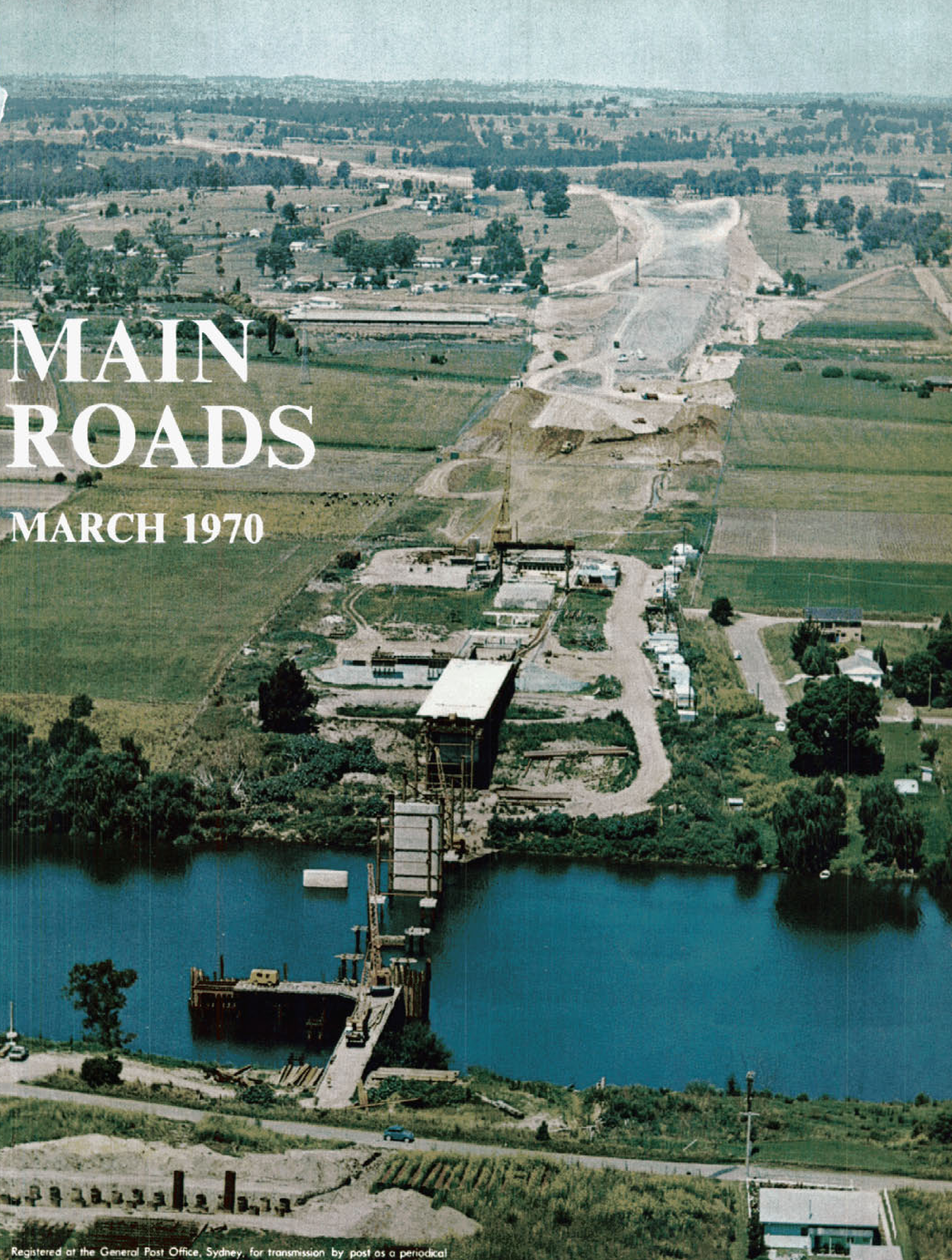

MAIN ROADS

MARCH 1970

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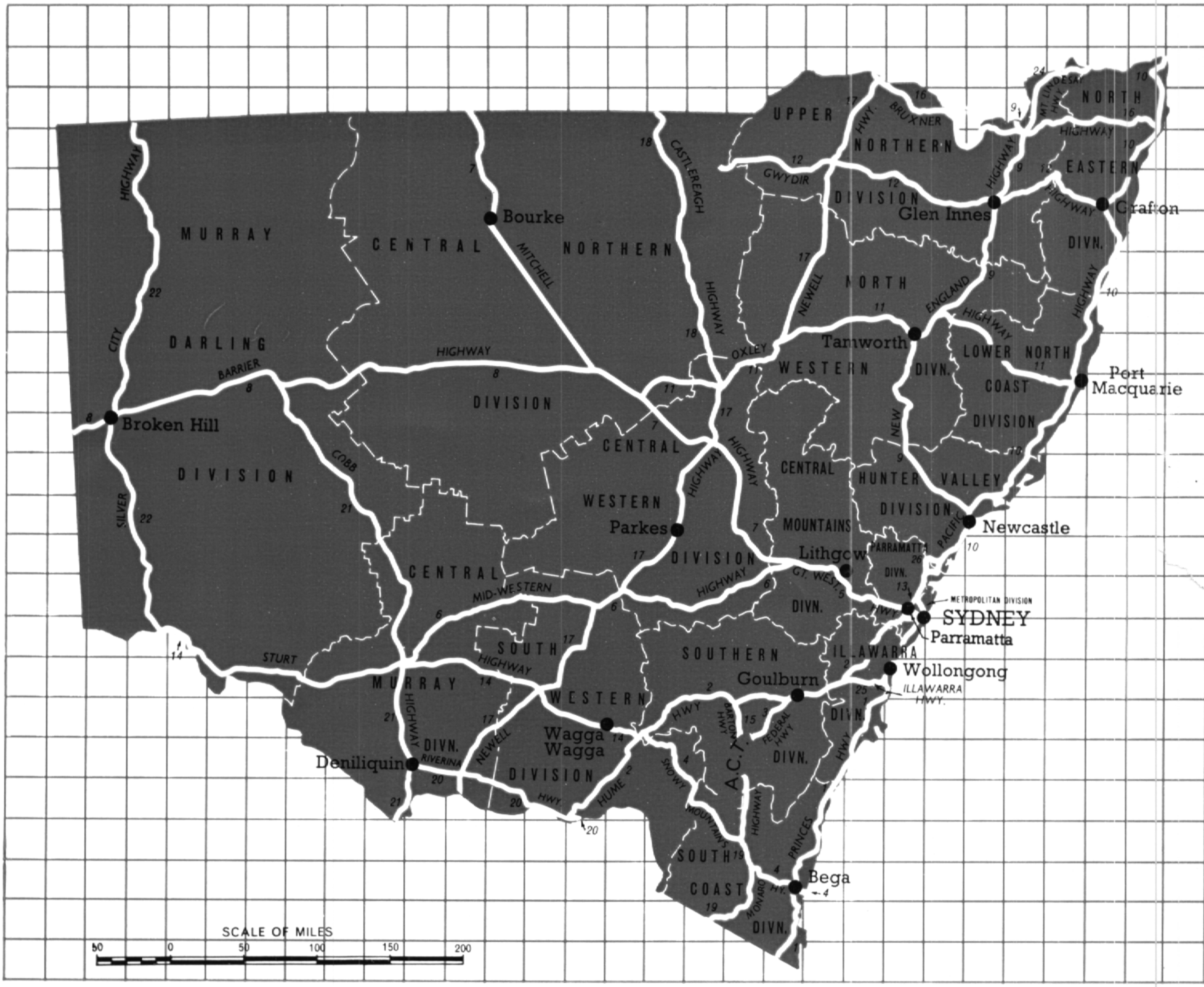

HIGHWAY SYSTEM OF NEW SOUTH WALES

Mileage of Main, Tourist and Developmental Roads, as at 30th June, 1969

Expressways	24
State Highways	6,535
Trunk Roads	4,210
Ordinary Main Roads	11,550
Secondary Roads (County of Cumberland only) ..	164
Tourist Roads	219
Developmental Roads	2,719
	25,421
Unclassified roads, in western part of State, coming within the provisions of the Main Roads Act	1,572
TOTAL	26,993

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 30th June, 1969—4,474,600

Number of vehicles registered in New South Wales at 30th June, 1969—1,847,597

STATE HIGHWAYS
DIVISIONAL BOUNDARIES
DIVISIONAL OFFICES

MAIN ROADS

Journal of the Department of Main Roads, New South Wales

MARCH, 1970

VOLUME 35 NUMBER 3

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Front Cover: Construction of the new bridge over the Nepean River at Regentville and section of the Western Expressway—looking east.

Back Cover: Extensive earthworks in progress during construction of the South Western Expressway from Cross Roads, near Liverpool to the Campbelltown-Camden Road—looking north near Ingleburn.

Keeping the Highways Clean

Driving along the State Highways of New South Wales, while on business or recreation, can be a pleasure. Most highways pass through beautiful and scenic countryside and the average motorist appreciates the natural beauty that surrounds him.

Why then does he so often spoil this by the inconsiderate and indiscriminate scattering of litter? What a trail he thoughtlessly leaves behind—drink cans, bottles, cigarette packets, sweets wrappers, fruit peels; these all go out the car window—for someone else to gather up.

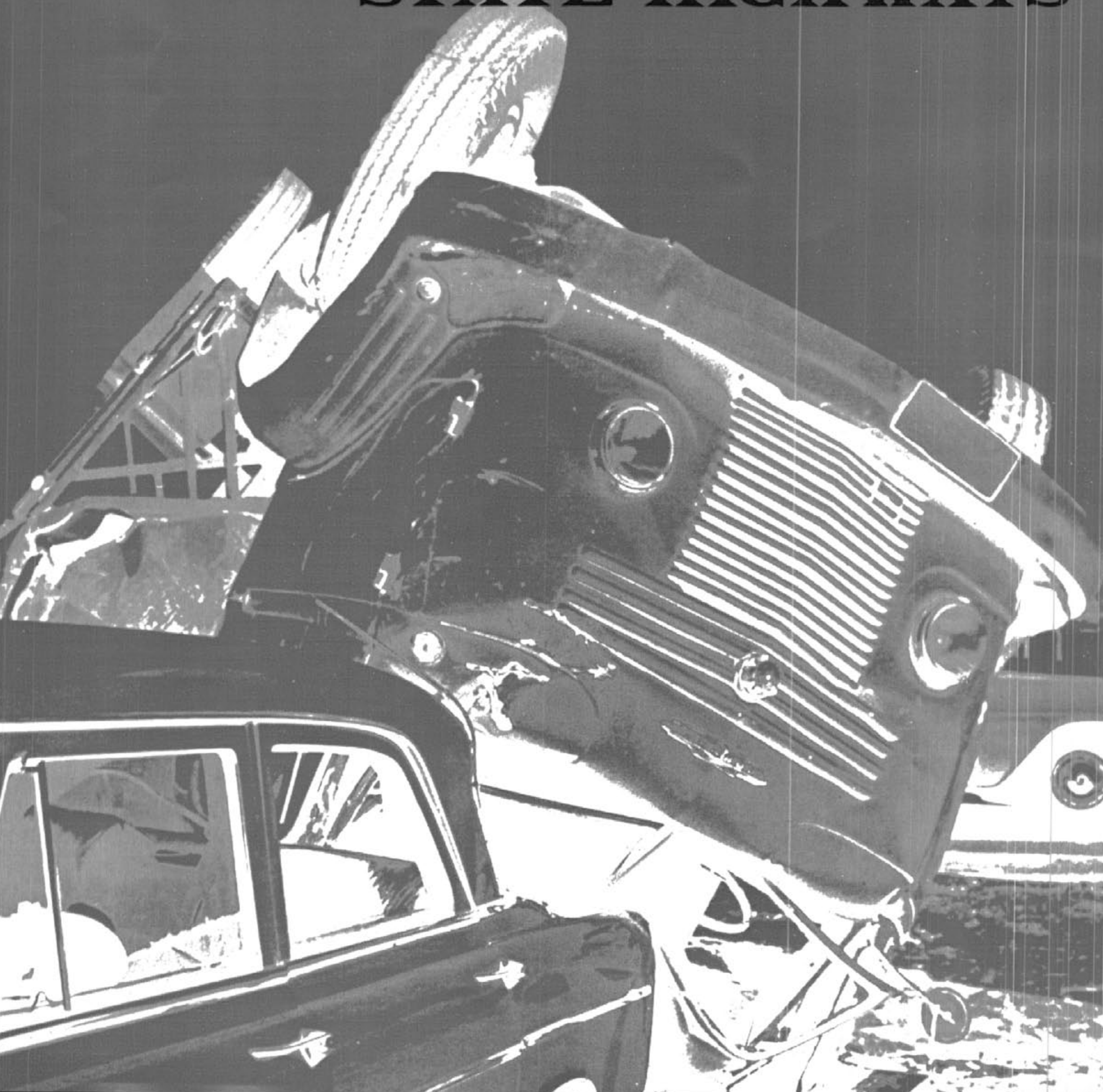
Unfortunately there is also the blatant offender who methodically collects all his garden and household litter, places it in bags, boxes, etc., and transports it to some secluded roadside spot where he dumps it. Old washing machines, rusted refrigerators, and derelict vehicles are among the "heavy-weights" which, having suffered technical knock-outs, are left battered by the roadside for someone else to carry away.

