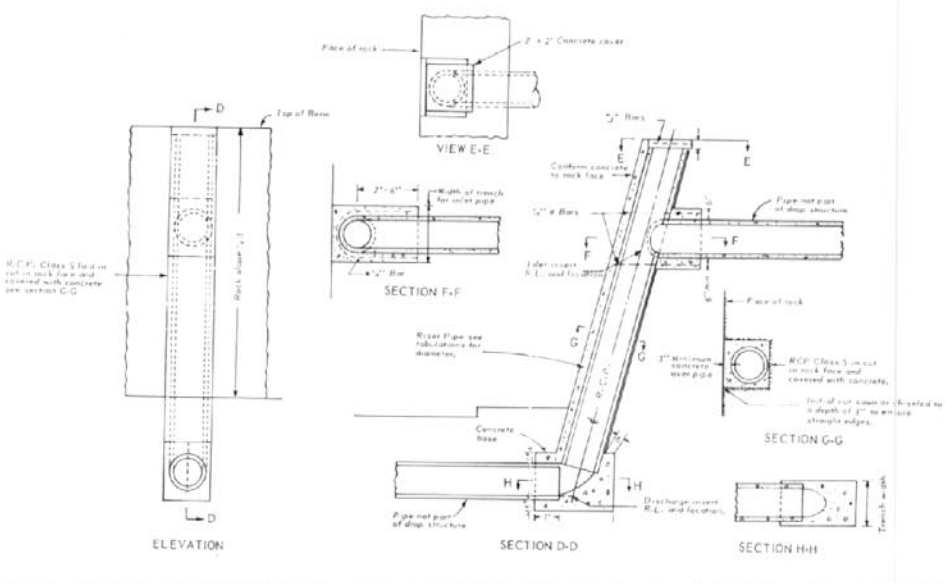
Where drainage pipes had to be brought down rock batters, special drop structures (as illustrated in Figure 3) were constructed. The faces of these drop structures were plastered with coloured mortar and sand crushed from the adjacent sandstone to blend with the adjoining batter surface.

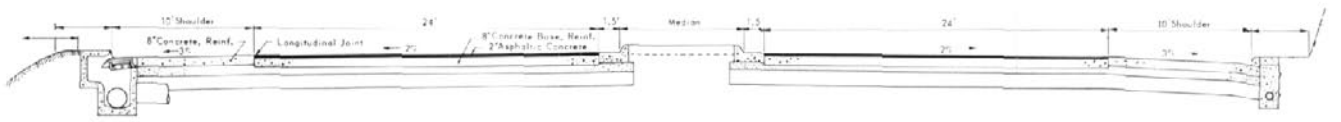
About 1,300 lineal feet of cast iron pipes, varying from 4 inches to 9 inches in diameter were used to connect drainage from the bridges to the general drainage system.

Two hundred and seventy-two single and double grated gully pits comprising eleven types and varying in depth from 2 feet to 26 feet were required. These were constructed from reinforced 2.5 K concrete with a maximum slump of 4 inches.

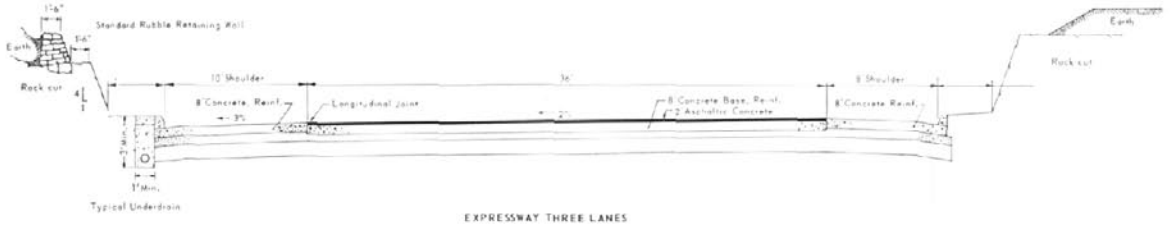
Opposite: Figure 4: Typical roadway sections

Figure 3: Drop structure for rock cuts

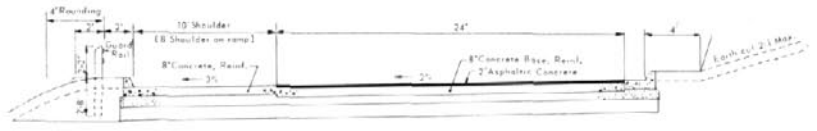




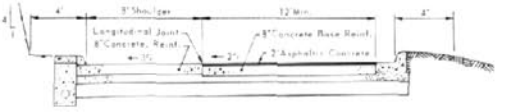
EXPRESSWAY FOUR LANES DIVIDED



EXPRESSWAY THREE LANES



EXPRESSWAY (OR RAMP) TWO LANES



RAMP ONE LANE

Subsoil drains were constructed along the edges of formation in all cuttings and at other locations where water seepage was evident. They consisted of trenches, 18 inches wide by 3 feet deep, with a minimum grade of one per cent. Agricultural pipes of 6-inches diameter were laid 2 inches above the bottom of the trench which was backfilled with filter material of graded crushed basalt. Joints were wrapped with bitumen impregnated hessian. Inspection pits were provided at intervals of 200 feet. Some 15,000 feet of subsoil drains were provided.

Various types of open drains were provided in medians and verges, on berms, behind retaining walls and in landscaped areas. In all cases, these were lined by 4-inch concrete paving, 3½ inch "no-fines" coloured concrete or 2-inch asphaltic concrete.

PAVEMENT

All pavements on the expressway consist of 12 inches of selected sub-base, 6 inches of broken stone base course, 8 inches of reinforced concrete base and 2 inches of asphaltic concrete running surface. The total area of concrete base and shoulders is 270,660 square yards which is equivalent to approximately 21 miles of 22 feet wide rural highway. Details of the pavement types are shown in Figure 4.

The specification for the sub-base layer required that the material have a plasticity index of less than 12 and be able to support heavy loading with 8 inches or less of cover. All stone was required to be broken down to less than 6 inches in greatest dimension. The excavated sandstone material was suitable for this purpose.

The base course consists of 6 inches (eight inches for shoulders) of compacted thickness broken stone of 1 inch maximum size, conforming to standard Departmental specifications. It was supplied by contract and spread in two layers of 4 inches compacted thickness, either by a mechanical spreader (Figure 5) or by graders. Compaction was by 10–12 ton smooth steel rollers and 11–15 ton pneumatic-tyred rollers. The degree of compaction required was not less than 95 per cent of that obtainable using the Department's Test Method MR-T112 (Modified AASHO Compaction Test).

The surface of the compacted base course was required to contain no irregularities greater than one half-inch when tested with a 10-feet long straight edge with a tolerance from the finished grade of +0 and −½ inch.

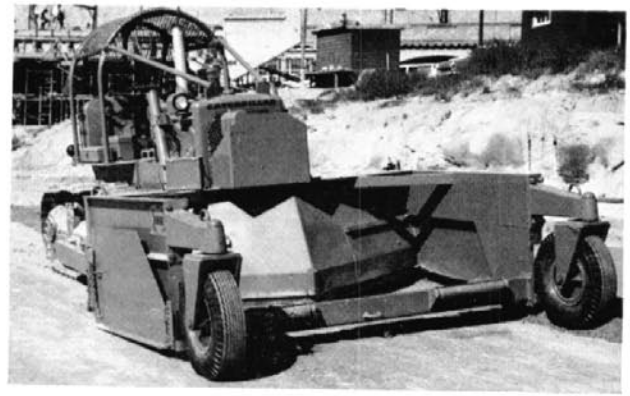


Figure 5 Base course spreader mounted on 120 hp tractor

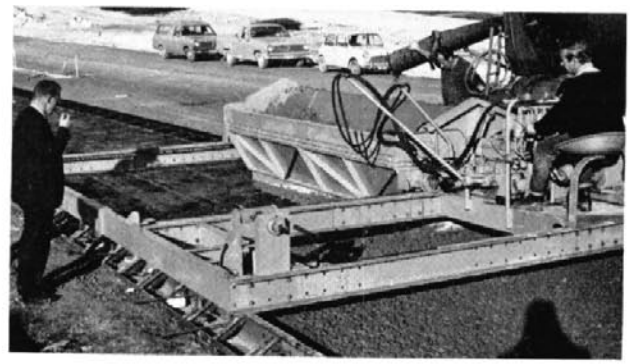


Figure 6 Base Paver—spreading the lower four inches of concrete pavement

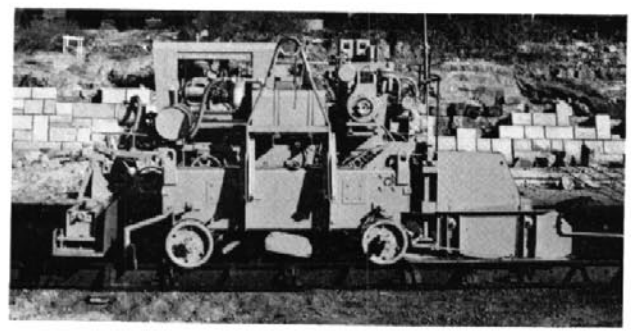


Figure 7 General view of paver

Figure 8 Concrete paver working

Figure 9 Finishing of paving run with bridge

After checking density, depth and surface finish of the base course, the surface was swept clean and sealed with cationic bitumen emulsion applied at the rate of 0.10 gallons per square yard.

The concrete base consists of Class 2.5K (3K for shoulders) concrete, with 1½-inch maximum size aggregate and 2-inch maximum slump. This is reinforced with wire reinforcing fabric, located in the middle third of the slab. Approximately 35 per cent of the concrete was placed by a mechanical paving train and the rest by hand. All concrete was supplied by local pre-mix organizations.

The concrete paving train comprised three basic units and the operations were carried out in the following order:

☐ The lower 4 inches of concrete were placed by the base paver (Figure 6). This was a self propelled unit with the hopper travelling transversely.

☐ The bar mat was placed, spliced and tied by hand.

☐ Concrete for the upper 4 inches was discharged from ready-mix trucks directly in front of the paver (Figures 7 and 8). The worm gear in front of the paver spread the concrete and a stationary screed immediately behind the worm gear levelled it to slightly higher than the finished surface. The concrete was vibrated by a surface type vibrating element (4,000 c.p.m.) located in the centre of the paver and extending over the full width of the pour. At each edge of the pavement two immersion type vibrators ensured compaction around the keys and dowels. The surface was finished by a large moving screed/float on the rear of the machine.

☐ The required rough texture in the surface finish was obtained by brooming or by a mechanized burlap bridge. (Figure 9).

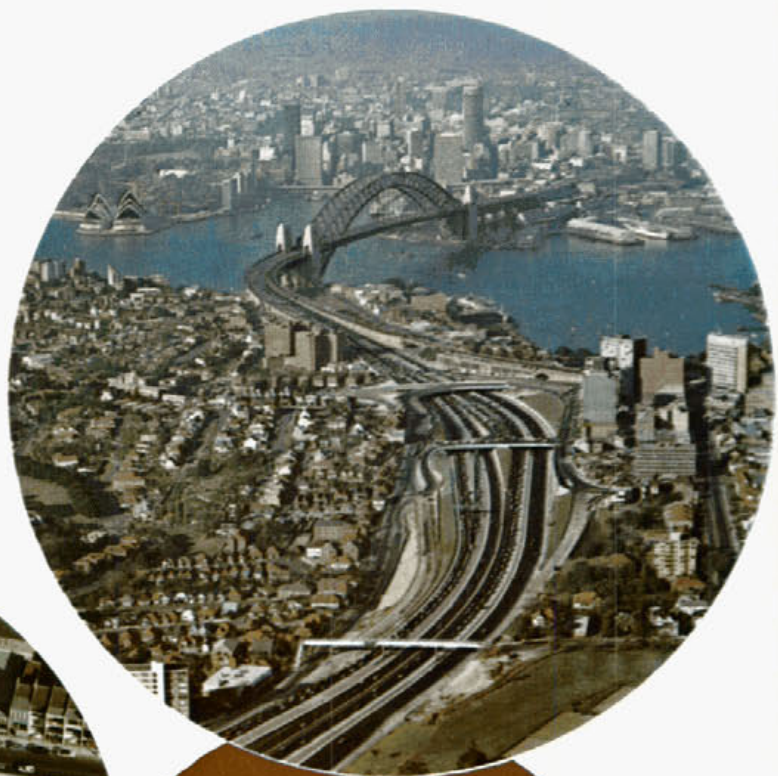
The concrete base has no expansion joints, other than where it meets structures. A 2 in x ⅜ in contraction joint was formed with special polystyrine fillers at 25 feet intervals. The polystyrine fillers were removed later and the joints filled with 20/30 bitumen prior to placement of the asphaltic concrete.

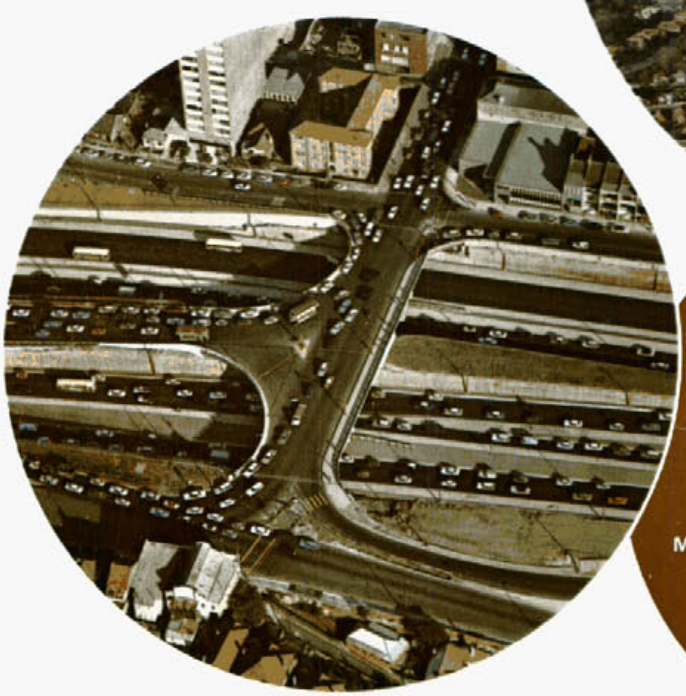
As far as practicable, longitudina joints were made to coincide with lane markings and hence, all concrete pour were generally twelve feet wide. The longitudinal joints were connected with steel dowels ½-inch diameter and 4 feet 6 inches long, spaced 30 inches apart. Where the pavement width exceeded 36 feet, one longitudinal joint was left without dowels.

Looking south towards
Ernest Street Overbridge

Looking north
towards Miller Street

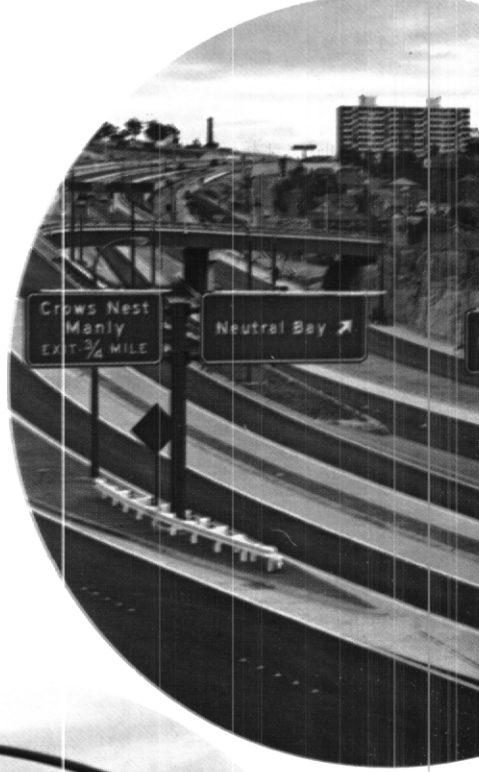
Traffic on the Warringah Expressway





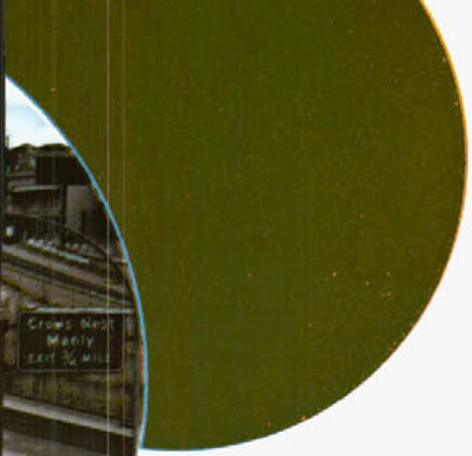
Morning peak traffic
approaching
Sydney Harbour Bridge

Mount Street Overbridge

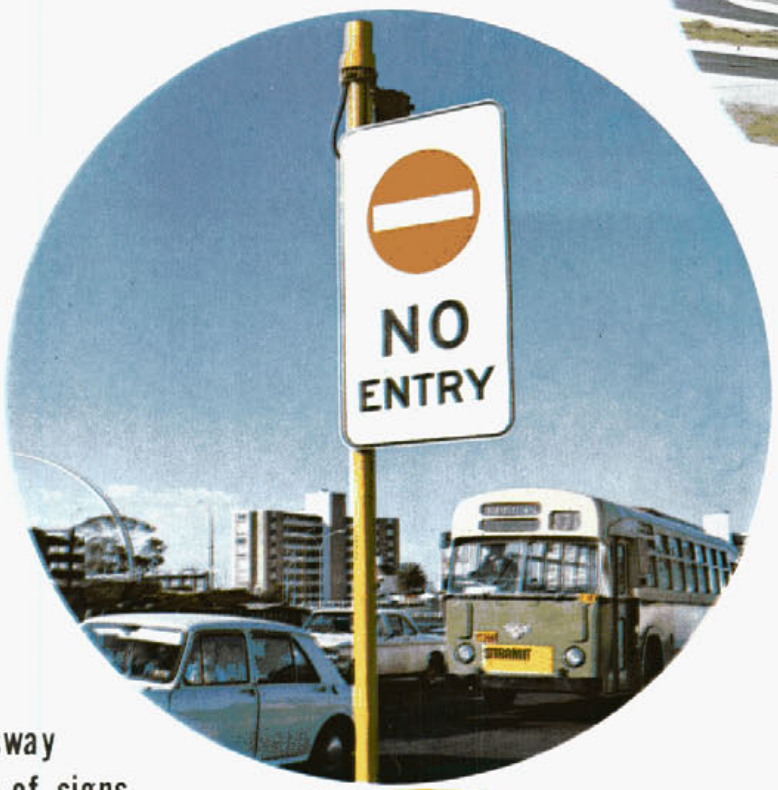


Some of the
general direction signs
to be seen on the expressway

This blunt warning
is necessary and effective
for motorists
who make a wrong turn
and face a stream of oncoming traffic



The largest of all the signs—
116 feet long with movable direction si



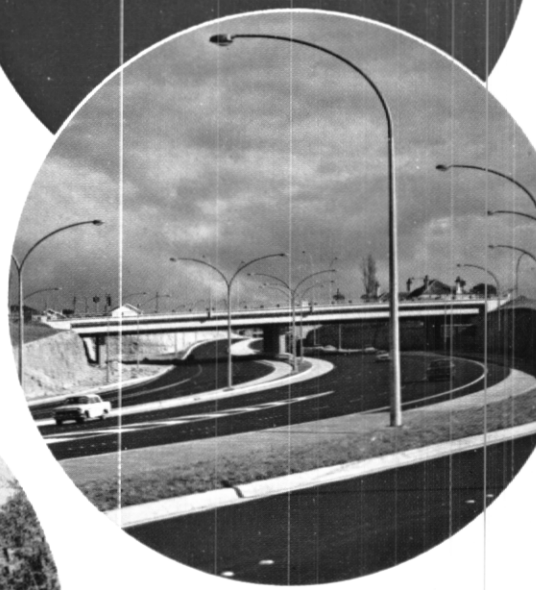
ts on the
ah Expressway
ide variety of signs
for their guidance

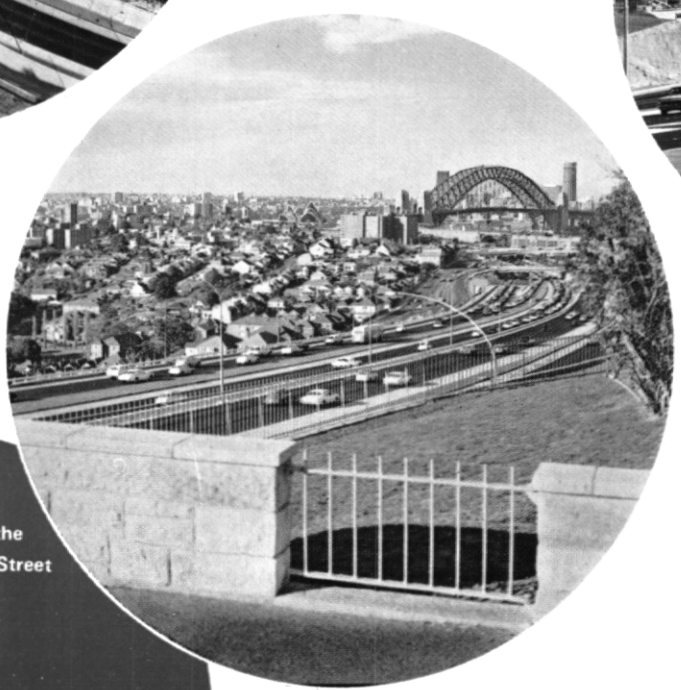
New international road sign symbols
used for the first time in Australia

Mid-morning traffic
near the Ridge Street Footbridge

Falcon Street Overbridge

Miller Street Overbridge





View from the
pedestrian lookout Ridge Street

The tolerances for the finished concrete base were +0 inch and $-\frac{3}{8}$ inch, with irregularities of no more than one quarter inch measured from a 10 feet straight edge.

Two methods of curing the concrete were employed:

1. Where the concrete was to be later covered by asphaltic concrete, bitumen emulsion broken down with water in the ratio of one to four was used. This was applied by hand sprayers at a rate of one gallon per 75 square yards.
2. On the shoulders where the concrete was to be left exposed, commercial "fatty acid" curing compounds were used.

Commercial aliphatic alcohols were used successfully to reduce plastic or setting cracks in the surface of the concrete bases during hot, dry and windy weather. These materials were sprayed on the concrete immediately after screeding, forming a monomolecular film which retarded evaporation. The application rate of the material varied from 250 to 400 square feet per gallon and the "life" of the film was approximately 3 hours.

The asphaltic concrete manufactured and placed on the expressway pavements by the Department by direct labour amounted to 21,000 tons in either $\frac{3}{4}$ inch or $\frac{3}{8}$ inch material.