The phrase "There's been some dirty work at the crossroads!" used to be a familiar one in many music-hall melo-dramas. Unfortunately, it has a more serious and contemporary application as it describes the all too frequent reality of roadside litter. An article on this growing problem is included in this issue.

The Department of Main Roads is making an all-out effort to keep our highways clean but to do this it needs the co-operation of all motorists and their passengers. It appeals to them, when they stop for a meal or snack, to gather up all their litter and place it in its rightful place—the litter bin. These bins are provided at all rest areas and established picnic spots and at regular intervals on the roadside. Where there are no such facilities, litter should be carried in the car and placed in the first litter bin along the way.

If road users would retain whatever litter accumulates during their journeys and deposit it in litter bins instead of carelessly throwing it out of vehicle windows, then the Department could gather and remove it far more efficiently, quickly and cheaply. In the long run all travellers would benefit from the consequently clean and litter-free road reserves beside our highways.

AN ANALYSIS OF FATAL ACCIDENTS ON NON-METROPOLITAN STATE HIGHWAYS



Since 1966, the sites of all fatal accidents on State Highways in New South Wales have been inspected and reported on by senior engineers of the Department immediately following the accident. These inspections were made so that road conditions could be critically examined at each accident site to determine to what extent, if any, road features and conditions may have contributed. Analyses have been made of the reports submitted by the Department's engineers for the years 1966, 1967 and 1968 and this article sets out the results.

The mileage of State Highways in New South Wales as at 30th June, 1968 was 6,542. The analyses were confined to the rural or non-metropolitan lengths of highways and accordingly a total of about 102 miles has been subtracted from this figure. The lengths excluded are:

State Highway No. 1 (Prince's Highway): Sydney to Waterfall and Fairy Meadow to Coniston.

State Highway No. 2 (Hume Highway): Sydney to Liverpool.

State Highway No. 5 (Great Western Highway): Sydney to Prospect.

State Highway No. 10 (Pacific Highway): Sydney to Asquith and Kotara to Hexham.

During the three years under consideration there were 750 fatal accidents which resulted in 922 deaths on the remaining 6,440 miles. Various aspects of these accidents are now analysed.

Based on average annual daily traffic volumes for the year 1967, the average fatal accident rate on the non-metropolitan State Highways is in the order of 7·1 accidents per 100 million vehicle miles. In general the rates for the most important highways are below this average. For instance the figure for Prince's Highway is 6·6, for the Great Western Highway 4·7, and for the Pacific Highway 5·8. The New England Highway and the Hume Highway are slightly above average at 7·7 and 8·1 respectively.

General features of the roadway at the sites of the fatal accidents are shown in table 1. Because the lengths of roads under study are predominantly rural, the percentage of accidents which occurred at intersections (7·2 per cent) is much lower and the percentage which occurred on bends and curves (40·5 per cent) is higher than the average for the State as quoted in Statistical Statements of Road Accidents by the New South Wales Department of Motor Transport.

The distribution of fatal accidents throughout the day is given in table 2.

TABLE ONE

LOCATION OF FATAL ACCIDENTS ON NON-METROPOLITAN STATE HIGHWAYS 1966–68

Location	Accidents	Per cent
Intersection	54	7·2
Straight road	287	38·4
Straight road near curve	77	10·2
Bend or curve	304	40·5
Bridge, culvert or causeway	22	2·9
Level crossing	6	0·8
	750	100·0

TABLE TWO

FATAL ACCIDENTS BY TIME OF DAY 1966–68

Time of day	Accidents	Per cent	Expected per cent
0000–0200	63	8·4	5·2
0200–0400	42	5·6	2·0
0400–0600	33	4·4	1·3
0600–0800	50	6·7	7·1
0800–1000	48	6·4	8·5
1000–1200	55	7·4	8·1
1200–1400	58	7·7	8·5
1400–1600	82	10·9	11·1
1600–1800	83	11·0	17·1
1800–2000	72	9·6	13·0
2000–2200	80	10·7	8·6
2200–2400	84	11·2	9·5
	750	100·0	100·0

TABLE THREE

FATAL ACCIDENTS BY TYPE OF VEHICLE 1966–68

Responsible agent	Accidents	Per cent
Car, station wagon	608	81·1
Car and trailer	2	0·3
Van, light truck	5	0·7
Heavy truck	14	1·9
Semi-trailer	57	7·6
Bus	2	0·3
Pedal or motor cycle	25	3·3
Pedestrian	19	2·5
Animal	1	0·1
Unknown	17	2·2
	750	100·0

Photographs by courtesy of Australian Consolidated Press Ltd

It should be noted that these photographs are not related to matters discussed in this article.

The "expected per cent" of accidents shown in the last column is derived from the percentage of accidents which occur during each period of the day from data supplied by the Department of Motor Transport for all road accidents in New South Wales in 1967. The results show that the fatal accidents tend to occur with greater frequency during hours of darkness.

Table 3 lists the responsible agent for each of the 750 fatal accidents. A feature here is that semi-trailers, which represent only 0·7 per cent of vehicle registrations, were involved in over 7 per cent of the single vehicle fatal accidents. Including cases where more than one vehicle was involved as well as the single vehicle accidents, semi-trailers and heavy trucks featured in 27 per cent of all fatal accidents. However it must be borne in mind that the average annual mileage of semi-trailers and heavy trucks is considerably greater than that of the average car or station wagon. From classification counts taken at 138 sites it is estimated that 18 per cent of all traffic on rural State Highways comprises heavy trucks and semi-trailers. These 2 categories of vehicles make up only 1·8 per cent of the total registration of motor vehicles, so there is a very considerable difference between what might be termed their expected incidence and their actual incidence. The available evidence does not warrant an accusation of disproportionate responsibility against heavy freight vehicles.

Of the 750 fatal accidents under study, a driver is judged to be responsible for 643 of them. In table 4 the age groups of the responsible drivers are compared with the action which caused the accident. The under-25 group of drivers is shown up unfavourably as being responsible for a disproportionate percentage of the accidents. In the intermediate age ranges, driver responsibility is less than would be expected on a pro-rata basis, while for the over-60 group responsibility is about what would be predicted from pro-rata considerations.

In table 5 the physical configuration of the highway at the accident site is compared with the physical nature of the accident. It is seen that by far the most common types of fatal accidents are running off the road (28 per cent of the total) and head-on collisions (31 per cent). Some accidents occurred on a straight section of road but near enough to a curve to have been influenced by it. In these cases the accident is counted against the appropriate curve. The figures do not point to sharp curvature as a specially significant factor in accident causation.

The 643 driver-responsible fatal accidents are further analysed in table 6. It is seen that of the known causes the greatest single one (in the opinion of the reporting officers) is excessive speed, with failing to keep left a fairly close second. It will be seen that the various categories of driver fault produce the type of accident which would be expected. For instance, not keeping left results in head-on collisions and going to sleep leads to running off the road.

Today Departmental policy on new 2-lane highway work is to provide a pavement width of either 22 or 24 feet, depending on the region of the State and the classification of the highway. Narrow pavement widths, particularly those less than 20 feet, are usually thought of as tending to contribute to accidents. If they do the point is not brought out in the data presented in table 7. More detailed

TABLE FOUR

AGE OF RESPONSIBLE DRIVERS vs CAUSE

	Age Group of Responsible Drivers										
	Under 17	17–20	21–24	25–29	30–39	40–49	50–59	60+	Not Stated	Total	Per cent
Excessive speed	1	37	24	9	17	8	2	2	17	117	18·2
Inexperience	3	3	1	..	1	..	..	..	..	8	1·2
Overtaking improperly	..	12	14	5	8	3	8	6	13	69	10·7
Not keeping left	..	14	19	10	10	11	10	5	21	100	15·6
Not yielding right of way	..	4	2	1	2	1	4	5	11	30	4·6
Intoxicated	..	..	2	3	2	4	..	1	..	12	1·9
Asleep or fatigued	..	13	11	7	10	4	3	2	11	61	9·6
Sudden illness	..	..	..	1	2	3	8	8	4	25	3·9
Inattentive driving	..	5	1	2	2	1	4	6	8	29	4·5
Other causes	1	3	4	2	4	4	4	5	20	47	7·4
Cause not known	1	22	27	10	13	21	13	15	22	144	22·4
Total drivers	6	113	105	50	71	60	56	55	127	643	100·0
Per cent	0·9	17·6	16·3	7·8	11·0	9·3	8·7	8·6	19·8	100·0	
Per cent of licensed drivers by age group in N.S.W.	..	8·4	9·7	11·7	24·5	21·6	15·0	9·1	..	100·0	

TABLE FIVE

RADIUS OF CURVATURE AT FATAL ACCIDENT SITE

Type of Accident	Straight Road	Over 1,500 ft	1,010–1,500 ft	810–1,000 ft	610–800 ft	410–600 ft	Below 400 ft	Total	Per cent
Intersection accidents	29	..	..	..	..	..	..	29	3·9
Accidents involving turning movements	32	..	..	..	..	..	1	23	3·1
Rear end	39	3	1	..	2	1	..	46	6·1
Side swipe (opposite direction)	10	3	2	4	..	2	2	23	3·1
Hit fixed object within road formation	32	5	2	4	2	3	2	50	6·6
Hit fixed object and overturned	5	3	2	3	6	2	..	21	2·8
Overturned on road	24	6	2	2	1	4	5	44	5·9
Ran off road and overturned	22	7	2	8	6	5	4	54	7·2
Ran off road	89	10	8	13	8	11	20	159	21·2
Head-on collision	108	29	18	13	6	23	24	221	29·5
Pedestrian involved	27	1	..	..	1	..	..	29	3·9
Others	39	2	1	..	..	6	3	51	6·7
Total	446	69	38	47	32	57	61	750	100·0
Per cent	59·5	9·1	5·1	6·3	4·3	7·6	8·1	100·0	

statistics would be required to elucidate the matter. Having regard to the high proportion of relatively narrow pavement still remaining on the State Highway system no statistical significance resides in the columns "All Accidents" and "Accidents Involving Trucks and Semi-Trailers".

Table 8 dissects the 280 fatal accidents in which a vehicle hit a fixed object. In the majority of cases the object was not on or immediately beside the pavement so there must have been some prior cause of the vehicle leaving the pavement.

To date what has been gained from the study is a greater awareness by the Department's engineers of how and when fatal accidents can occur. More attention is given to the treatment of sub-standard curves, new treatments have been adopted for bridge approaches and bridge handrails, and the size of guideposts has been reduced from 7 inch round to 4 inches by 2 inches sawn. Consideration is being given to the need, where practicable, to locate vertical obstructions further from the edge of the pavement. Finally, a detailed analysis of the more accident prone sections of highway is being undertaken.