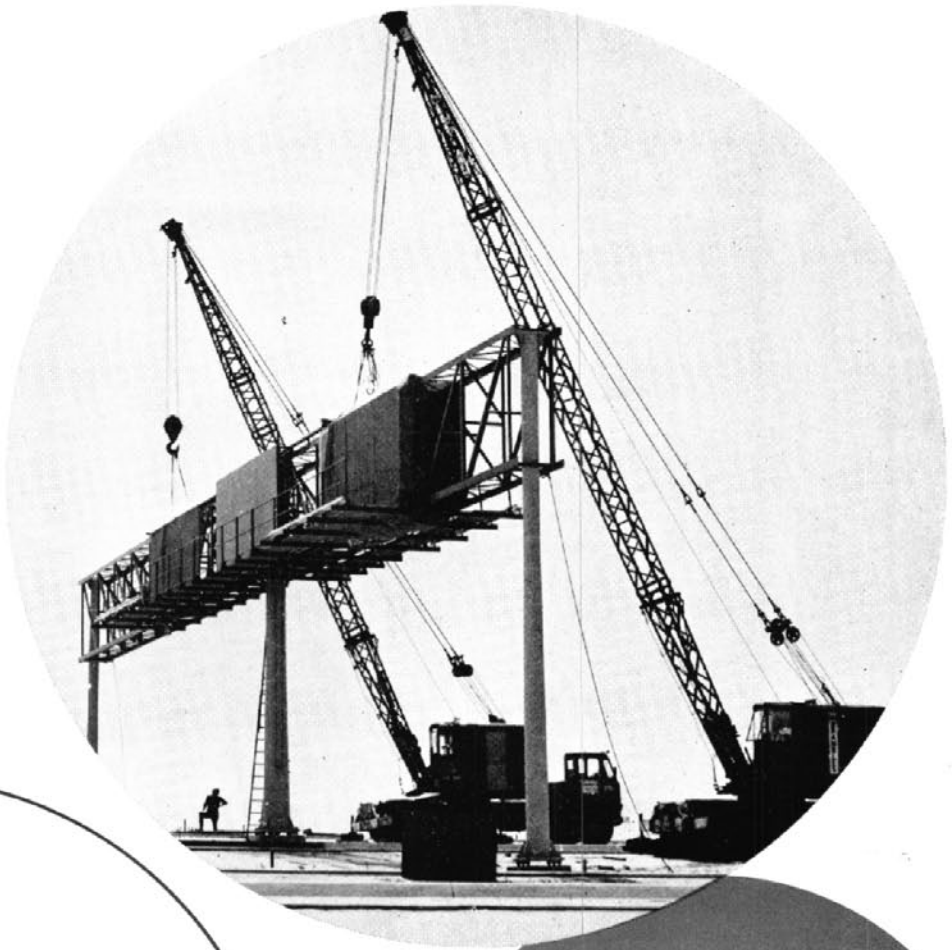


Figure 11 Installation of the longest (116 feet) sign structure with 17 feet long movable signs

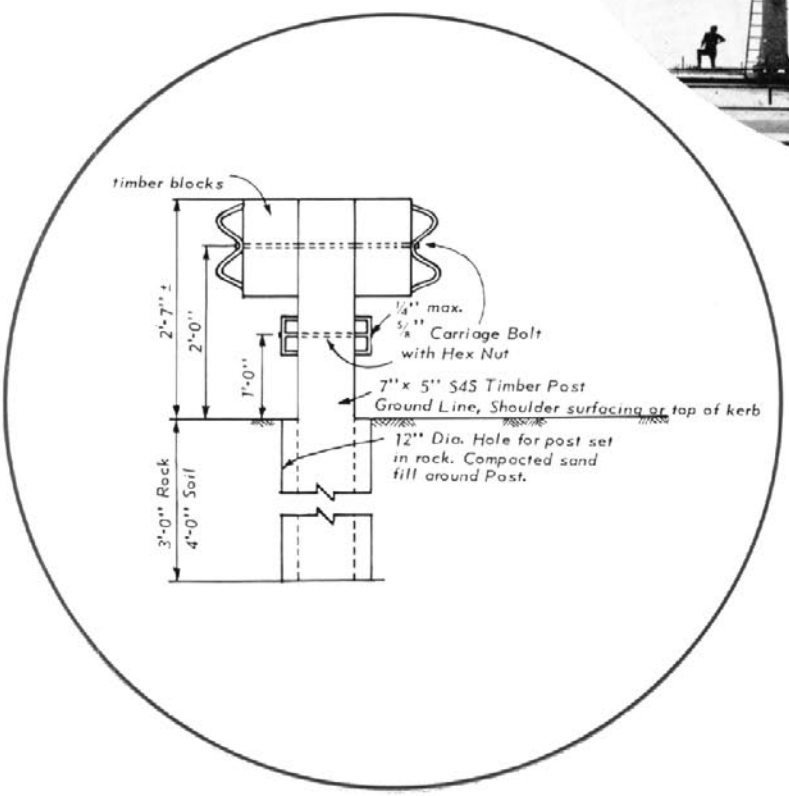


Figure 10 Double blocked out guard rail posts

KERB AND GUTTER

There are eleven different types of kerb and gutter on the expressway, with a total length of over 22 miles. Kerb heights vary from 5 inches to 9 inches and gutter widths from 1 to 2 feet with each type designed to provide a specific function. All kerb and gutter work was hand formed because of the variations in type and transitions.

ROAD FURNISHINGS

Guardrail Approximately 17,000 lineal feet of corrugated steel guardrail were provided at various locations on the expressway. Three types were utilized, non-blocked out, single-blocked out and double-blocked out. In all cases 7-inch by 5-inch standard posts and blocks were used but the double blocked out guardrail was further strengthened with two 5-inch by 2-inch channels as shown in Figure 10.

Signposting The expressway signposting consists of nearly 200 signs of various types and sizes. Broadly they can be grouped into the following classifications:

☐ Major Moving Signs—these are large truss type structures supported on tubular columns, with large (17 feet x 7 feet 6 inches) remote controlled changeable messages. The largest of these signs is 116 feet long. (Figure 11).

☐ Major Fixed Signs—erected on butterfly type structures with tubular columns and arms—the signs are in sizes up to 20 feet x 7 feet.

☐ Rotating Prism Signs—these are either:

1. Small trussed structures containing three prisms each with three sides rotating on a horizontal axis and bearing a different message on each side, or
2. Small single four-sided prisms rotating on a vertical axis and bearing a different message on each side.

☐ Changeable Arrow Signs—are erected on small trussed structures with fixed signs and changeable arrows, indicating different directions for conditions of traffic flow.

☐ Simple Signs—normal direction and advance direction signs.

☐ Regulatory Signs—standard regulatory signs.

All signs are reflectorized, some being additionally illuminated with fluorescent lighting. In general, 16-inch upper case and 12-inch lower case letters were used in the message on the major signs. The sign support structures and the signs were manufactured, erected and electrically wired by the Department by direct labour.

Linemarking A total of approximately 20 miles of pavement linemarking was placed by the Department by direct labour.

Lane lines are defined by raised pavement markers placed to simulate a painted line. These markers consist of 4-inch diameter dome shaped ceramic buttons and 4-inch square reflective markers. They are attached to the pavement by epoxy resin in groups of four ceramic and one reflector markers spaced at 3-feet intervals. Each group of markers is attached to the pavement at intervals of 23 feet.

The advantages of raised pavement markers over a painted line are:

☐ better delineation during wet weather at night;

☐ the need for frequent renewal of painted lines is eliminated;

☐ the reflective markers placed at 35 feet intervals accentuate lane lines at night; and

☐ a "rumble" effect is achieved when vehicles run along the markers reminding drivers that they are moving out of a marked lane.

Lighting Expressway light standards are 35-feet high mounted with high pressure mercury-vapour lamps with a rating of 700 W. The height of standards on surface streets is 25 feet with a lamp rating of 250 W. An intermediate lamp rating of 400 W. is used on access ramps and lamp standards are 30 feet high. Outreaches vary from 6 to 15 feet to provide a uniform overhang of 4 feet. The average spacing of light standards on the expressway is 125 feet.

A feature of the roadway lighting is the use of specially designed standards having composite light gauge steel vertical pole section and fibreglass outreaches. This combination provides visually pleasing and structurally adequate lamp standards on the expressway with emphasis on safety, durability, low maintenance costs and economy of production.

As an added safety feature a pull-out plug and a cast receptacle are mounted direct on 2-inch conduit in the base of the pole. Separation of the pole from the base spigot on impact, breaks the electrical circuit. Thus there will be no risk from electricity should collisions occur in which lamp standards are broken.

Light standards on overbridges are protected by a guard rail. Heavier gauge steel standards, in character with the bridge architecture and designed with the same elliptical curvature as the road type standards, were used on the bridges.

The construction of foundations for the light standards and installation of conduits were carried out under the contract. The Sydney County Council erected the standards and installed all wiring and light fittings.

Traffic Signals There are no traffic signals on the main expressway carriageways but all major access ramps are signal controlled at the point where they join surface streets. No less than 80 traffic signal pedestals were required.

Telephones For emergency use, eight field telephones were installed at strategic locations on the expressway. These were connected direct to the Toll Office on the Sydney Harbour Bridge, which provides a 24-hour emergency service.

Fencing Nearly 16,000 lineal feet of boundary fences were provided; 4,000 lineal feet comprised steel picket fence and the remainder was grey plastic coated chain link fence. The chain link fences are 6 feet high and the picket fences are 4 feet 6 inches high. They are erected on a concrete apron 12 inches wide.

Fire Hydrants Fire hydrants are provided in the area immediately north of the Sydney Harbour Bridge, with provision for stand pipes, on the irrigation mains over the rest of the length.

STRUCTURES

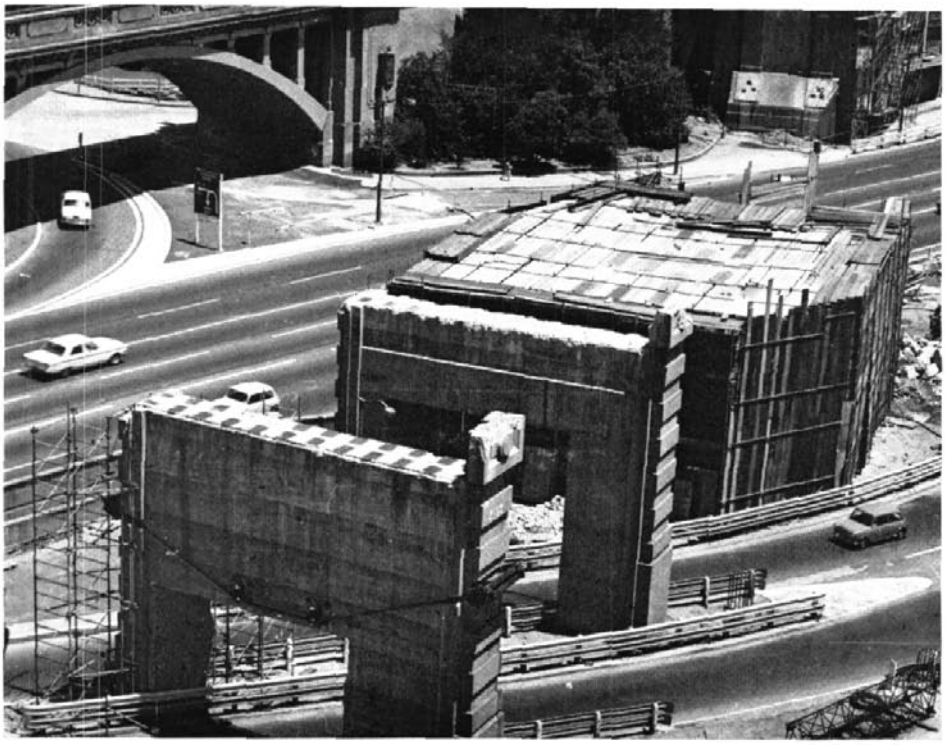
In order to carry cross traffic over the expressway, five overbridges each with provision for pedestrians and one overbridge solely for pedestrians were constructed. Sections of two existing viaducts on the approach to the Sydney Harbour Bridge were extensively altered to provide a smooth approach for traffic from the expressway to the bridge approach. The total length of various types of retaining walls required was just over two and one half miles.

Alterations to Viaduct Alterations to the two existing viaducts on the northern approach to the Sydney Harbour Bridge consisted of the complete demolition of several concrete spans, the demolition of a steel arch bridge over the Bradfield Highway, the lowering of the superstructure on six concrete spans and the construction of two prestressed reinforced concrete structures totalling 878 feet in length.

Because of the close proximity to the Bradfield Highway and the north shore railway the use of explosives for demolition of the existing viaducts was kept to a minimum. Drill rigs were used extensively to drill holes up to 3 inches in

Below: Figure 12 Safety box for blasting concrete in the southern abutment of old tramway arch bridge

Bottom: Figure 13 Traffic moving without interruption while the arch is supported and dismantled



diameter in the concrete, and the concrete split by the use of hydraulic jack rock busters placed in these holes. Explosives were used for the demolition of the lower section of one of the steel arch bridge abutments where the large mass of concrete involved made demolition by any other means impracticable. In this instance a large box 40 feet square and 25 feet high made from 3 inch thick oregon planks attached to steel scaffolding was constructed over the concrete mass to confine the explosions and ensure the safety of the adjacent traffic. The box was complete with lid and a mobile door which was removed after each explosion to remove the concrete rubble. (Figure 12.)

The 220-feet long steel arch bridge over the Bradfield Highway had to be removed without interference to traffic. The structural steel members were removed without cutting and, as it was proposed to use it at another location all members were match-marked prior to dismantling.

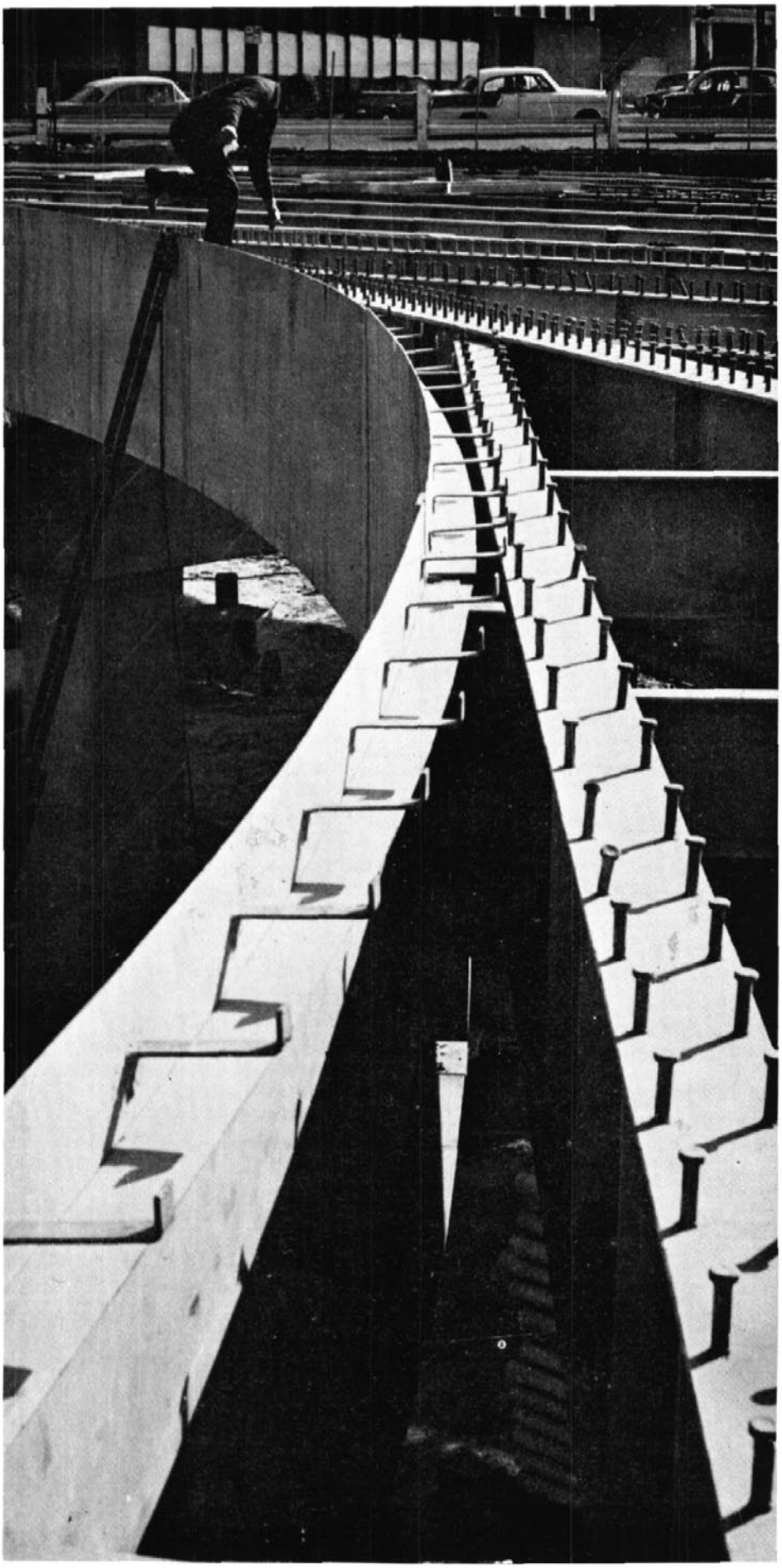
The six traffic lanes on the Bradfield Highway beneath the arch bridge carry in the order of 110,000 vehicles per day and it was essential that there should be no interruptions to this flow. To avoid interference to this traffic, all six lanes remained open during the day and the road was only partially closed during the night when traffic was considerably lighter.

Extensive protective scaffolding wae erected beneath the bridge during the dismantling of the superstructure and ths removal of the rivets in the field splices of the arch ribs.

Following dismantling of the superstructure and the replacement of the rivets in the field splices of the arch ribs by a small number of high tensile bolts, the protective scaffolding was removed and two supports erected under the arch ribs at the third points. (Figure 13). With the aid of these supports, the arch ribs were removed during five consecutive nights with six lifts of 20 tons each and four of 45 tons each.

The superstructure on one of the viaducts was lowered over six 44-feet spans by amounts varying up to 6 feet 10 inches.

The superstructure was first supported by a system of deck hangers, spreader beams, jacking hangers, cross-head beams and supporting columns. The supporting columns were placed through holes cut in the deck and were founded upon the existing piers at a level below that to which the superstructure was to be lowered.



Following demolition of the piers to the required level, the superstructure was lowered by means of a synchronized hydraulic jacking system, placed between the upper and lower cross-head beams.

Overbridges

Concrete Box Girder Overbridges Concrete box girder overbridges were constructed at High Street and Miller Street. They are continuous reinforced concrete box girder structures with spans of varying length, the longest span on the High Street Overbridge being 106 feet and the two main spans on the Miller Street Overbridge are each 95 feet long. The High Street Overbridge is "Y" shaped with a horizontal curve of 175 feet radius extending over three spans.

The box girders are supported by headstocks hidden within the girders and are integral with the tops of the pier columns. The piers are founded on spread footings on rock and are hinged between the footings and the columns.

Approach slabs were constructed at all abutments to provide a satisfactory transition from road slab to bridge structure and, in the case of the Miller Street Overbridge, to reduce the maximum bending moment in the centre of the spans.

The High Street Overbridge is 346 feet long and the width including one footpath and barrier rails varies from 38 feet to 62 feet.

The Miller Street Overbridge is 251 feet long and 94 feet wide. It provides for three lanes of traffic in each direction and there are two 12-feet wide footways.

Steel and Concrete Overbridges Welded steel girder bridges with reinforced concrete decks and reinforced concrete piers and abutments were constructed at Mount Street, Falcon Street and Ernest Street.

The Mount Street Overbridge consists of two separate structures, each continuous over two spans, 128 feet and 141 feet long respectively and providing four traffic lanes in one direction. To allow for smooth traffic movement the width between kerbs varies between 50 feet and 150 feet. The variation in width between kerbs occurs only on the south side of the bridges and the resulting complex layout of girders, which was aesthetically undesirable, is hidden by steel fascia plates. (Figure 14).

The Falcon Street Overbridge consists of two separate structures, one being simply supported and 96 feet long and the other continuous over three spans

and 273 feet long. It provides for three lanes of traffic in each direction.

The Ernest Street Overbridge is made up of three single span, simply supported structures, the longest span being 125 feet. It carries three lanes of traffic in each direction.

Because of the presence of soft rock and clay seams where some of the abutments are located, apron type abutments have been adopted where necessary. This type of abutment protects the underlying rock from weathering and reduces the load on the main abutment wall by transmitting some of it through the apron wall to the lower footing which is founded on sound rock. (Figure 15).

Pedestrian Overbridge A pedestrian overbridge was constructed at Ridge Street approximately half-way between the Mount Street and Falcon Street Overbridges. This structure is of four spans with a total length of 326 and it is 8 feet wide. It is constructed with prestressed post-tensioned reinforced concrete girders with a concrete deck located midway between the top and bottom flanges of the girders and a steel grille type handrail on the top of the top flange.

Retaining Walls More than 2½ miles of various types of retaining walls were constructed throughout the length of the expressway. These comprised squared uncoursed rubble walls, mass concrete and reinforced concrete cantilever and counterfort walls varying in height from a few feet to 36 feet. The exposed stonework in the rubble walls was scabbled to provide a broadly plane surface and uniform texture. Tapered vertical rustications 2 inches wide and ¾ inch deep were provided at 2-feet centres on the exposed faces of all concrete walls.

Testing A small laboratory was established at the Milson's Point Works Office to control the quality of all work undertaken and materials used. It carried a staff of three testing operators.

Tests carried out in this laboratory included:

- ☐ Field density and moisture control of earthworks and pavement materials in-situ.
- ☐ Lower liquid limits and lower plastic limits of sub-grade, sub-base and base course material.
- ☐ Mechanical analysis of sub-base and base course materials, concrete aggregates and subsoil drain filter material.
- ☐ Identification of unsuitable or unstable material below fill areas.

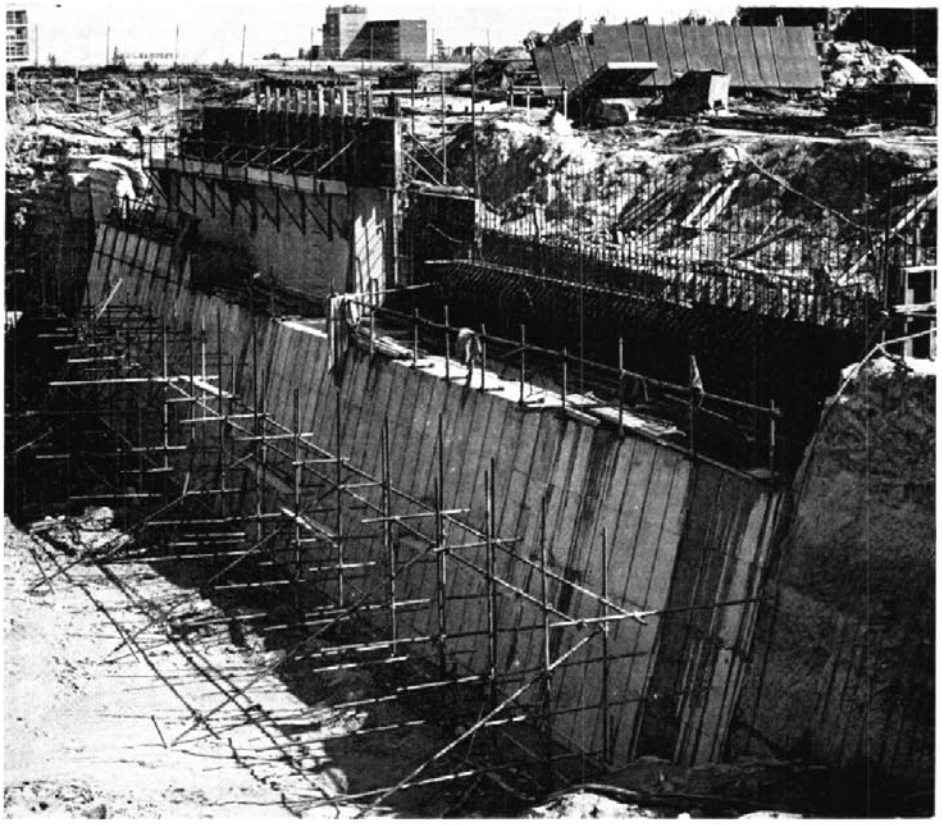


Figure 15 *Apron wall abutments*

Opposite: Figure 14 *Fascia plates on Mount Street Overbridge*

Other testing such as concrete strengths, neoprene bearings, reinforcing steel and gradings of asphaltic concrete etc., were carried out in the Department's Central Testing Laboratory.

Landscaping From early in the design stages special consideration has been given to the final appearance of the expressway. To this end Professor P. Spooner, of the University of New South Wales, was retained by the Department as consultant to advise on and prepare a scheme for landscape treatment. This scheme provides for the shaping of the construction areas to blend with the adjacent land contours and the planting of lawns, shrubs and trees in appropriate areas within the expressway boundaries.

Special attention was also given to the method of excavation of the rock cuttings so that the batters or side walls would present a pleasing appearance.

When landscaping is complete there will be about 112,500 square yards of Kikuyu lawns, 61,500 assorted shrubs and ground cover plants and 360 trees of various species in the 1½ miles of expressway.

Narrow medians have been covered with either 4 inches of portland cement concrete or coloured pea gravel "no-fines" concrete. The latter provides a distinctive non-reflective surface.

To irrigate the large expanse of lawns and ground cover areas, some 10,500 lineal feet of 4-inch and 6-inch diameter irrigation mains are being provided. A special underground reservoir of 22,000 gallon capacity, and pump-house is provided for water storage and reticulation.

Developmental Roads and Works - A Review of Achievements

Assistance rendered by the Department of Main Roads in the provision of Developmental Roads and Works is accelerating the advancement of rural areas which would otherwise remain undeveloped or underdeveloped for a considerable time, with consequent advantages and rewards to the man on the land, the local authority and the State in general.

Under the Main Roads Act the Department of Main Roads is empowered to recommend the proclamation of Developmental Roads and Works and to assist local government authorities by grants to provide for their construction. An article published in the March, 1956 number of this Journal related the policy pertaining to Developmental Roads and Works.