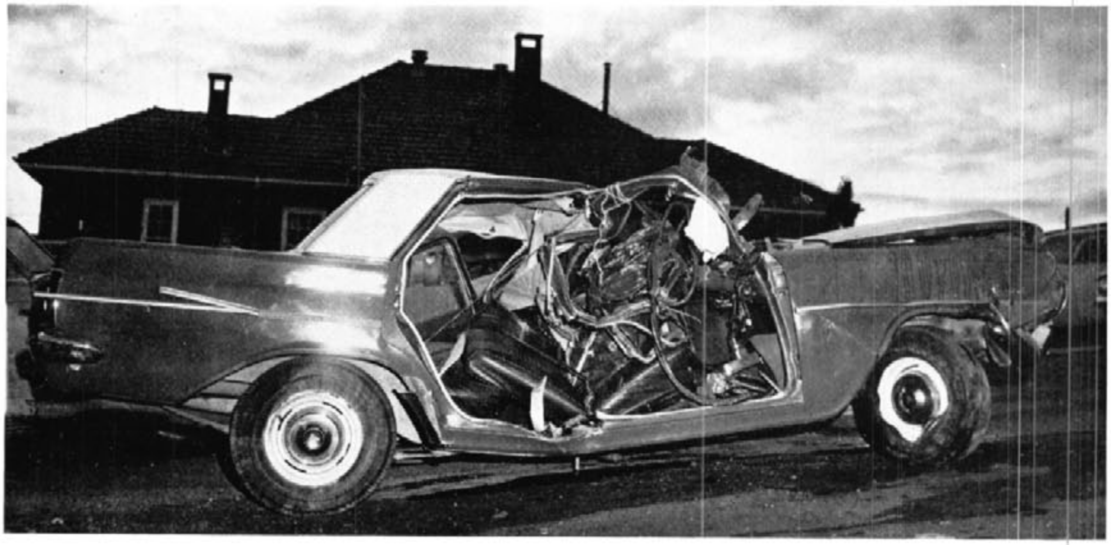


TABLE SIX

COMPARISON OF ACCIDENT TYPE WITH CAUSE

Driver fault	Intersection accident	Accident involving turning movements	Rear end and side swipe (same direction)	Side swipe (opposite direction)	Hit fixed object within road formation	Hit fixed object and overturned	Overturned on roadway	Ran off road and overturned	Ran off roadway	Head-on collision	Pedestrian involved	Others	Total	Per cent
Excessive speed	2	..	3	1	13	7	10	19	35	26	1	4	121	18·8
Inexperience	..	..	2	..	1	..	..	..	3	2	..	..	8	1·2
Overtaking improperly	1	..	7	1	..	..	1	1	10	48	..	..	69	10·7
Not keeping left	..	..	..	10	3	1	1	1	..	83	..	1	100	15·6
Not yielding right of way	19	4	1	..	..	..	..	..	..	..	1	5	30	4·7
Intoxicated	..	..	..	..	2	2	..	..	5	3	..	..	12	1·9
Asleep or fatigued	..	..	2	1	8	1	6	7	28	7	..	2	62	9·6
Sudden illness	..	1	..	1	3	1	1	2	13	3	..	..	25	3·9
Inattentive driving	1	1	11	1	..	1	1	..	5	1	3	4	29	4·5
Other causes	6	13	5	1	1	..	..	..	..	4	..	13	43	6·7
Cause not known	..	3	9	3	12	4	10	18	46	25	2	12	144	22·4
Total	29	22	40	19	43	17	30	48	145	202	7	41	643	100·0
Per cent	4·5	3·4	6·2	2·9	6·7	2·6	4·7	7·5	22·6	31·4	1·1	6·4	100·0	

TABLE SEVEN

PAVEMENT WIDTH AND ACCIDENTS

Pavement width	All accidents	Accidents involving trucks and semi-trailers
18 feet	156	38
19–20 feet	240	63
21–22 feet	115	
23–24 feet	66	96
24 feet	113	
Not known	60	
	750	197

TABLE EIGHT

ACCIDENTS IN WHICH VEHICLES HIT FIXED OBJECT

Type of fixed object hit by vehicle	Hit object within road formation	Ran off road and hit object	Overturned after hitting object: Within formation	Overturned after hitting object: Off roadway	Other classes	Total	Per cent
Bridge handrails or members	23	..	..	..	1	24	8·7
Tunnel walls or piers	1	..	..	..	1	2	0·7
Guide posts	24	..	28	..	8	60	21·8
Safety fences	8	..	3	..	2	13	4·8
Kerbs and gully pits	..	1	..	1	1	3	1·1
Public utility poles	3	19	1	1	4	28	10·2
Roadworks	..	1	..	..	1	2	0·7
Trees within or beside road formation	26	..	..	2	2	30	10·9
Trees within road boundaries	..	65	..	1	2	68	24·7
Boulders, outcrops, and cuttings within or beside road formation	2	..	5	..	2	9	3·4
Boulders, outcrops, and cuttings within road boundaries	..	5	..	5	..	10	3·6
Others	2	16	..	5	3	26	9·4
Total	89	107	37	15	27	275	100·0
Per cent	32·4	38·9	13·4	5·5	9·8	100·0	

Heavy Prime Movers and Floats

On its works the Department uses a large quantity of crawler track equipment. Such plant cannot travel for any appreciable distance on public roads, firstly because of the damage to the road pavement which would be caused by the cleated tracks, and secondly because it is too slow. Therefore it is mandatory that plant items with crawler tracks be transported from job to job. Although many types of rubber-tyred plant do not cause pavement damage and are not slow, nevertheless, where considerable distances are involved, it is usually found convenient to transport them rather than require them to travel under their own power.

The transportation of hired plant used on Departmental works is generally the responsibility of the owners, but it is, of course, governed by the same principles.

For moving its own plant during the 12 years from 1957 to 1968 inclusive the Department maintained a fleet of Leyland "Hippos". These units were powered by 160 horsepower engines and had a maximum payload of 25 tons. During 1969, these vehicles were "retired" from service because of their age and condition and also because their load capacity did not now match the "indivisible" weight of some plant items which had been increasing steadily over the years.

To replace these vehicles, the Department procured four White model 7464TDB units and three Atkinson model T3266C units. The White units are of American origin and were imported in the CKD (completely knocked down) condition and assembled in Sydney. The Atkinson units were imported from Britain and assembled in Melbourne.

Both types of vehicles are powered by a Cummins model NTC335 turbo-charged diesel engine developing approximately 300 horsepower. Both are fitted with fifteen speed Fuller single stick gearboxes and, although there are slight differences in the transmissions, the performances of the two types of vehicles are practically identical.

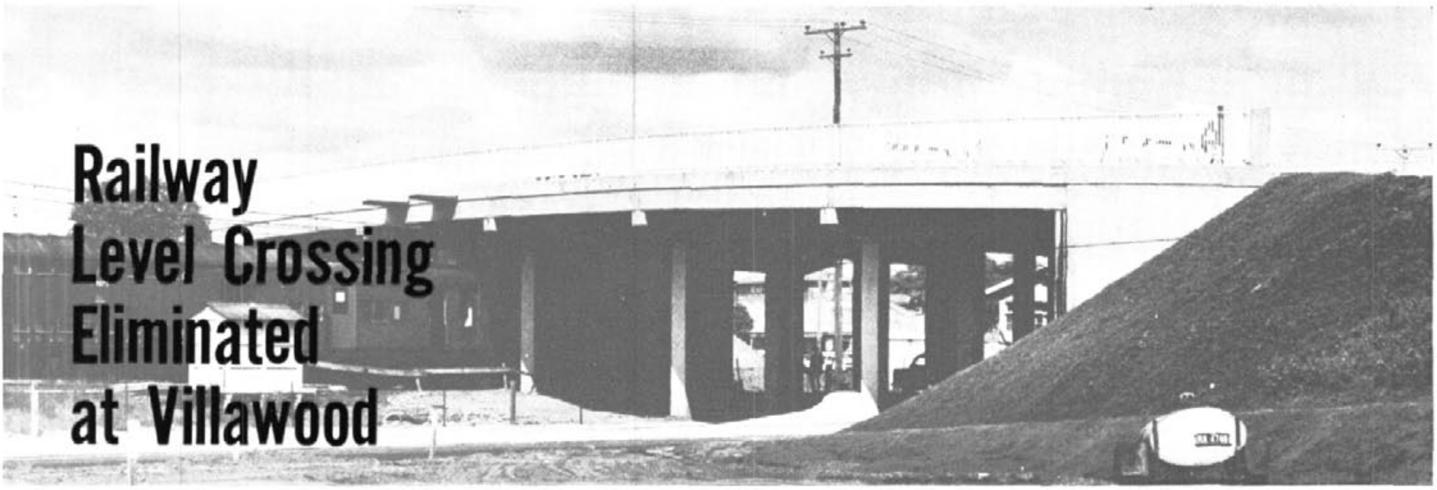
Comfortable sleeper-type cabs are fitted to each vehicle and, to give access to the engine, they are of the forward tilting type. The provision of a hydraulic tilting mechanism enables one man to do this, after the cab protection frame (the bull bar) has been dropped. The White cabs are imported and are constructed mainly of aluminium. The Atkinson cabs are of double skin fibreglass construction and are of Australian design and manufacture.

The prime movers operate in combination with three-axle 32 ton capacity low loaders. Each axle carries four wheels, that is, two duals. The third axle is demountable (with the assistance of a crane) and may be carried at the front end of the tray. The load capacity is then reduced to 25 tons. The low loaders are of the "flush deck" rather than the "drop" type and this provides maximum deck length. With the low loader in the three-axle condition the overall length of the unit exceeds 50 feet and therefore a permit is required to enable it to travel on public roads. In the two-axle condition the unit is within Ordinance limits and no permit is necessary. The width of the tray is 8 feet.

The new units are stationed at strategic locations around the State. The four White vehicles are located at Bourke, Broken Hill, Bega and at the Department's Central Workshop at Granville, while the three Atkinson vehicles are at Dubbo, Yass and Holbrook.

Atkinson Model T3266C on the left and White Model 7464TDB on the right.

Railway Level Crossing Eliminated at Villawood



Railway Overbridge at Villawood

Another railway level crossing was eliminated from the State's road system when a bridge to carry Woodville Road over the railway line at Villawood was opened to traffic on Saturday, 21st February, 1970.

It was the second railway level crossing to be eliminated from this road (State Highway No. 13) in the last 3 years. In 1967, the level crossing at Dog Trap Gates, Granville was replaced by an underpass.

The new 5-span concrete bridge has an overall length of 198 feet. It has dual 3-lane carriageways separated by a median 3 feet wide, and two footways each 8 feet wide. Although the bridge had not been completed, it was practicable for three southbound lanes and two northbound lanes to be brought into operation. The final completion of ramps will be undertaken while the bridge is in operation.

Besides eliminating the railway level crossing on the Highway, this bridge provides a better local facility in that it crosses over Christina Road, and allows pedestrians to pass underneath the Highway.

When finished, the bridge will complete the work of the Department of Main Roads in the provision of dual carriageways on State Highway No. 13 between the Great Western Highway at Parramatta and the Hume Highway at Lansdowne.

The Department of Railways designed this bridge and it was built by Arthur Boyd Constructions Pty Ltd. The Department of Main Roads is carrying out all the roadworks with its own staff.

The bridge contract was $165,000 and the roadworks will cost approximately $572,000.

The total cost of the project will therefore be about $750,000 and will be shared by the Department of Railways and the Department of Main Roads.

Elimination of Railway Level Crossings on Main Roads

The railway level crossing at Villawood was the 171st to have been eliminated from the Main Roads System since the Main Roads Act came into effect in 1925. The number of level crossings on Main Roads has now been reduced to 394 comprising 333 on New South Wales Government Railways, 50 on privately-owned railways and 11 on Victorian Government Railways which extend into New South Wales.

During the 12 months ended 30th June, 1969, four railway level crossings were eliminated from the Main Roads System:

State Highway No. 4

Snowy Mountains Highway

The bridge constructed over Gilmore Creek also spans the Tumut-Batlow railway line and has eliminated the level crossing on the highway at Gilmore. The level crossing is still available for local traffic.

State Highway No. 9

New England Highway

The construction of a deviation between Kankool and Willow Tree eliminated two level crossings from the route of the New England Highway. The level crossing at Kankool has been closed and the level crossing at Willow Tree is now on the route of the Merriwa-Willow Tree Road (Main Road No. 358).

Main Road No. 350

Trundle-Tullamore

The construction of a deviation north of Trundle eliminated two level crossings from the Main Roads System.

With a view to improving safety conditions at existing railway level crossings, improvements were carried out at a number of locations by the installation of six sets of automatically operated flashing lights, increasing sight distance at various locations and the provision of warning signs on road pavements in approach to the crossings.

Since 30th June, 1969, the level crossing on the Barrier Highway at Muriel Tank, between Nyngan and Cobar, was eliminated by the completion of a 40 feet long concrete bridge. The bridge was constructed by the Department of Railways and following construction of the approaches by Bogan Shire Council and contract, it was opened to traffic in December, 1969.

Radio Telephony Networks on Main Road Works

The Department first employed radio communication on a regular basis on its works in New South Wales in 1949. In that year a small base station was set up in the Divisional Office at Glen Innes, with a field station at the Works Office at Gibraltar Range, some 30 miles to the east (see "Radio Telephone Communication between Glen Innes and Gibraltar Range" in *Main Roads*, December, 1949). The frequency used was 4460 kilocycles and the system continued to operate until work on the Gibraltar Range job was temporarily suspended 2 or 3 years later.

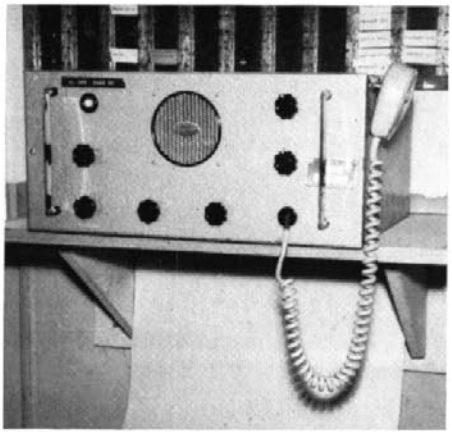
In early 1951 the Department established a 60 watt base station at Bourke which controlled a network of five 10 watt mobile stations operating in the district. The frequency used was 5280 kilocycles. Towards the end of the same year a 100 watt base station was set up at the Department's Works Office at Cooma, using the same frequency of 5280 kilocycles. This worked with a network of five 15 watt mobile stations in the Snowy Mountains area (see "Radio Communication on Main Road Works. Networks in use in Bourke and Cooma Districts" in *Main Roads*, September, 1954). These two networks were discontinued in the late 1950's.

Subsequently, the Department decided to employ radio telephony on its outlying works on a much broader basis than previously used. Because of the distances over which reliable communication was required the choice of system naturally fell on HF (high frequency). The repeater stations which would have been required for a VHF (very high frequency) system ruled out the latter on economic grounds. It was realised that noise interference was an inherent disadvantage of amplitude modulated HF, but it was considered that it would be acceptable to have effective communication for 80 to 90 per cent of the time.

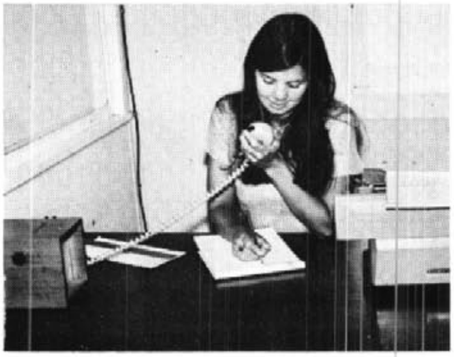
Field tests carried out in 1965–66 showed that two channels would be needed to properly cover the range from 0 to 200 or more miles both day and night. The Postmaster-General's Department allocated to the Department the two frequencies of 2344 kilocycles (channel A) and 4540 kilocycles (channel B). In principle the lower frequency is for shorter ranges of up to 50 to 60 miles in daylight, while the higher frequency covers ranges in excess of this in daylight. During the hours of darkness the lower frequency would cover all ranges.

During 1966 tenders for the equipment were invited, and the present networks were installed in 1966 and 1967. Base stations have been located at Bega, Jindabyne, Wilsons Valley, Broken Hill, Wentworth, Wilcannia, Tibooburra, Bourke, Walgett, Nyngan and Cobar. Additional base stations are proposed for Coonabarabran and Moree, and when these are installed in 1970 the total number of base stations will be thirteen. As the Department's operations change, the base stations are shifted. For instance, Jindabyne base station will be moved to Cooma during 1970. The eventual total of mobile stations will be 108; at the present time the number is approximately 60.

Bega Base Station in use by Works Engineer



Base transmitter-receiver in Works Engineer's office



Remote monitor in use by typist at Bega Base Station

Both the base and mobile stations transmit at a power of 25 watts, which except in special circumstances is the maximum permitted by the Postmaster-General's Department for this type of service. The base stations use a horizontal dipole (long wire) aerial while the mobile stations use a whip aerial 8 feet long which is fitted with a base loading coil.

Both the base and the mobile stations employ valves in their circuitry. In this particular type of service valves are judged to give a more reliable performance than the transistorised equipment which is available.

Where it is necessary to overcome noise at the base stations, battery operated transistorised receivers have been installed in electrically quiet spots remote from the base at distances varying from a few hundred yards to several miles. These remote receivers are connected to the bases by the Postmaster-General's Department or private land lines.

Base stations are provided with the facility for listening to both channels simultaneously. This is advantageous because the mobile stations on any given network, due to their location, are likely to be using both channels, some on the higher frequency, some on the lower. When a call comes in to the base, the operator of the base transmitter replies on the appropriate channel.

Base stations are also provided with a remote control unit comprising a speaker, a volume control and a microphone. This enables the set to be operated from a second position in the office.

The mobile stations are simple to operate. The controls comprise

- off-receive-transceive switch
- channel selector switch
- mute (noise limiting) control
- volume control
- press-to-talk switch on the microphone.

The channel selector switch also switches the aerial base loading coil to the one appropriate to the channel.

Some mobile sets in remote areas are fitted with a third channel (4055 kilocycles) which permits communication with the Royal Flying Doctor Service. Apart from requesting medical assistance, should such be required, this facility can be used for passing urgent messages after normal working hours when the Department's base stations have closed down.

The noise problem inherent in the high frequency part of the radio spectrum was mentioned earlier. However, the Department's experience is that communication is possible most of the time.

In addition to being set up in certain camps, the mobile sets are fitted to a diverse range of vehicles, including station wagons, utilities, fitter's trucks, patrol graders, and snow clearing plant. The Divisional Engineers at Broken Hill and at Bourke have them installed in their cars. Generally speaking the sets are switched to the "receive" position when there is anyone in attendance. The channel listened to, A or B, depends on the location and the prevailing conditions. There is a certain amount of mobile to mobile working although traffic is primarily between mobile and base.

The classes of personnel who use the mobile sets include engineers, construction foremen, maintenance foremen, bridge foremen, plant foremen, plant operators and fitters. The purposes for which the sets are used include the reporting of road conditions, the reporting of breakdowns, ordering stores, diagnosing plant faults, and passing timesheet information from field to base.

Interference between networks does not constitute a serious problem. It is true that at certain times a signal can be heard from several hundred miles away, that is, well outside a network's region. However the adoption of a policy of listening before speaking to ensure that the channel is clear appears to have obviated the difficulties which might otherwise accrue in this regard.

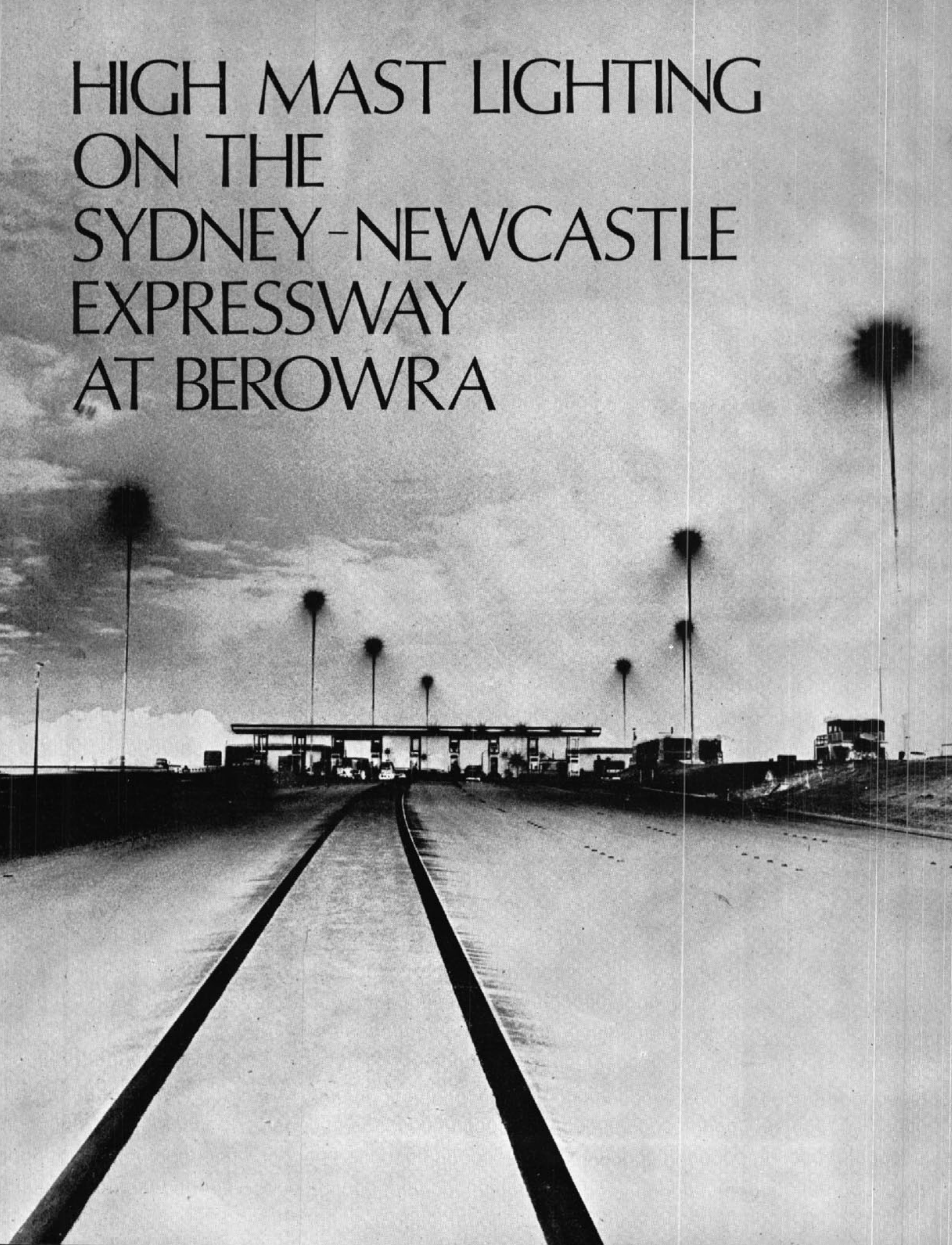
The Departmental organisations which have been equipped with radio communication have found it very advantageous and would now be extremely reluctant to dispense with the facility.

Mobile transceiver in use by Works Engineer

Mobile transceiver installed in Works Engineer's vehicle

Remote receiving aerial installation at Hergenhans Lane, 4 miles from Bega

HIGH MAST LIGHTING ON THE SYDNEY-NEWCASTLE EXPRESSWAY AT BEROWRA



High mast lighting has been installed at two locations on Main Roads in New South Wales.

Firstly, a single 80 feet tower has been installed by the MacKellar County Council as a supplement to normal street lighting at a channelised intersection in the Sydney suburb of Narrabeen. The second installation, which was by the Department of Main Roads, is at the Berowra Interchange of the Sydney-Newcastle Expressway and includes the expressway toll plaza and an adjacent Lorry Checking Station operated by the Department of Motor Transport.

The following results and conclusions have been obtained from field measurements of the illumination provided by the high mast lighting at the Berowra Interchange.

LAYOUT OF STUDY AREA

The general layout of the area where measurements were taken, together with the positions of six of the nine 100 feet towers which have been installed, is shown in figure 1. Towers Nos. 1 and 2, were considered the most suitable for study as they have the same R.L. (reduced level) and are situated in an open flat area. Furthermore it was possible to isolate them from other light sources without endangering traffic safety.

Both single-tower and twin-tower illumination were studied. For the investigation of single-tower illumination, towers Nos. 2, 3, and 4 were extinguished, whilst for twin-tower illumination, towers Nos. 3, 4, and 5 were extinguished. The closest conventional street lighting to towers Nos. 1 and 2 was 200 feet south of tower No. 1. It was found that this lighting had negligible effect closer than 150 feet to the tower.

Photographs of the area by day, evening, and night are shown in figures 2 (a), 2 (b), and 2 (c). A photograph of the lantern assembly at the top of the mast is shown in figure 3.

TOWER AND LANTERN CONSTRUCTION

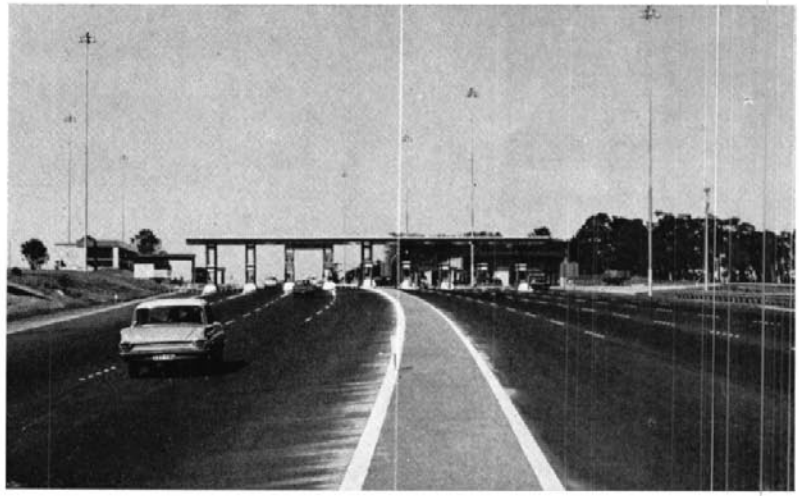
The towers were designed and manufactured by James Watt Pty Ltd. They are circular with a stepped taper over their whole length, reducing from 21 inches in diameter at the base to 6 inches in diameter at the top. London Electric "raise and lower gear" is installed within each mast.