The provisions of the Act are intended to enable the State Government to assist the growth of rural production and settlement, and may be regarded as recognition that in undeveloped or underdeveloped areas, the cost of providing the necessary access and farm-to-market roads may be beyond the financial resources of local government authorities.

From the inception of the Main Roads Act in 1925, to 30th June, 1967, some 5,323 miles of road have been proclaimed as Developmental. Of these 796 miles have been subsequently reclassified as Main or Tourist Roads and a further 1,790 miles have been deproclaimed following completion so that Councils can use funds from other sources to to carry out improvements such as bitumen surfacing. In the same period, 209 individual works, generally bridges or short lengths of road, have been proclaimed as Developmental Works.

Expenditure by the Department of Main Roads on Developmental Roads and Works in the 10 years to 30th June, 1967 was $11,977,174.

In the 10 years from July, 1958 to June, 1967, work was carried out on 186 Developmental Roads in 97 country shires and on 121 Developmental Works in 61 shires. In all, 113 out of the total 129 country shires received grants from Developmental Funds over the period. Of the shires which did not receive grants, most are in well established areas of the State while the others are in the dry western areas of extensive grazing where the benefits of such road developments would be very slight since they would bring about only minimal increases in productivity. Prior to the mid 1950's these western shires did not exist and the Department of Main Roads was responsible for all roads in this unincorporated portion of the State.

When a road has been proclaimed as Developmental, the Council prepares plans and specifications for the new construction works needed and subject to funds being available the Department makes grants to the extent that it is able to do so until the work is completed. The Department usually meets the full cost of construction of Developmental Roads, but the council accepts full responsibility for its maintenance after construction.

Developmental Road construction is invariably limited to a gravel pavement, 12 to 22 feet wide, with formed shoulders. The pavement width for any particular road depends upon such factors as topography, the expected traffic flow and the desired speed rating of the road.

There are two main categories of Developmental Roads:

- Access roads required to open up undeveloped or underdeveloped land.
- Farm-to-market roads which may pass through poor country, but which are required as arterial routes connecting producing areas and their market town, railhead or port.

The overlap between these two categories is quite considerable, since any Developmental Road of an arterial nature will also open up areas through which it passes, where development is lagging.

The arterial character of a Developmental Road proposal can be a factor in justifying its proclamation on the basis that it may in the future become part of the Main Roads System. Such roads often pass through difficult and, at times, almost uninhabited regions where the Shires concerned could not justify the very considerable expenditure required to build the road.

These arterial-type Developmental Roads are mainly planned to provide improved and more rapid inter-district communication to facilitate the movement of goods and services from market areas to the farming communities. These roads are not concerned so much with providing access to individual farms but at providing access to one or more of a series of towns or communities.

Roads such as these may be considered as a long term investment in the overall development of the State. They may slow down the rate of rural depopulation by improving living conditions and standards in country areas.

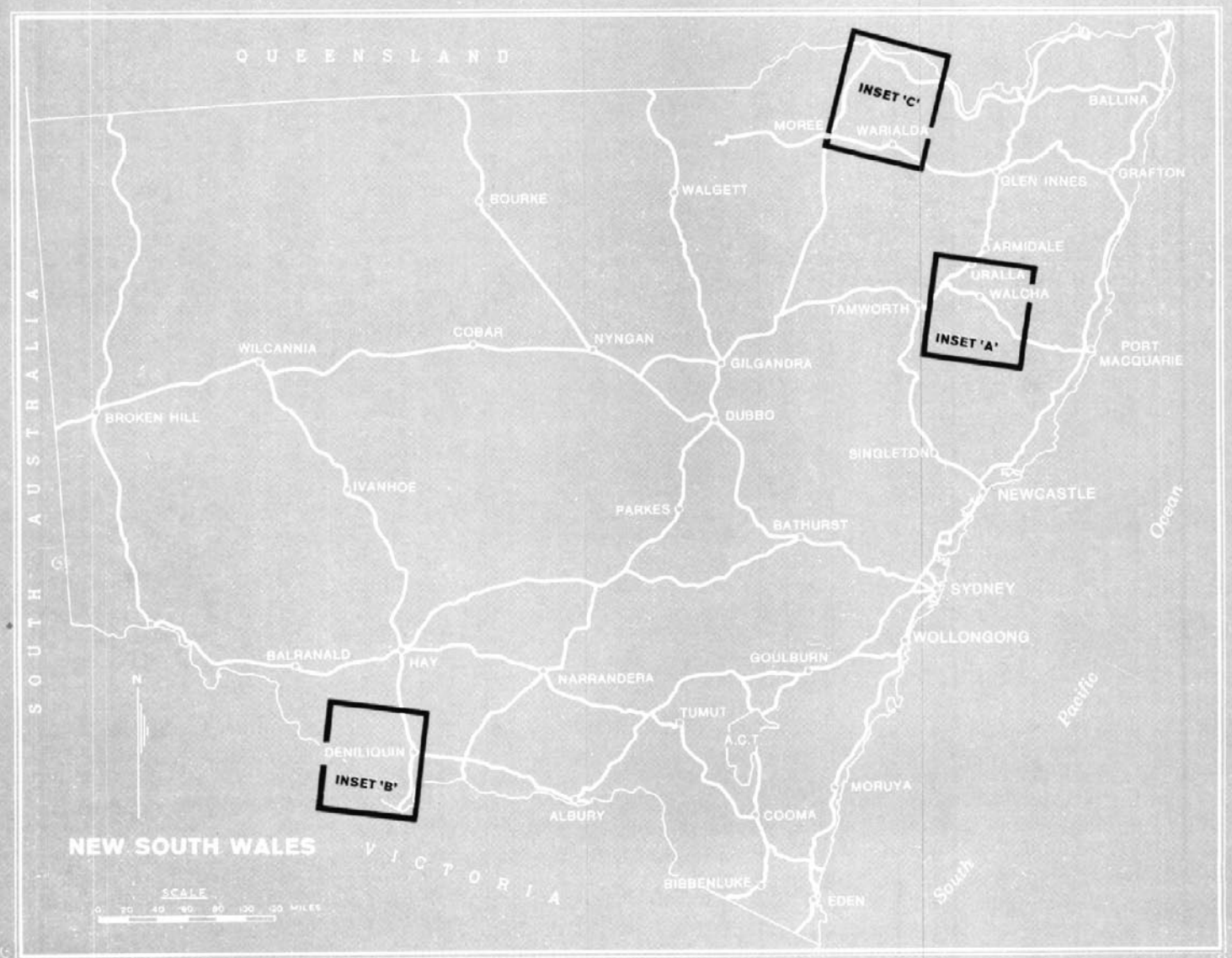
The benefits derived from this type of Developmental Road cannot be measured solely on a local basis, however, as these benefits will accrue both to the State and to the nation, as a whole and may not be fully realized for many years, it is therefore fitting that the cost of development should be met from State and Federal sources by way of Developmental Road funds.

The provision of local access roads in undeveloped and underdeveloped areas is often beyond the financial resources of the local Shire Council because of the demand for expenditure of most of the Shire's revenue in the already developed parts of the Shire, that is, in the area from which most of the revenue is derived by means of rates.

Shire rates are based on the Unimproved Capital Value of the land which is an indication of the general degree of development and desirability of an area. The greater the degree of development the higher the Unimproved Capital Value. These shires which have more than a small area of poorly developed land are not in a position to raise sufficient revenue to improve the access to these areas because the low Unimproved Capital Value of this land does not produce a high rate return to the shire council.

Not all undeveloped or underdeveloped regions are suitable for the expenditure of funds on Developmental Roads because they lack the potential for a greater degree of development. Only those with the potential for a significantly higher level of production can be considered for these purposes. Among areas which warrant Developmental Roads are those for example which will respond to the use of fertilizer but where this commodity cannot be brought in economically because of poor roading facilities. This includes areas where freight costs are abnormally high because only small trucks can negotiate the existing roads.

A further justification for Developmental Road construction is the severe and/or prolonged flooding of existing road facilities. Such conditions retard development by depriving farmers of an assured access to markets and sources of supply. This situation tends to impose on an area a form of land use, such as wool production, which does not require marketing at a specific time, bringing about a form of extensive land use which



in all probability is not the one most suited to the potential of the area. Thus the value of the land is restrained from rising to its true level.

Poor access also acts as a deterrent to further and closer settlement because it deprives the landowner of full use of the social and educational facilities available in the local communities. For example it may at times cause extensive interruption to his children's education. Conditions such as these seriously reduce the desirability of land in the affected areas and this in turn serves to maintain the existing low Unimproved Capital Value of the land.

Construction of better standard roads or the provision of stream crossings by means of Developmental Roads or Works produces a cumulative effect by improving the desirability of the land for prospective buyers and permitting more efficient use of the land. These changes have the effect of raising the Unimproved Capital Value of the properties served and this in turn increases councils' rate revenue from these properties so enabling Council to adequately maintain these new or improved roads. This whole process may even have a continuing effect resulting in the eventual bitumen sealing of the road.

In order to illustrate some of the results and benefits that have accrued from the construction of Developmental Roads three case studies are presented here. These studies have been drawn from different parts of New South Wales and involve regions of such diverse land uses as the grazing of beef cattle and sheep on mainly natural pastures, dry wheat farming with some grazing of sheep and cattle, and rice growing and mixed farming under irrigation. Each study describes the state of development of the area prior to the proclamation of the Developmental Road and then shows the effects of the improved road on the development of the area it serves.

CASE STUDY No. 1

Developmental Road No. 1227 from Terrible Billy through Hellhole to Nowendoc (Road AB in Inset "A") within the Shire of Walcha, was proclaimed on 20th March, 1953. The road is 22.35 miles long and is situated on the southern extremity of the New England Tableland approximately 200 miles north of Sydney and varies in altitude from 4,300 feet at the western end to 3,000 feet at the eastern end.

At the time of proclamation only short sections of the road had been formed while, of the remainder, part was an unformed track and the rest was not accessible to vehicular traffic. By early 1968 construction was nearing completion and the entire route was traffickable. A total of $146,551 had been expended by the Department of Main Roads on the construction of Developmental Road No. 1227 and it was estimated that a further $47,000, which had already been granted to Walcha Shire, would be sufficient to complete the road.

Properties in the area served by this road are mainly used for the grazing of beef cattle and sheep with small areas of a number of the properties being used for potato growing. Timber getting is also carried on and could be of increasing importance with the possible future development of softwood plantations in the area.

During the period between 1955 and 1965 the average size of farms in the area served by the road decreased by 22 per cent to a little over 2,100 acres compared with a decrease of only 2 per cent for the whole of Walcha Shire. The scope for further significant reductions in farmsize does, however, seem to be limited.

Possibly the most important consequence of the improved access is that superphosphate can now be brought into the area economically. Between 1960 and 1967 the quantity of superphosphate used annually on these properties rose from a negligible amount to 617 tons. The application of superphosphate to soils in the area by both aerial and surface top-dressing has led to the cultivation of improved pastures thus providing adequate winter feed in a region where winter pasture growth is minimal because of low temperature.

Cattle numbers increased from 3,300 in 1955 to 7,300 in 1965. Accompanying this increase was a marked change in farm management policy from the production of store cattle to the production of prime lightweight steers. The benefits to be derived from this change can be judged from the fact that in 1966 the average price of store cattle was $80 per head while the price of fat cattle was $120 per head. A further change in farm management was the breeding of replacement stock on the properties instead of buying calves bred in nearby regions. This latter change has been made possible largely because of the availability of adequate winter feed and improved pastures.

Sheep numbers have increased from 14,500 in 1955 to 39,000 in 1965. This increase has been mainly the result of the same factors evident above in relation to cattle numbers, however, there has not been the same impetus here because of a number of economic factors which have tended to depress the sheep and wool industry throughout Australia. In addition annual average rainfalls of from 35 inches to 45 inches tend to produce conditions unsuitable for sheep.