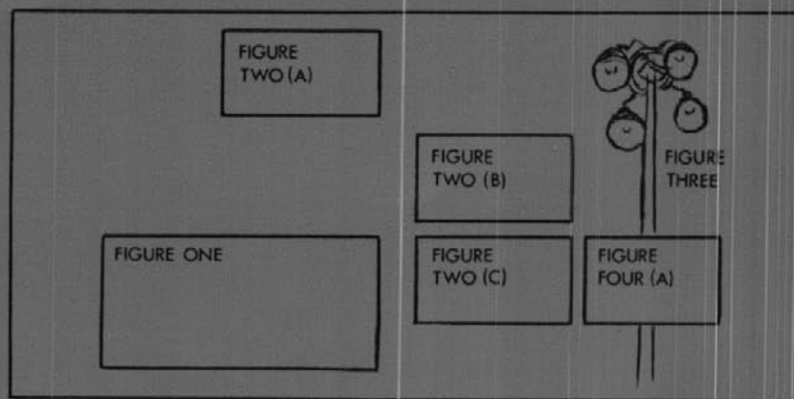
There are four lamps on each tower. They are Benjamin BMH1001 Lanterns (70° cut-off) with Sylvania Lamps, 62,000 lumens and an average expected life of 24,000 hours (1,000 watts, 415 volts).

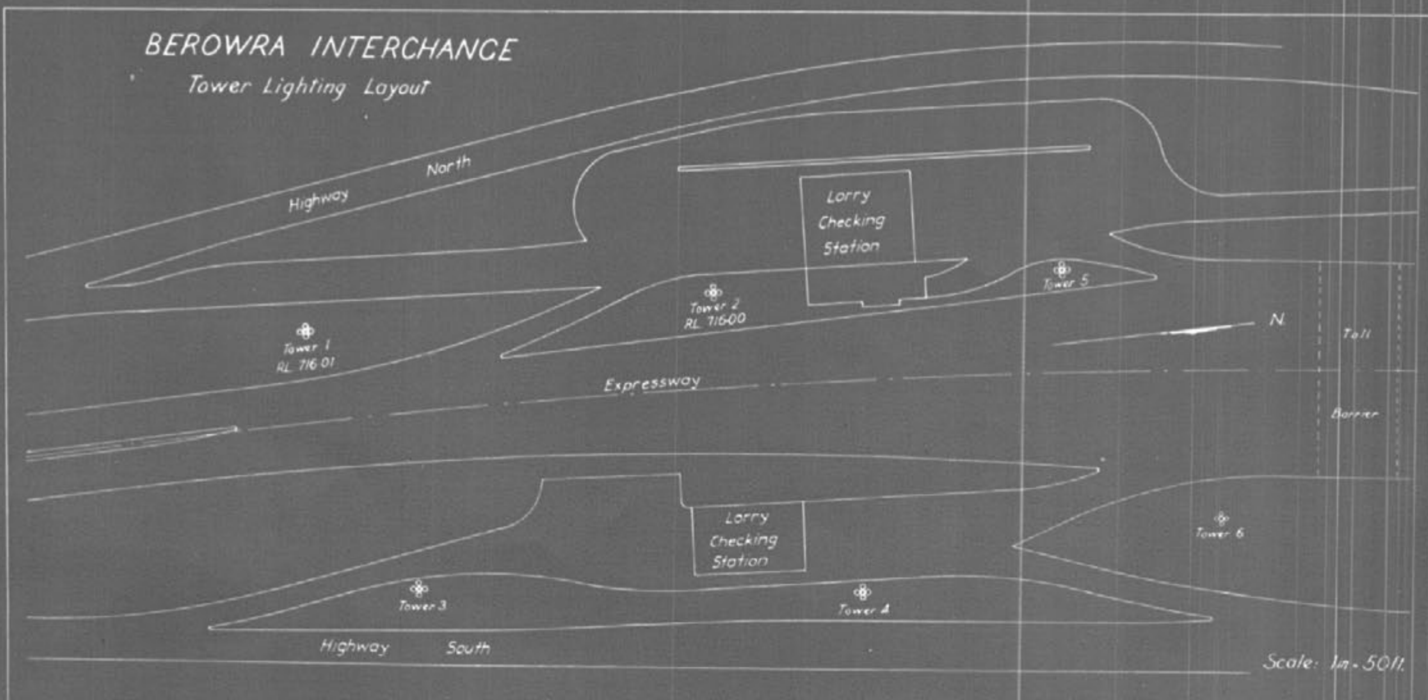
MEASUREMENTS TAKEN

All measurements of illumination were taken with a Weston Illumination Meter loaned by the Institute of Highway and Traffic Research of the University of New South Wales. The meter was modified to increase sensitivity in the lower ranges by removing the cosine and colour correcting filters.

HIGH MAST LIGHTING







The readings were later adjusted to account for both these corrections.

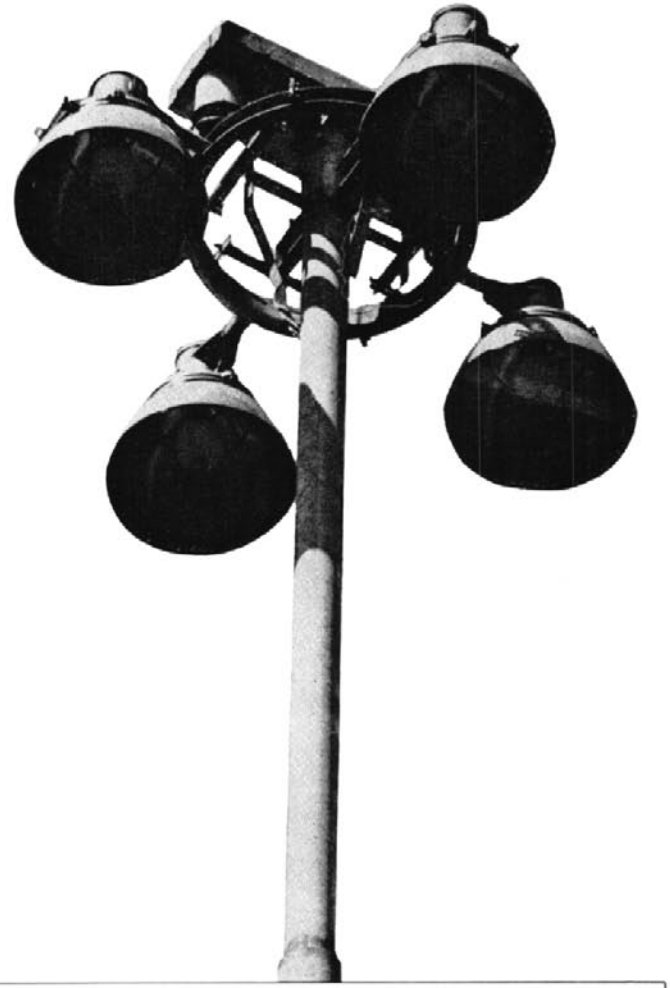
(*a*) *Single Tower*

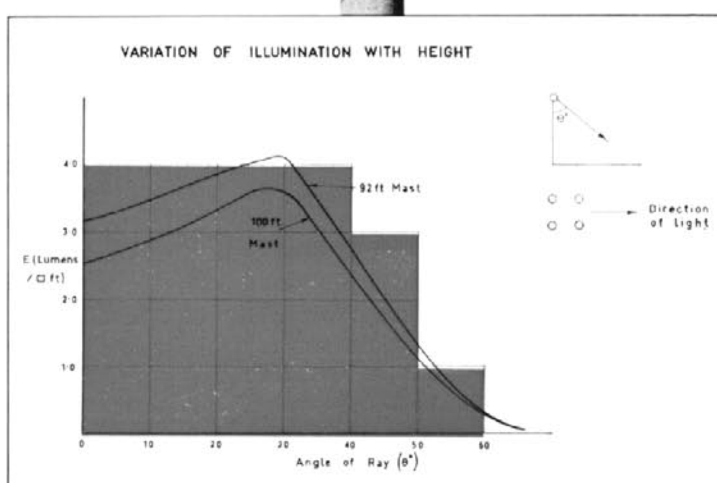
Readings were taken radially at $22\frac{1}{2}$ degree intervals from the tower, at ground level (100 feet) and 8 feet from ground level (92 feet).

The results are shown in figures 4 (a), 4 (b), and 5. Comparison was made with the supplier's specification and is illustrated in figure 6.

(*b*) *Twin Towers*

Towers Nos. 2 and 3 are at the same level and spaced 292 feet apart. Radial measurements were taken as for the single tower, but at ground level only, to give the contour map shown in figure 7.





(*c*) *Using the formula:* $I = \dfrac{EH^2}{\cos^3 \theta}$

where: I = Luminous intensity of candelas
E = Illumination in lumens per square foot
H = Height in feet
θ = Angle in degrees, measured from the vertical

and the results shown in figures 4 (a) and 4 (b), the luminous intensity was found for varying vertical angles.

HIGH MAST LIGHTING

From this information the polar distribution diagram shown in figure 8 was constructed. As is shown, an agreement in results was obtained for

$$H = 100$$
and
$$H = 92$$

and from this diagram theoretical road illuminations for mast heights of 80 feet, 100 feet and 120 feet were calculated and drawn, as shown in figure 9.

SUMMARY OF RESULTS

(i) Figures 6 and 7 show that the position of the individual tower lanterns in the horizontal plane makes an appreciable difference to the road illumination at any point. With one lamp directionally behind the mast the illumination close to the tower is decreased by almost one quarter. However, illumination in this area is more than adequate. Further from the mast, where illumination drops to a critical level, the directional effect of individual lanterns becomes negligible.

(ii) Lanterns supplied proved to have higher cut-offs than were quoted in the specifications. This affected the illumination mid-way between towers where the vertical angles were in the 60°–70° region. Where maximum theoretical spacing is used, this factor is critical.

(iii) Figure 8 shows that a higher mast height than was used would give a more uniform distribution while still maintaining a satisfactory degree of illumination.

SOME GENERAL OBSERVATIONS

High mast lighting is best suited to an area lighting system. It requires somewhat more light flux per unit area than a conventional lighting system to achieve a minimum level of illumination of about 1 lumen per square foot. This appears to be satisfactory for the lighting of an area such as a toll plaza and can be achieved with four 1,000 W lamps mounted on 100 feet high masts at a spacing in the order of 250 feet.

For the lighting of other large areas, such as an interchange, it appears possible from the Department's experiments that a lower minimum level of illumination may be satisfactory. If in such areas a minimum illumination level of 0·75 or even 0·5 lumens per square foot would be acceptable, this could be achieved with 120 feet high masts at 350 to 400 feet spacing.

With a conventional lighting installation the aim is to produce an even luminance on the road surface and its surrounds, against which objects can be seen in silhouette. This system takes advantage of the preferential reflection properties of road surfaces for light at large angles of incidence.

High mast lighting is normally designed to provide direct illumination of objects and the surfaces to be seen. Because of the additional light flux per unit area that is provided, consideration of road luminance as a criterion for design does not have the same significance as with conventional systems and as provided for in the Standards Association of Australia Street Lighting Code.

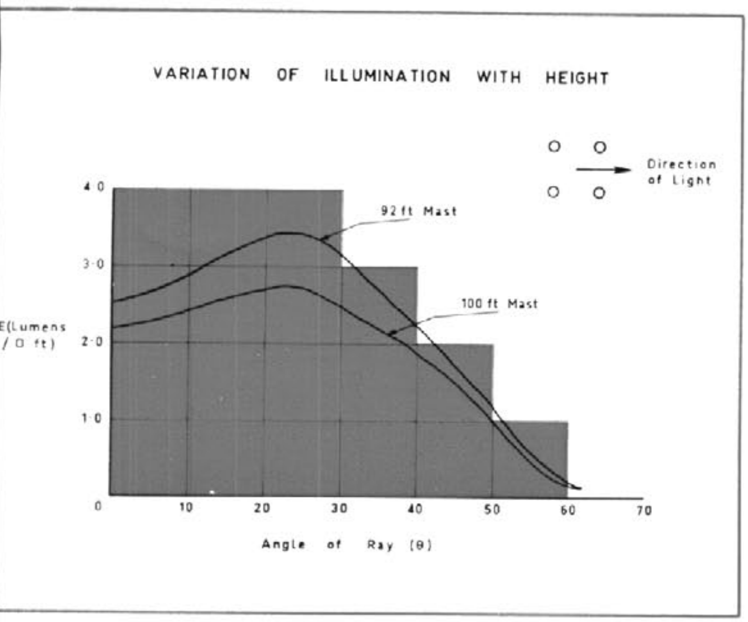
At Berowra, a conventional lighting system in accordance with the Code

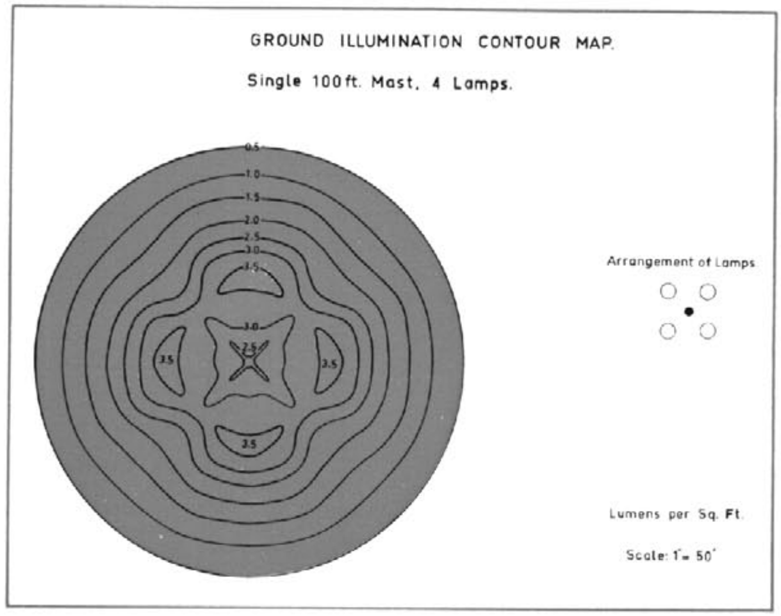
FIGURE FOUR (B)	FIGURE FIVE
FIGURE SIX	FIGURE SEVEN
FIGURE EIGHT	FIGURE NINE

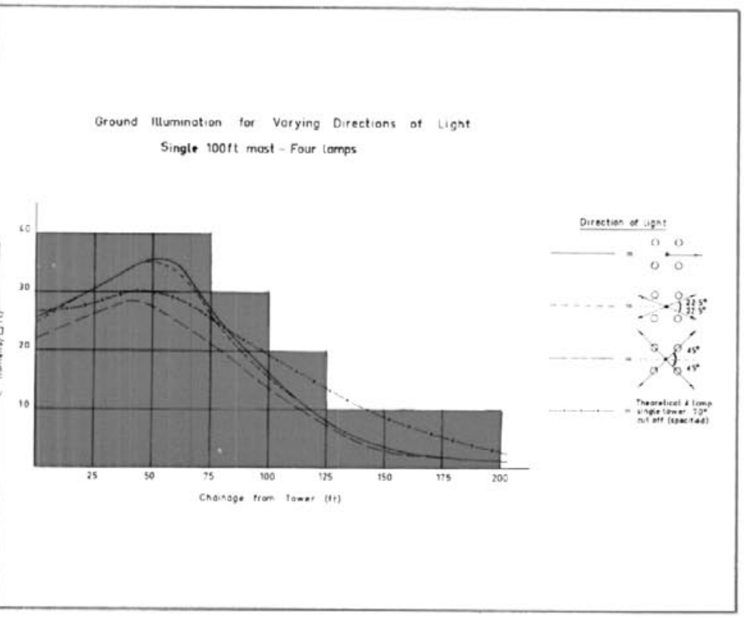
would have required the installation of approximately 45 lamp standards in the area where the 9 masts were erected. On the basis of comparable costs, one high mast in place is equivalent to approximately nine or ten conventional lamp standards. It follows therefore that from considerations of installation costs a high mast system does not present any advantages.

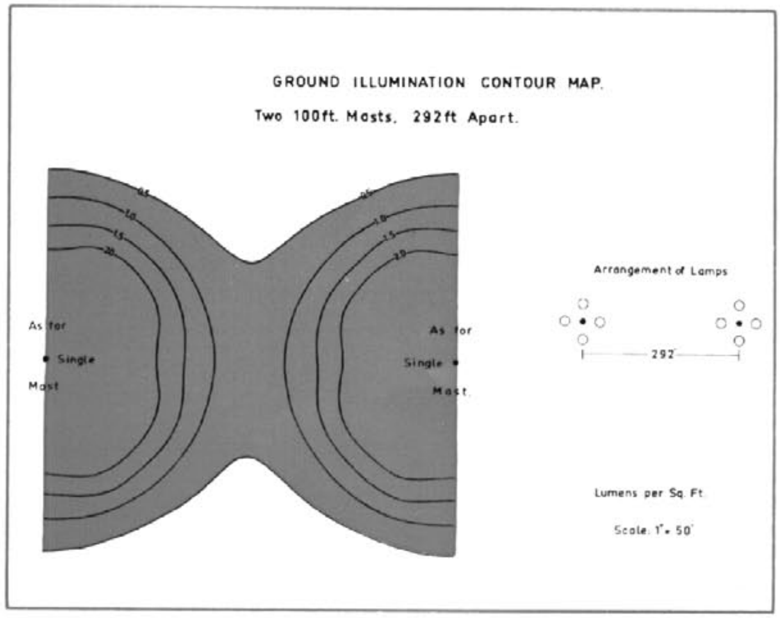
The advantages which are gained, however, are:

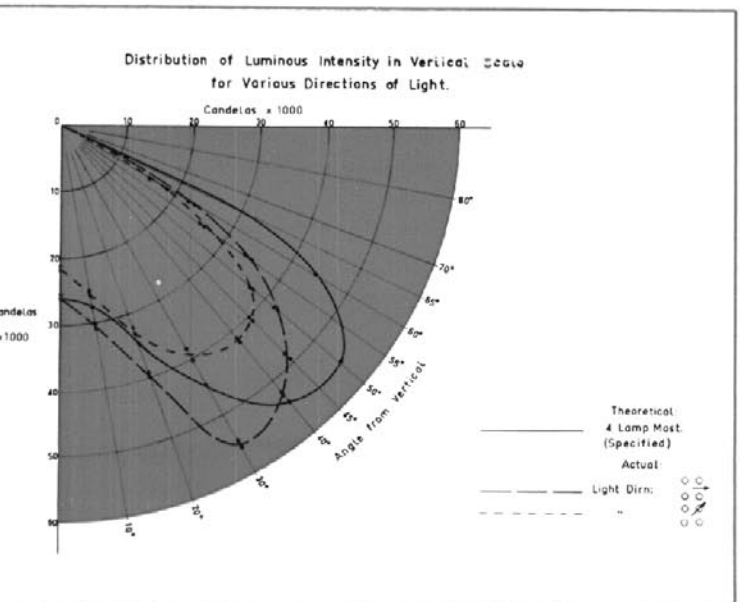
- better distribution of light over large areas;
- direct illumination of objects on the roadway;
- an improved appearance due to the significant reduction in the number of light standards;
- complete absence of glare;
- ease of maintenance clear of the road carriageways.

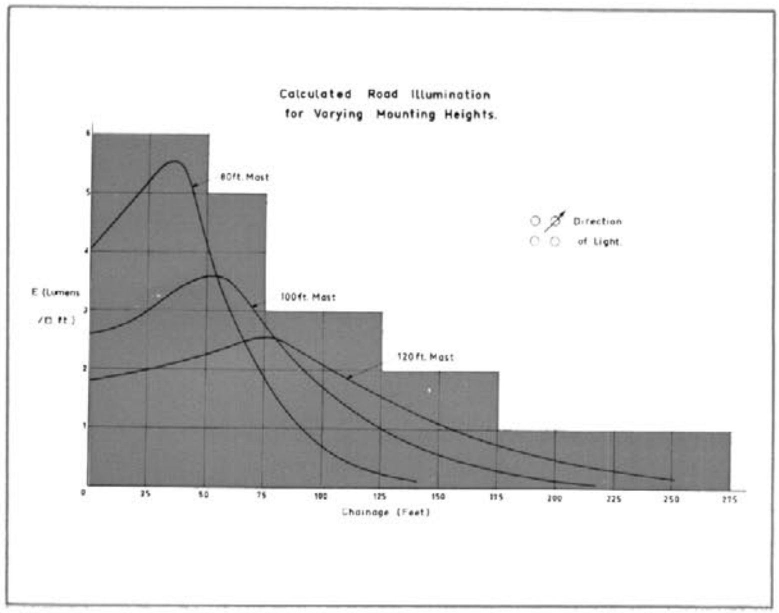

VARIATION OF ILLUMINATION WITH HEIGHT
Direction of Light
92 ft Mast
100 ft Mast
E(Lumens / □ ft)
4·0
3·0
2·0
1·0
0
10
20
30
40
50
60
70
Angle of Ray (θ)


GROUND ILLUMINATION CONTOUR MAP.
Single 100 ft. Mast, 4 Lamps.
Arrangement of Lamps
Lumens per Sq. Ft.
Scale: 1" = 50'


Ground Illumination for Varying Directions of Light
Single 100 ft mast – Four lamps
Direction of Light
25
50
75
100
125
150
175
200
Chainage from Tower (ft)


GROUND ILLUMINATION CONTOUR MAP.
Two 100ft. Masts, 292ft Apart.
As for Single Mast
As for Single Mast.
Arrangement of Lamps
292'
Lumens per Sq. Ft.
Scale: 1" = 50'


Distribution of Luminous Intensity in Vertical Scale for Various Directions of Light.
Candelas × 1000
Angle from Vertical
Theoretical
4 Lamp Mast.
(Specified)
Actual
Light Dirn:


Calculated Road Illumination for Varying Mounting Heights.
80ft. Mast
100ft. Mast
120ft. Mast
Direction of Light.
E (Lumens /□ ft.)
Chainage (Feet)

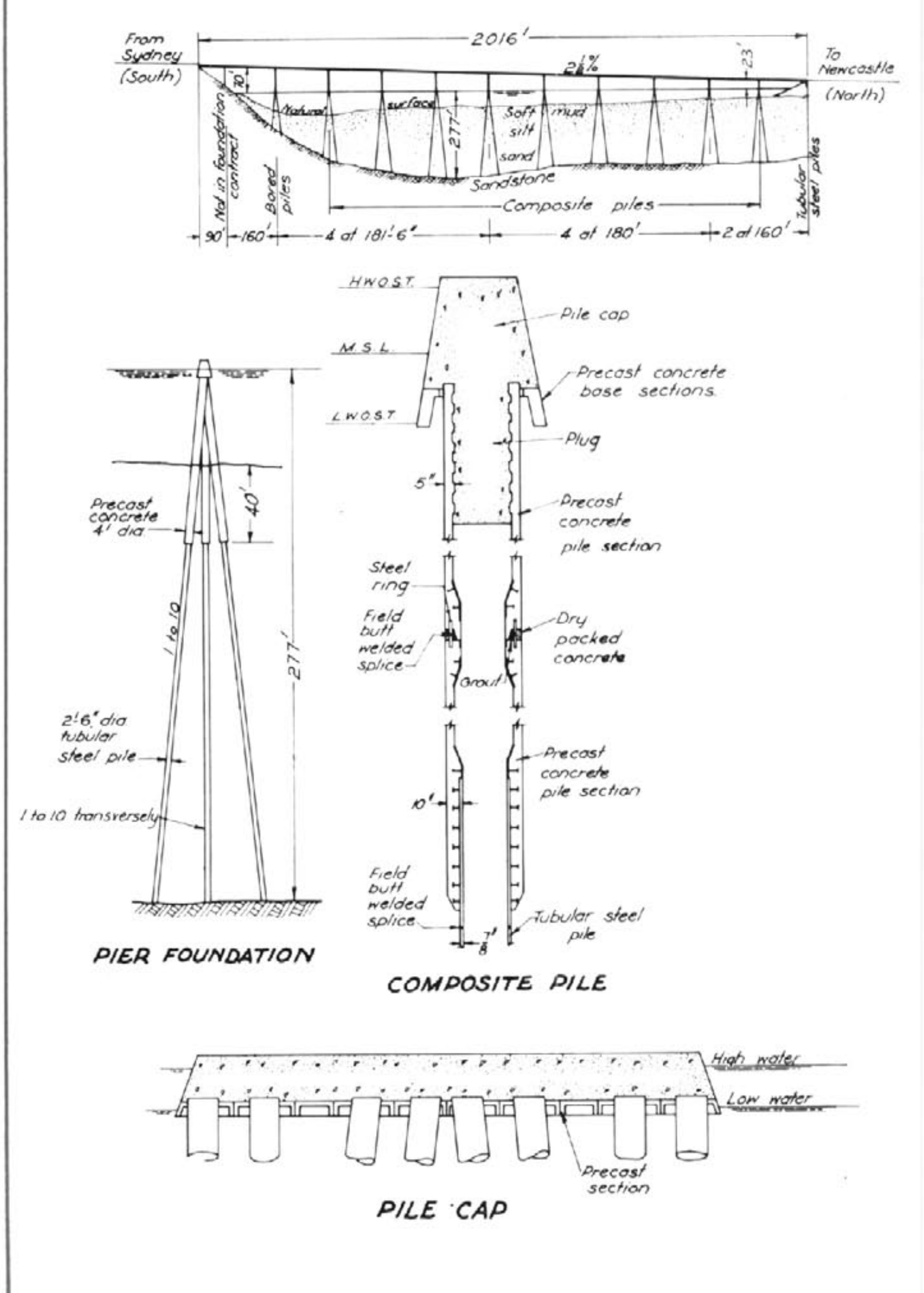
Foundations for New Bridge over the Hawkesbury River

In October, 1969, a tender of $1,330,629 from John Holland (Constructions) Pty Ltd was accepted by the Department for the construction of the foundations for a new bridge to carry the Sydney-Newcastle Expressway over the Hawkesbury River near Brooklyn. These foundations will rank amongst the deepest piled bridge foundations in the world and special piles had to be designed to suit the difficult site conditions. The contract for the construction of the bridge foundations was separated from the rest of the construction, so that an early start could be made with the building of the foundations while the rest of the bridge was still at the detail design stage. The contract time for the construction of the foundations is 52 weeks and it is planned to have the bridge completed and opened to traffic by Christmas, 1971.