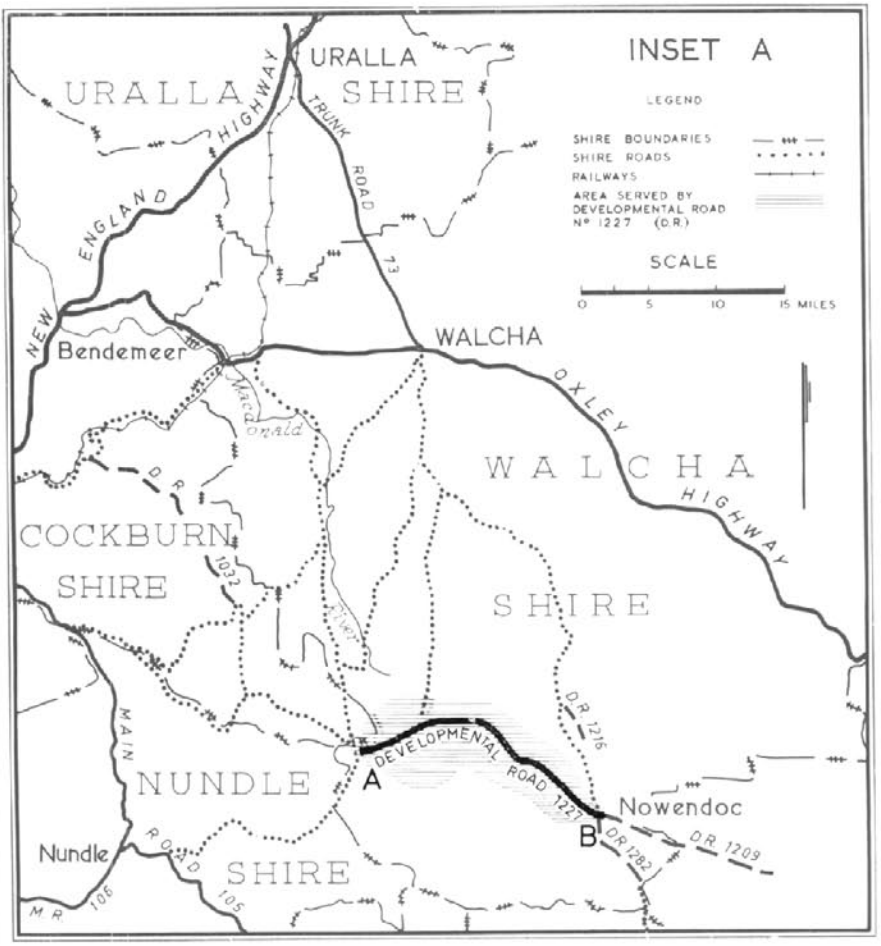
Developmental Road No. 1227 is only one of a number of roads being constructed on the southern margin of the New England Tableland with the eventual aim of providing new arterial routes from the tableland to the coast thus providing new market outlets, especially for fat cattle. These new arterial routes are also expected to lead to the realization of the potential of the region as an area suited to the production of softwood timber. Accordingly, while a single Developmental Road is not likely to have a marked effect on the timber industry, it will have a place in the long term development of the industry.

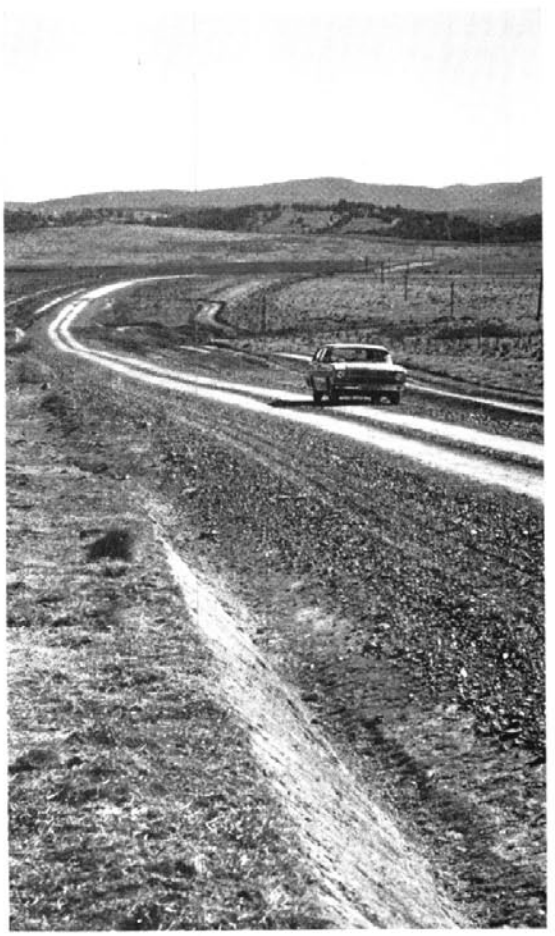
The easier access to markets provided by the construction of Developmental Road No. 1227 has led to a significant increase in potato growing. Only two farmers in the area grew potatoes in 1956, but by 1966 the number had risen to 15. Conditions for growing potatoes in this area are ideal but they must compete with improved pastures for any vacant land, thus an expansion can only be expected on those farms with no alternative form of cash income.

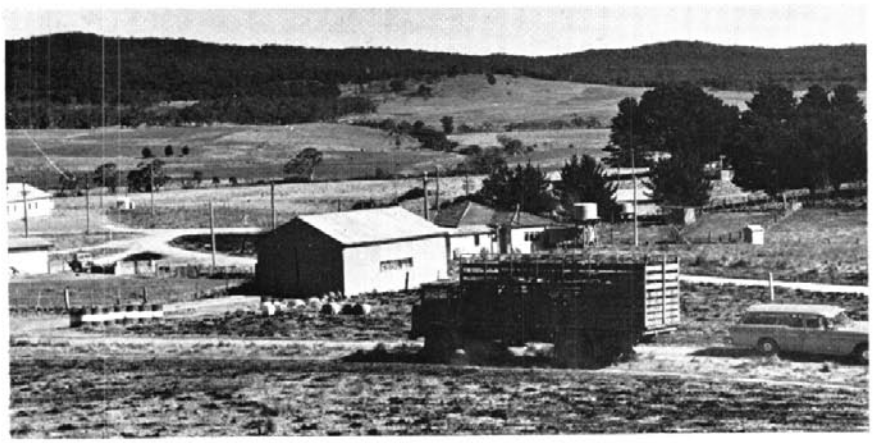
Between 1956 and 1966 the total unimproved capital value of the land in the immediate vicinity of the road has increased by 44 per cent. This compares with an increase of 95 per cent for the whole of Walcha Shire. But, both of these figures are subject to so many external economic factors that it is not possible to isolate the impact of the road on land values.

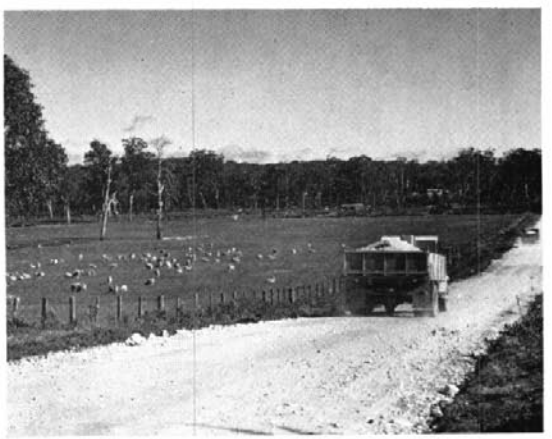
Briefly it can be stated that the construction of Developmental Road No. 1227 has resulted in a marked increase in the acreage of improved pasture, an increase in stock numbers, especially cattle and a change in farm management policy with the replacing of store cattle with fat cattle. The underlying reason for these changes has been that, with improved road conditions, it is now possible to transport superphosphate into the area. This road is a link in a new arterial road system being developed between the Tableland and the coast, which will provide new market outlets for inland produce.

Developmental Road No. 1227 provides assured access between areas of highland pastures, which are gradually being extended and local service centres









CASE STUDY No. 2

Developmental Road No. 1236, known as the Rangemore Road, was proclaimed on 18th March, 1955, as a 22-mile section of the road from Rangemore to Deniliquin within the Shires of Murray and Wakool in the Central Murray region of south-western New South Wales (Road CD in Inset "B"). The Road traverses a flat riverine plain at an altitude of approximately 300 feet. At the time of proclamation the road was in a poor condition, part of it being merely an unformed track. It was often closed following rainfalls of less than half an inch and also by water backing up along the numerous creeks in the area during periods of high river levels. Since construction, that portion of the road in the Shire of Murray was deproclaimed on 23rd June, 1967 to enable Council to carry out further improvements. The total cost of construction of the road was $43,913.

Approximately 119,000 acres of farmland are served by Developmental Road No. 1236. This land is used for sheep grazing for wool and meat on irrigated improved pastures, irrigated rice growing, grazing of beef and dairy cattle, and wheat growing. Of the area served by the road, approximately 80,000 acres are within the Wakool Irrigation District. Some irrigation is carried out in the remaining area on a purely private basis.

In the period from 1951–52 to 1965–66 rice acreage rose to 1,500 acres representing an increase of about 15 per cent. This minimal increase is the result of Government control over rice acreage, dictated by the availability of water, rather than any disinclination of the part of farmers to grow more rice. The areal distribution of rice growing varies from year to year because it is grown on a 7-year rotation with improved pastures, and thus any area designated as rice growing area may be under pasture six years out of seven.

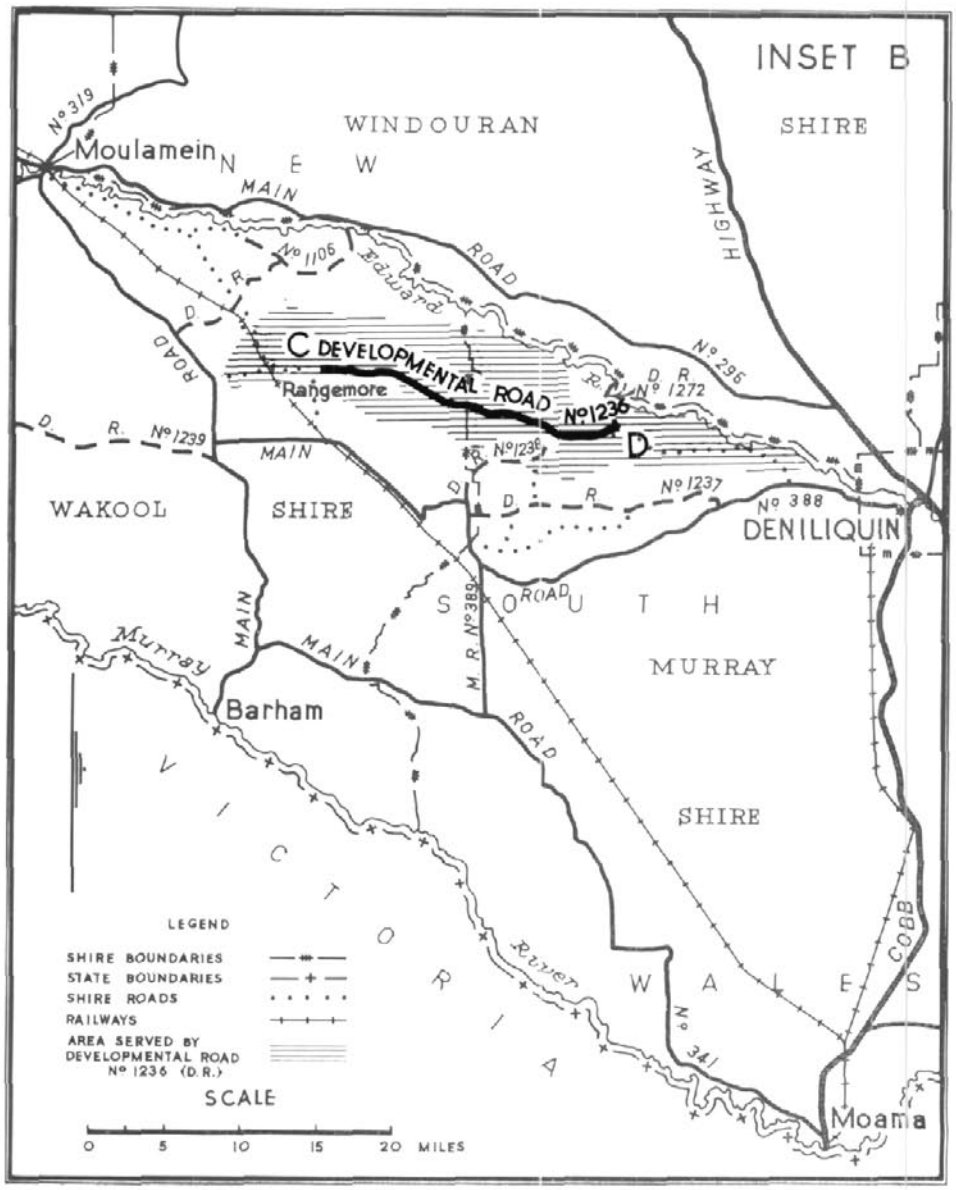
More obvious has been the increase in area under fodder and other cereal crops, notably wheat. The total area under these crops has risen by 430 per cent to 4,000 acres between 1951–52 and 1965–66 and the bulk of this increase has resulted from the expansion of wheat growing.

Although stocking rates for sheep were reasonably high in 1951–52, sheep numbers, on farms served by the road, had risen by 64 per cent to 74,000 by 1965–66. A large proportion of these sheep are fattened and trucked to Deniliquin for sale. In the same period cattle numbers rose by 234 per cent to 3,340.

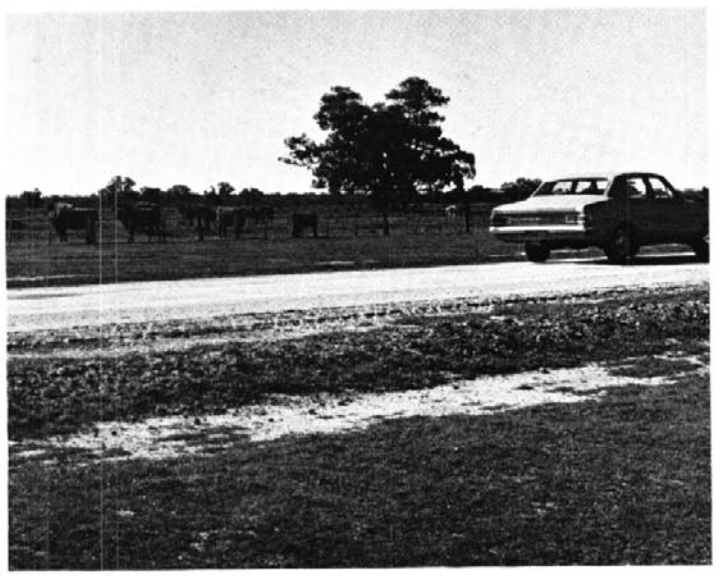
The area of land under improved pasture had increased to about 10,000 acres by 1965–66, an increase of 43 per cent during the preceding 14 years. Most of the increase has occurred in the west where water from the Wakool Irrigation District is available. However, numerous areas in the eastern section of the area have been developed for pasture with private irrigation schemes.

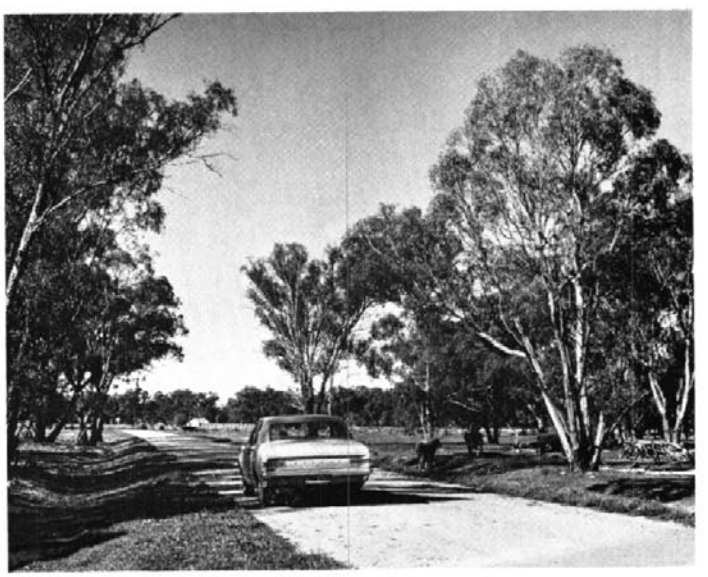
Coinciding with the actual construction of Developmental Road No. 1236 between 1959 and 1962 there was a marked rise in the Unimproved Capital Value of a sample of properties in the area served by the road. The values of these properties rose by an average of 89 per cent while the values of a sample of properties in the same region, but not served by this particular road, increased by 79 per cent. The difference between these increases would seem to indicate a definite gain by these properties as a result of improved access conditions.

A number of changes can therefore be attributed to the construction of Developmental Road No. 1236. Among these are the increased areas sown to wheat and improved pastures, the latter being accompanied by an increase in stock numbers. The greater rise in Unimproved Capital Values in this area, compared with surrounding areas, may be attributed to the greater attractiveness of these properties because of the better access provided by the road.



Provision of access roads such as Developmental Road No. 1236 has aided full utilization of irrigation schemes and associated dryland farming in the Western Riverina



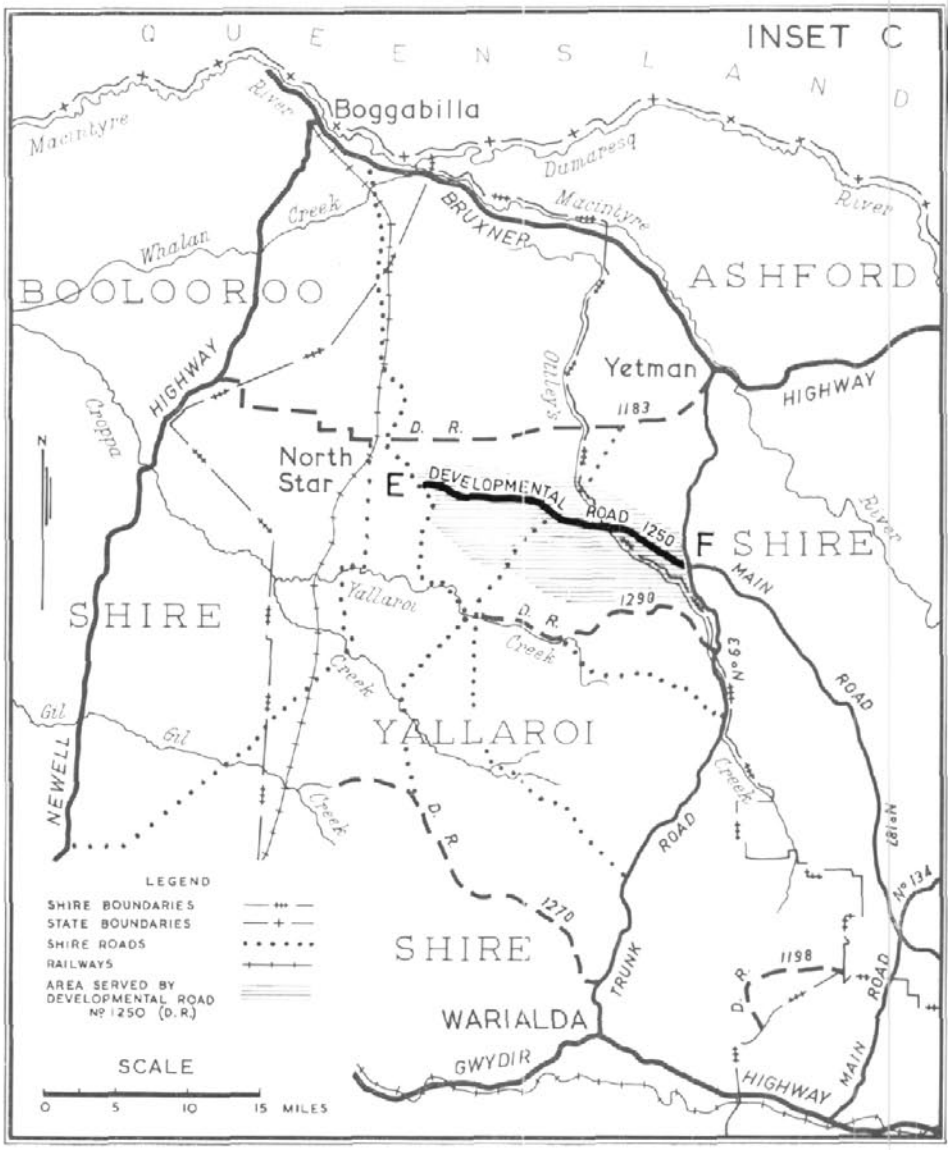


Developmental Road No. 1250, the Rocky Dam-Booraba Road, was proclaimed on 20th September, 1957. It is a 20.3 miles length of road within the Shires of Ashford and Yallaroi in the Northwestern Slopes region of New South Wales (Road EF in Inset C). Prior to proclamation only 2½ miles of the road had been formed and gravelled, the remainder was generally unformed and mainly over black and chocolate clayey soils which could become impassable after only a quarter of an inch of rain. When the road was proclaimed in 1957, wheat farming and cattle raising had been developed as important adjuncts to woolgrowing but further expansion appeared to be limited to a large extent by the lack of reliable access to rail and storage facilities. Construction of the six miles of road in Ashford Shire was completed in 1960 and the section in Yallaroi was completed in 1966. The total cost of constructing the road was $119,372, which was met by the Department of Main Roads.

This road serves an area of about 68,000 acres which in 1955 was divided into 17 properties but as a result of subdivision this number had increased to 23 by 1967 with the majority in the 1,000–5,000 acre range

As expected at the time of proclamation, there has been a considerable expansion in the wheat acreage in this area. In 1955, 180,000 bushels were harvested from 6,200 acres while in 1967, production was expected to be 430,000 bushels from 13,600 acres. This expanded production is due largely to the fact that the soils and the rainfall regime of the area are suited to the growing of premium grade wheat. Yields in good years average about 30 bushels per acre giving a profit of $60 an acre as against $24 to $28 per acre for the same land when used for wool growing. As an example of the expansion of wheat growing in this area one of the properties served by Developmental Road No. 1250 grew 600 acres of wheat in 1966, 1300 acres in 1967, and it is expected that an additional 500 acres will be sown in 1968. There is little evidence of an increase in other crops, although there is some irrigation for lucerne and oats and some sorghum is grown to rest wheat fields and to remove black oats.

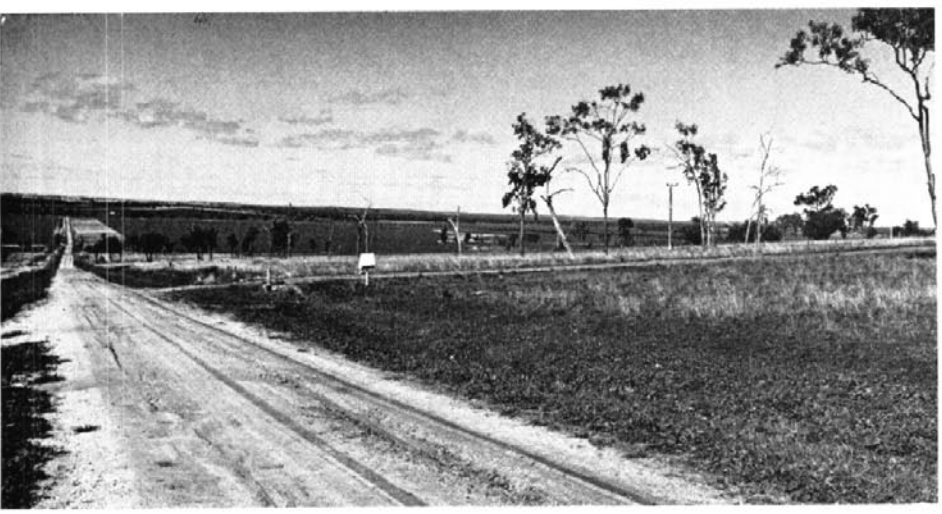
Stock numbers in the area along the road have shown a very marked decrease since 1955. At that time there were 53,898 sheep and 2,783 cattle but by 1966 the number of sheep had fallen by



48 per cent to 27,934 and the number of cattle by 62 per cent to 1,049. These decreases differ considerably from the trend for the whole of the Shires of Ashford and Yallaroi where sheep numbers have decreased by 6 per cent but cattle numbers have increased by 0.5 per cent in the same period.

For the 20 properties in Yallaroi Shire there has been an average rise in Unimproved Capital Value of 45 per cent from $4.8 to $7.2 per acre between 1960 and 1967. (Values for the three properties in Ashford Shire could not be obtained). Land suitable for wheat growing now sells for $20 per acre cleared as against $6 to $8 per acre where used for stock.