The new bridge will be situated about 100 feet upstream from the existing 3-lane bridge which was completed in 1945. It will be 2,016 feet long and will carry six traffic lanes. The new bridge will be graded at 2½ per cent from a height of 70 feet above water level at the steep and rocky southern bank of the river down to 23 feet above the swampy northern bank.

Extensive test boring indicated solid sandstone bed rock at depths of up to 277 feet below water level, under a deep overburden of very soft mud, silt and sand. The records of the pile driving and the sinking of the open caisson of the existing bridge also showed the presence of a thick layer of soft river mud below the river bed. The main caisson pier of the existing bridge was sunk to rock by open dredging to an average depth of 240 feet but on three occasions the ground support failed and the caisson ran free for distances of 53 feet, 30 feet and 28 feet.

The mud layer clearly could not be assumed to give sufficient lateral support



PIER FOUNDATION

COMPOSITE PILE

PILE CAP

to the foundation piles and consequently their great unsupported length has required the design of large pile sizes.

Modern techniques make the sinking of large foundation piles to great depths a practical proposition. Since the foundation will be an expensive part of the new bridge, it becomes economically desirable to reduce the number of foundation piles to a minimum by using a light superstructure of moderate span lengths, to reduce the weight of the structure, and to reduce the overturning movements on the foundations by framing the piled piers rigidly into the bridge superstructure. Steel box girder spans, 160 to 180 feet long, will be placed in such a way that the positions of most of the new piers will match those of the existing bridge. If longer spans were employed, the total weight of superstructure, and therefore the total number of bridge piles, would have increased. The saving in the number of pile caps and pier columns would not have compensated for the increased number of piles and the greater cost of the superstructure.

Three different types of piles are to be used in the new bridge. The northern abutment will be supported on driven tubular steel piles filled with in situ concrete. The southernmost river pier will rest on 130 feet long bored concrete piles on steeply sloping rock, under an overburden of river mud. The remaining pier foundations will consist of driven composite piles. The southernmost land-based pier and the southern abutment were not included in the contract for the foundations but will be built together with the superstructure of the bridge.

Tubular steel piles in northern abutment

The northern abutment piles are designed for a 250 ton load. They will have ample lateral support from the rock ballast at the shore and therefore need only be of 30 inch diameter. The ½ inch thick pile steel tubes are to be driven to rock 216 feet below water level and filled with concrete. Down to a level 40 feet below the river bed the pile is designed as a reinforced concrete column, without assistance from the steel tube which is considered expendable, since it will be subjected to corrosion. Below this level the pile is designed as a composite tubular steel and concrete column, without internal steel reinforcement.

Bored piles in southernmost river pier

The maximum design load on these piles is 330 tons. Steel boring tubes 3 feet 6 inches in diameter, are to be sunk to rock surface and solid rock will be excavated to a depth of at least 4 feet. A steel reinforcement cage and concrete will be placed inside the steel tube and into the rock excavation, forming a 127 feet long reinforced concrete column.

Composite piles

These piles are also designed for a maximum load of 330 tons. One vertical composite pile is to be tested with a 500 ton load.

Because of the great pile length of up to 277 feet, the lower part of the pile, which will be safe from corrosion, is to be a steel tube, 30 inches in diameter and ¾ inch to ⅞ inch thick. The upper part of the pile, to a depth of at least 40 feet below river bed level, will be a pre-tensioned hollow precast concrete tube, 48 inches in diameter and 5 inches thick.

The concrete tube has a steel starter tube of 30 inch diameter attached to its base and this will permit joining to the steel tube below by field butt welding in the same way as the steel tubes of the lower part are joined to each other.

The longer concrete pile sections located in the deeper part of the river will be manufactured in two lengths which are to be joined by the field butt welding of projecting steel rings and by dry packing concrete. The composite piles will be driven with a BSP16B hammer of 79,600 ft lb driving energy.

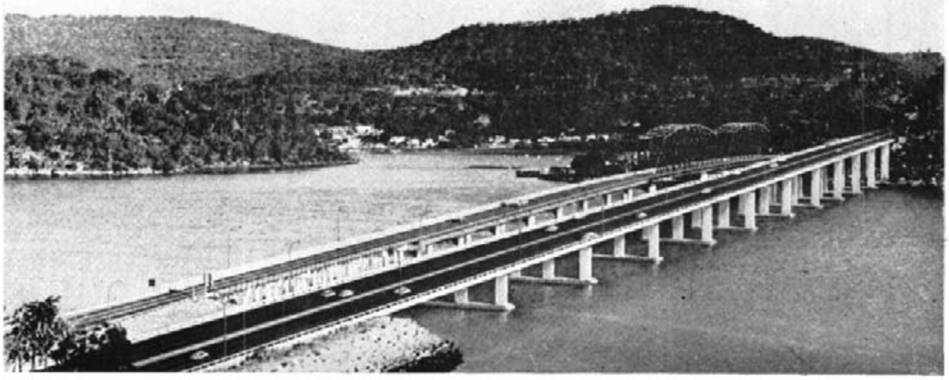
The continuous central cavity of the composite piles will permit internal jetting and the grabbing and removing of obstacles such as sunken logs and boulders, if this is required to assist the driving of the piles.

All the bored piles and the composite piles, with the exception of the test pile, will be battered 1 to 10 either in the direction of the bridge or perpendicular to it to resist side loads on the bridge. Each river pier will be supported on eight piles.

Pile caps

The three columns of each river pier will be supported on reinforced concrete pile caps. The caps will be constructed by first placing precast concrete base sections which will serve as a working platform above low water level. Formwork for the main part of the pile cap will be attached to this platform and steel reinforcement and concrete placed within the forms. The precast hollow concrete piles will be plugged at the top with in situ concrete for a depth of 7 feet and steel reinforcement projecting from the plugs into the pile caps will provide continuity between piles and pile caps.

Artist's impression of the proposed bridge over the Hawkesbury River to serve Sydney-Newcastle Expressway traffic. The view is looking south and shows the present bridge on the left.



Record Traffic Volumes on Sydney-Newcastle Expressway

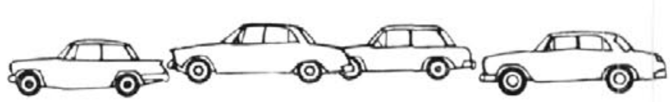
On the Sydney-Newcastle Expressway over the Christmas holiday period from 24th to 28th December, 1969, inclusive, the busiest day was Friday, 26th December. On this day the traffic in both directions totalled 33,072 vehicles on the Berowra-Hawkesbury River section and 34,478 on the Hawkesbury River-Calga section. This was a record day as the previous highest volume of vehicles in one day was on Easter Monday 7th April, 1969, when 30,523 vehicles used the first section and 31,937 vehicles used the second section.

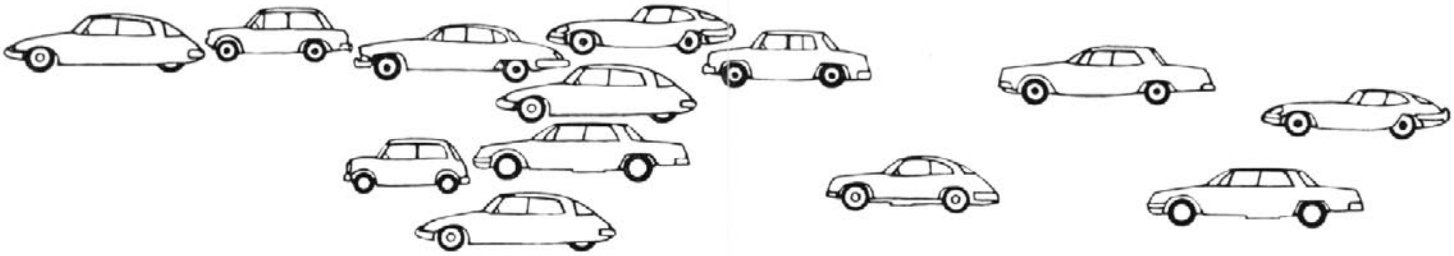
The number of vehicles in both directions for the whole period on the first section was 111,247 and this represented an increase of 27.7 per cent over figures for the same period in 1968.
The number of vehicles on the second section was 113,722 which was an increase of 29.6 per cent over last year's figures.

The table opposite shows traffic volumes on each section of the Expressway for each of the 5 days in both 1968 and 1969. The percentage increase in traffic is also shown.

24th December .. ..
25th December .. ..
26th December .. ..
27th December .. ..
28th December .. ..

24th December .. ..
25th December .. ..
26th December .. ..
27th December .. ..
28th December .. ..





COMPARISON OF TRAFFIC STATISTICS FOR THE CHRISTMAS HOLIDAY PERIOD IN 1968 AND 1969

HAWKESBURY RIVER TO CALGA TOLLWAY

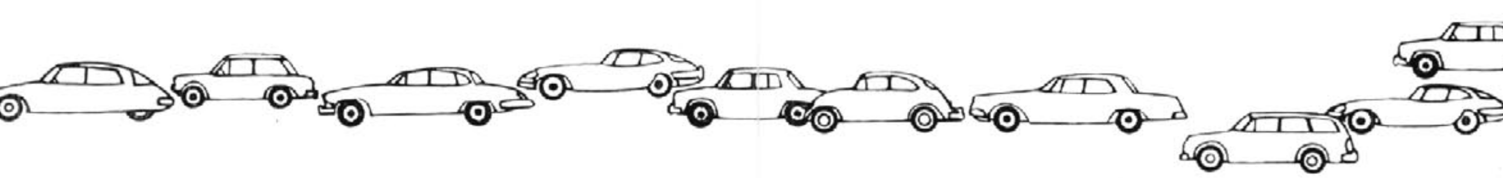
Christmas, 1969			Christmas, 1968			
Northbound	Southbound	Total	Northbound	Southbound	Total	Percentage Increase
15,013	6,083	21,096	11,150	5,218	16,368	28·9
18,580	7,639	26,219	14,036	6,626	20,662	26·9
23,842	10,636	34,478*	17,912	10,993	28,905	19·3
19,141	13,272	32,413	14,631	9,241	23,872	35·8
12,130	21,057	33,189	14,206	9,709	23,915	35·8
88,706	58,687	147,395	71,935	41,787	113,722	29·6

* Maximum traffic on one day—Hawkesbury River to Calga—Friday, 26th December, 1969—34,478.

BEROWRA TO HAWKESBURY RIVER TOLLWAY

Christmas, 1969			Christmas, 1968			
Northbound	Southbound	Total	Northbound	Southbound	Total	Percentage Increase
14,487	5,844	20,331	10,638	4,875	15,513	31·0
17,915	7,219	25,134	13,594	6,411	20,005	25·6
23,012	10,060	33,072*	17,638	10,802	28,440	16·3
18,610	12,860	31,470	14,425	9,066	23,491	34·0
11,884	20,182	32,066	14,061	9,737	23,798	34·7
85,908	56,165	142,073	70,356	40,891	111,247	27·7

* Maximum traffic on one day—Berowra to Hawkesbury River—Friday, 26th December, 1969—33,072.