The improved access to storage and transport facilities provided by Developmental Road No. 1250 and the suitability of the soils and climate have resulted in the very rapid expansion of wheat



Reliable access to storage facilities provided by roads such as Developmental Road No. 1250 has been an important factor in the significant expansion of wheat acreages on the North West Slopes

growing on the properties served by the road. As a consequence of the increasing area being devoted to wheat there has been a marked decrease in sheep and cattle numbers. Increased land values are a further indication of the considerable development which has occurred.

A number of points emerge from these case studies of areas in which Developmental Roads have been constructed. Firstly, there has been a definite trend toward more intensive land use. This has been brought about by such factors as the easier availability of fertilizer, by adjustments to farm management, and by more reliable access to markets. Secondly, land values have shown marked rises. The higher value of land may be attributed partly to the more intensive land use made possible by better roads and partly to such economic factors as the general decrease in the value of the dollar. Thirdly, all three case studies have shown trends, of varying intensity, toward changes in land use. These trends have been, to a large extent, the result of a fall in the return from wool and mutton production but, they have been given impetus by the better and more reliable access to markets that has been provided by the construction of Developmental Roads.

Because of the policies followed by the Department of Main Roads in determining the need for Developmental Roads it may be assumed that similar results are in evidence in all areas where these roads have been constructed or are in the process of construction.

The justification for the expenditure of Departmental funds on Developmental Roads is in the undoubted financial benefit which they produce. Financial and other benefits accrue at three levels:

The Farmer gains from the assured efficient transport for his goods to market, perhaps generally lower transport costs thereby having an opportunity to change to more lucrative crops by virtue of this transport assurance, and finally he is able to give his family the benefit of transport to towns and schools making life in the area more worthwhile and enjoyable.

The Local Government authority gains from the increased rate revenue derived from higher Unimproved Capital Values of the land served by the road. Indeed some financial benefit is desirable as Council will have a new liability to maintain adequately the new road or bridge at Council's full cost.

The State gains by increased agricultural productivity and by more intensive, efficient and up-to-date methods brought about by improved and guaranteed transport opportunity.

MAIN ROADS FUND

Receipts and Payments for the period from 1st July, 1967 to 30th June, 1968

Receipts	County of Cumberland Main Roads Fund $	Countr Main Roads Fun $
Motor Vehicle Taxation (State)	6,534,537	26,138,15
Charges on Heavy Commercial Goods Vehicles under Road Maintenance (Contribution) Act, 1958 (State)	2,513,109	10,052,43
Commonwealth Aid Roads Act, 1964	5,279,159	20,561,63
Road Transport and Traffic Fund	..	10,10
From Councils under Section 11 of Main Roads Act and/or for Cost of Work	8,433,007	192,92
Other	682,811	664,18
Total Receipts	**$23,442,623**	**$57,619,43**
Payments		
Maintenance and Minor Improvements of Roads and Bridges	4,089,692	14,091,30
Construction and Reconstruction of Roads and Bridges	8,422,276	34,064,78
Land Acquisitions	4,488,531	651,93
Administrative Expenses	1,482,266	3,359,78
Loan Charges, Payment of Interest, Exchange, Management and Flotation Expenses—State Loans	122,390	845,71
Interest and Provision for Repayment of Loan Borrowings under Section 42A of the Main Roads Act	375,283	37
Miscellaneous*	4,103,578	4,632,84
Total Payments	**$23,084,016**	**$57,646,75**

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

SYDNEY HARBOUR BRIDGE ACCOUNT

Receipts and Payments for the period 1st July, 1967 to 30th June, 1968

Receipts	$
Road Tolls	3,987,07
Contributions—Railway Passengers	287,54
Omnibus Passengers	28,22
Rent from Properties	131,80
Miscellaneous	7
Loan Borrowings for the Warringah Expressway Approach	3,600,00
Total Receipts	**$8,034,72**
Payments	
Cost of Collecting Road Tolls	530,51
Maintenance and Minor Improvement	573,38
Alteration to Archways	4,53
Provision of Traffic Facilities	136,05
Administrative Expenses	71,12
Loan Charges, Payment of Interest Exchange, Management and Flotation Expenses—State Loans	1,195,43
Interest and Provision for Repayment Loan Borrowings under Section 7 of Sydney Harbour Bridge Administration Act	763,12
Miscellaneous	4,40
Transfers to Expressway Fund	4,775,00
Total Payments	**$8,063,57**

TENDERS ACCEPTED BY COUNCILS

The following tenders (in excess of $10,000) for Road and Bridge Works were accepted by the respective Councils for the three months ended 30th June, 1968.

Council	Road No.	Work or Service	Name of Successful Tenderer	Amount
				$
Abercrombie	T.R. 54	Construction of a 3 cell 12 feet by 12 feet reinforced concrete box culvert and approaches at Caloola Creek 22.50 miles south of Bathurst.	Central Constructions Pty Ltd.	16,188.00
Boomi	M.R. 367	Winning, loading and hauling gravel between 54.95 miles and 60.70 miles from Moree.	J. A. Draper	11,702.40
Cessnock	M.R. 181	Construction of a 5-span reinforced concrete bridge 150 feet long over Wollombi Brook 19.00 miles from Cessnock.	Moy Bros	45,709.00
Cessnock	M.R. 588	Supply and laying of asphaltic concrete between 2.65 miles and 4.65 miles east of Buchanan.	Boral Road Services Pty Ltd.	25,884.00
Coolah	D.R. 1304	Bitumen surfacing between 0.00 miles and 10.00 miles from Trunk Road No. 55.	Shorncliffe Pty Ltd	11,850.38
Coolah	M.R. 206	Construction of a 5-span reinforced concrete bridge and approaches 150 feet long over Limestone Creek 2.50 miles from Dunedoo.	G. P. and D. E. Morassi	39,199.27
Coonamble	M.R. 383	Bitumen surfacing between 0.00 miles and 8.00 miles north of Coonamble.	Boral Road Services Pty Ltd.	15,295.96
Denman	M.R. 209	Construction of a 3-span prestressed concrete beam bridge 90 feet long over Sandy Creek, 15.50 miles west of Muswellbrook.	L. G. Rixon	33,019.00
Denman	S.H. 9	Supply and loading of up to 25,000 cubic yards of pavement gravels for reconstruction 22.50 miles to 24.20 miles north of Singleton.	J. H. De La Mare	21,250.00
Guyra	M.R. 135	Bitumen sealing and re-sealing works at various locations west of Guyra.	Emoleum Ltd	14,810.83
Lockhart	T.R. 59	Priming and sealing of pavement between 51.00 miles and 55.53 miles west of Wagga Wagga.	Emoleum (Aust.) Ltd	15,812.61
Lockhart	T.R. 59	Loading and hauling of 21,200 cubic yards of road gravel to between 51.00 miles and 55.53 miles west of Wagga Wagga.	A. J. and L. M. Hughes	14,825.50
Namoi	M.R. 127	Winning, placing and compaction of 25,662 cubic yards of earthworks between 19.00 miles and 21.30 miles west of Narrabri.	Gemmell and Hickey	18,989.88
Tamarang	Various	Supply and spraying of bitumen at various locations	Boral Road Services Pty Ltd.	13,053.05
Tamarang	Various	Supply and delivery of aggregate at various locations	A. Sherman	10,431.00
Warren	M.R. 333 and M.R. 202.	Bitumen surfacing between 73.00 miles and 80.00 miles north of Warren on Main Road No. 333 and between 5.90 miles and 8.03 miles north of Warren on Main Road No. 202.	Shorncliffe Pty Ltd	15,558.39

TENDERS ACCEPTED BY THE DEPARTMENT OF MAIN ROADS

The following tenders (in excess of $10,000) for Road and Bridge Works were accepted by the Department during the three months ended 30th June, 1968.

Road No.	Work or Service	Name of Successful Tenderer	Amount
			$
State Highway No. 2	City of Liverpool. Supply of up to 2,100 tons of asphaltic concrete between Lansdowne Bridge and Warwick Farm.	Bituminous Pavements Pty Ltd	19,446.00
State Highway No. 10	Shire of Hornsby. Supply and spread up to 2,000 tons of asphaltic concrete between Mt Coolah and Mt Ku-ring-gai.	Pioneer Asphalts (N.S.W.) Pty Ltd	22,920.00
State Highway No. 10	Shire of Stroud. Construction of a 3-span pre-stressed concrete bridge 390 feet long over the Myall River at Bulahdelah.	Pearson Bridge Pty Ltd	338,859.00
State Highway No. 10	Supply and delivery of up to 2,000 tons of asphaltic concrete between Kangy Creek and Wyong Creek.	Bituminous Pavements Pty Ltd	19,600.00
State Highway No. 10	Bitumen resealing at various locations between 0.2 miles north of Bellingen/Nambucca Shire boundary and 1.00 miles south of Grafton.	Shorncliffe Pty Ltd	13,552.30
State Highways Nos 10 and 16.	Bitumen resealing at various locations	Boral Road Services Pty Ltd	11,149.00
State Highway No. 16	Shire of Ashford. Construction of a 3-cell 12 feet by 6 feet reinforced concrete box culvert over Little Sandy Creek approximately 1.25 miles east of Bonshaw.	K. A. Constructions Pty Ltd	12,383.07
State Highway No. 17	Shire of Coonabarabran. Supply of 1,800 cubic yards of aggregate to stockpiles at 50.00 miles and 52.00 miles south of Narrabri.	Namoi Gravel and Sand Pty Ltd	12,412.00
State Highway No. 17	Shire of Namoi. Construction of a 12-cell 8 feet by 7 feet reinforced concrete box culvert at Box Flat and a 9-cell 8 feet by 7 feet reinforced concrete box culvert at Tooley Gully.	Enpro Constructions	37,846.30
State Highway No. 17	Shire of Namoi. Construction of a 4-cell 10 feet by 8 feet reinforced concrete box culvert at Mallallee Creek, 39.90 miles south of Narrabri.	B. B. Lynch	30,612.40
State Highway No. 22	Supply and delivery of ½ in aggregate to stockpile sites between 24.00 miles and 29.00 miles north of Wentworth.	A. G. Leech Pty Ltd	20,700.00
State Highway No. 22	Supply and delivery of various precast concrete crowns and pipes to various sites north of Wentworth.	Rocla Concrete Pipes Ltd	14,136.28
State Highway No. 26	Shire of Gosford. Supply, haul, spread and compact up to 1,000 tons of ¾ in asphaltic concrete at Somersby.	Bituminous Pavements Pty Ltd	11,200.00
Trunk Road No. 56	Shire of Waugoola. Construction of a 3-span steel and reinforced concrete bridge 170 feet long over Back Creek, 10.20 miles north of Cowra.	A. Cipolla and Co.	51,125.50
Main Road No. 108	City of Newcastle. Construction of a 23-span pre-stressed concrete bridge 335 feet long over the North Arm of the Hunter River at Newcastle.	Dillingham Constructions Pty Ltd	3,669,293.38
Main Road No. 167	City of Liverpool. Supply of up to 1,400 tons of asphaltic concrete between Milperra Bridge and Stockton Avenue.	Emoleum (Aust.) Ltd	13,188.00
Main Road No. 214	Shire of Merriwa. Construction of a 2-span reinforced concrete and steel bridge 123.75 feet long over Four Mile Creek 2.20 miles west of Cassilis.	K. A. Constructions Pty Ltd	36,445.00
Secondary Road No. 2019.	Municipality of North Sydney. Widening on western side north of High Street.	Roadworks and Buildings Pty Ltd	19,045.25
Secondary Road No. 2043.	Municipality of Ku-ring-gai. Widening between Springdale Road and Koola Avenue.	Tomkin Constructions Pty Ltd	23,729.62
Southern and Wollongong Expressways.	City of Greater Wollongong. Construction of cement concrete integral type kerb and gutter, barrier kerb and mountable kerb at Porter Street—Porter Street Extension bridge approaches.	South Coast Paving and Terazzo Pty Ltd.	15,688.46
Sydney-Newcastle Expressway.	Manufacture, supply, deliver, tension, and erect pre-cast, prestressed girders on the bridge pier and abutments for the bridge to carry traffic over State Highway No. 10 over the expressway ramps, north of the Berowra Interchange.	E.P.M. Concrete Pty Ltd	63,908.00
Warringah Expressway	Municipality of North Sydney. Section 1. Sydney Harbour Bridge to Miller Street. Landscaping.	Ferguson's Landscape Co.	34,072.00