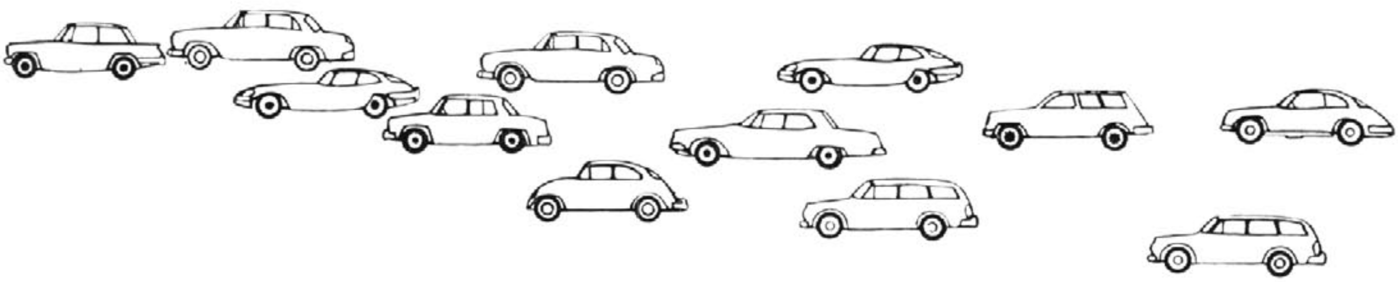
One-way Toll for Sydney Harbour Bridge

On 24th February, 1970, the Minister for Highways, the Hon. P. H. Morton, M.L.A., announced that a system of one-way toll collection will soon be introduced on the Sydney Harbour Bridge.

Under the new system, tolls will be collected from southbound traffic only. The introduction of one-way toll collection is planned to coincide with a change in traffic routing due to the construction of the first section of the Western Distributor and it is likely to operate from about 1st July, 1970. A new road layout of the Sydney Harbour Bridge toll plaza area will be made and will result in the elimination of the toll booths on the western side now used by lanes 1 and 2. Five other existing toll booths will be replaced with new movable units as they will be required only during the morning peak periods. It will still be necessary for rubber marker flaps to be moved at peak periods to channelise traffic into the appropriate lanes.

The existing and proposed toll charges are as laid out in the table on the opposite page.

	Existing rates (each way)	Proposed rates (Southbound only)
Motor car	0.10	0.20
Vehicles (not otherwise specified)—		
(a) whose tare weight exceeds 2 tons	0.20	0.40
(b) whose tare weight does not exceed 2 tons	0.10	0.20
Motor cycle with side-car or motor tricycle	0.5	0.10
Solo motor cycle, motor scooter or horsedrawn vehicle	0.2	0.5



Sydney Harbour Bridge Traffic

During the 12 months ended 30th June, 1969 the road vehicle crossings of the Sydney Harbour Bridge totalled 44,093,000 including 601,000 crossings by omnibuses.

The annual average daily traffic volume on the bridge increased by 6 per cent to 116,200 vehicles per day. The highest volume recorded on any one day was 153,620 vehicles on 3rd April, 1969.

Peak-hour flows in the direction of major flow have also increased, due mainly to the effect of improved approaches to the bridge on the north side brought about by the construction of the first section of the Warringah Expressway. The southbound flow in six lanes in the morning peak period frequently exceeded 11,000 vehicles per hour. In the evening peak period, flows in the order of 9,800 vehicles per hour were recorded. The increase in the morning peak-hour flow was approximately 11 per cent above 1967-68 figures and the evening peak-hour flow increased by approximately 9 per cent.

During the year, 2,932 vehicles were removed from the Sydney Harbour Bridge, Cahill Expressway and the Warringah Expressway by the Department's tow-truck organization. This was an increase of 589 vehicles above the number removed in the previous year and would have been due, in part, to an extension of the tow-truck service to the Warringah Expressway.

Details of breakdowns are shown in the following table:

BREAKDOWNS ON SYDNEY HARBOUR BRIDGE,
CAHILL EXPRESSWAY AND WARRINGAH EXPRESSWAY,
BETWEEN 6.30 A.M. AND 6.30 P.M.
1ST JULY, 1968 TO 30TH JUNE, 1969.

Cause of breakdown	Week days	Weekends and public holidays	Total
Lack of petrol	879	159	1,038
Mechanical breakdown	1,226	179	1,405
Flat tyres	267	74	341
Accidents	125	10	135
Abandoned	10	3	13
	2,507	425	2,932

Proposed New Bridges

☐ ON THE SOUTH WESTERN EXPRESSWAY
☐ ON THE SOUTHERN EXPRESSWAY NEAR WOLLONGONG
☐ OVER LAKE ILLAWARRA AT WINDANG
☐ AT CABRAMATTA

During February, 1970, the Department invited tenders for the construction of one of the eleven bridgeworks required on the South Western Expressway, which is now being constructed between Cross Roads, near Liverpool and the Campbelltown-Camden Road.

This tender is for the building of twin bridges to carry the South Western Expressway over Aero Road at Ingleburn. One bridge will carry northbound expressway traffic and the other southbound traffic. Each prestressed concrete bridge will have three spans with an overall length of 190 feet and a width between kerbs of 55 feet. The bridges were designed by Messrs Maunsell and Partners, Consulting Engineers.

Ten other crossings, some also requiring twin structures, will be built on the 9 mile section of the Expressway on which work is in progress. The length of bridgeworks required on this section totals approximately 3,000 feet.

The Department has already commenced work on the construction of a bridge to carry local traffic over Brooks Road.

In recognition of the rapid rate at which the Campbelltown area is developing, the Department commenced construction of the Expressway in October, 1969 and plans to complete this section by mid-1972.

☐ ON THE SOUTHERN EXPRESSWAY NEAR WOLLONGONG

In December, 1969, the Department called tenders for the construction of the first of five major bridges to be built on the section of the Southern Expressway now being constructed between Gladstone Avenue, Fig Tree and Five Islands Road, Unanderra. The total cost of these five bridges is estimated to be $1,760,000.

The first bridge will be a prestressed concrete structure at Masters Road and will consist of two spans with an overall length of 240 feet. The design for the bridge was prepared for the Department by Messrs Gordon Bull and Associates, Consulting Engineers of Sydney.

It will be constructed on a deviation of Masters Road which will provide an improved link between Springhill Road and the Prince's Highway at Fig Tree. It will also be part of the interchange at Fig Tree and will enable northbound traffic from Port Kembla to load onto the Expressway.

In March, 1970, the contract for the construction of this bridge was awarded to the Hornibrook Group, the contract price being $334,650.

During February, 1970, tenders were called for the construction of dual three-span prestressed concrete hollow box section bridges, 230 feet long, to carry the Expressway over a deviation of Five Islands Road. These bridges were designed for the Department by Messrs Taylor and Herbert, Consulting Engineers of North Sydney.

Tenders were also invited in February for the construction of a single span prestressed concrete hollow box frame bridge, 227 feet long and 72 feet wide, over the Expressway at The Avenue. The design of this bridge was prepared for the Department by Messrs Gordon Bull and Associates.

In addition to these bridges, tenders will be called at an early date for the construction of other major structures to carry the Expressway over the Main South Coast Railway Line and the Australian Iron and Steel Company's railway line.

☐ OVER LAKE ILLAWARRA AT WINDANG

In January, 1970, the Department accepted a tender of $507,219 from Peter Verheul Pty Ltd for bridgework which will duplicate the existing bridge over Lake Illawarra at Windang.

A new two-lane concrete structure, with one footway, will be erected alongside the existing timber bridge. Traffic will be diverted onto the new structure whilst the second stage, involving replacement of the superstructure of the present bridge, is in progress.

When the bridges have been combined as a single structure the new bridge will have a four-lane divided carriageway. The overall length of the bridge will be 983 feet and it will have two footways each 5 feet wide.

This bridge will benefit motorists using the Port Kembla-Shellharbour Road and is scheduled for completion by mid-1971.

Artist's impression of the proposed new bridge at Cabramatta—looking west.

Left: Looking north over earthworks in progress on the construction of the South Western Expressway. Twin bridges will carry the Expressway over Aero Road, Ingleburn, shown in the middle distance.

☐ AT CABRAMATTA

A new five-span prestressed concrete bridge is to be constructed over the railway line adjacent to Cabramatta railway station.

The bridge will be 267 feet long and will have a carriageway width of 44 feet which will provide four traffic lanes. A footway will be provided on each side of the bridge.

The bridge will link Cabramatta Road East and Cabramatta Road West (Main Road No. 534) and will extend over Broomfield Street (on the east side) and Railway Parade (on the west side). It will be constructed slightly to the south of the present bridge by the Department of Railways. The Department of Main Roads will contribute five-sixths of the cost of construction of the bridge and will pay the full cost of the roadworks in approach to the bridge. The total cost is estimated to be approximately $750,000.

Roadside Litter

An Ugly Problem

The Department has intensified its anti-litter campaign on State Highways and Main Roads. Since the 1969 Christmas holiday period the Department has concentrated its efforts on major roads radiating from Sydney with the objective of encouraging and educating the public to keep State Highways and Main Roads clean and tidy.

Litter bins have been installed at convenient locations along the Prince's, Hume, Great Western and Pacific Highways and on Mount Ousley Road, so that road users can avail themselves of these facilities. Information signs have been erected at regular intervals along these roads and, in addition, officers of the Department have been patrolling them in an effort to check irresponsible littering of the roadsides.

People who are observed dropping litter are asked to retrieve it and may be required to give their names and addresses. Offenders are liable to a fine not exceeding $100 or less than $10. In addition Police Officers throughout the State have been instructed by the Commissioner of Police to keep a close watch on motorists and others who litter the roadways and to take appropriate action against offenders.

Litter is generally left at the roadside in one of the following circumstances.

- ☐ Items placed in vehicles before a trip and indiscriminately thrown out during the journey. These items include food wrappings, cigarette packets and newspapers.
- ☐ Wrappings and containers of items purchased from roadside establishments, especially refreshment centres and fruit stalls. These items include drink cartons, cans and bottles, sweets wrappers and fruit peels. Although this material is strewn more thickly around the establishment, the effect of the retailing activity can be noted for several miles along the roadside, diminishing in intensity with distance from the activity.
- ☐ Litter scattered around places where motorists frequently park clear of the road for rest or refreshment including lookouts and other locations with pleasant views over the countryside or coastline, roadside rest areas and roadside fireplaces.
- ☐ Garbage and waste material which has been brought along the road to be dumped. Whereas litter deposited in the previous three circumstances is caused by lack of thought, foresight or concern, the habit of dumping garbage is premeditated and deliberate. It is more prevalent where housing development is sparse and the risk of detection by concerned residents is minimal. It is undertaken by people with a blatent disregard for public interest, who treat secluded sections of roadside (preferably where undergrowth can obscure their actions), and the area underneath bridges and culverts as garbage disposal sites. Dumped garbage often includes large items such as double beds, lounge suites, old household appliances and car bodies.

To remove litter and in an attempt to reduce the amount deposited at the roadside, the Department has taken the following measures.

Large litter bins have been provided at roadside stopping places and signs "Don't litter roadside, please use bins" erected nearby. Unfortunately these bins are often used for the dumping of large bundles of household garbage. When filled in this way the purpose of their erection by the Department is thwarted as they cannot be used by motorists who wish to deposit litter which has accumulated while travelling.

Departmental maintenance gangs are responsible for emptying these bins and maintaining the cleanliness of the area in the immediate vicinity. The period between clearances and clean-ups varies with the duties of the maintenance gang but it is usually not greater than one week and is occasionally carried out twice a week. Litter collected from these bins is either burnt, buried or taken to an established rubbish depot.

The Department's maintenance gangs also remove general roadside litter as part of the routine maintenance of the roads under their control. Several maintenance gangs in the Sydney Metropolitan Area spend some hours every Monday checking for and removing litter left along roads over the weekend. Where there is a retailing activity which results in litter, special efforts are made to keep the roadside clear in the immediate locality. However, in some areas it is not practicable to maintain a regular litter clearance scheme over the full length of all Main Roads. In these cases, the maintenance gang activities are, in general, confined to fireplaces and sections of the roadside at which dumping is frequent. Less frequent clearances are carried out along the remaining sections.

Picking up roadside rubbish which is spread over a large area is always time-consuming and often ineffective, especially under windy conditions. Collection and disposal of scattered litter can often take up to 20 per cent of the available weekly working time of a maintenance gang.

What is Litter?

According to *The Concise Oxford Dictionary* "litter" means "odds and ends, leavings, state of untidiness, disorderly accumulation of papers, etc." and "to litter" means "to make untidy; to scatter and leave lying".

Litter is many things but none of these is good or worthwhile.

- ☐ Litter is an unnecessary and unsightly blot on the landscape. It despoils the natural countryside and is the symbol of an unconcerned community.
- ☐ Litter is a fire hazard. A cigarette butt carelessly tossed into wayside papers could start a disastrous bushfire.
- ☐ Litter is a menace to health. It quickly becomes offensive, especially in hot weather, and creates a breeding ground for disease-carrying vermin.
- ☐ Litter is a potential danger to motorists.

  Discarded papers can blow onto windscreens and obscure the vision of drivers. Broken glass and other sharp objects can puncture tyres.

  Drivers can lose control of their vehicles when swerving to avoid bottles, tins and other items of litter dropped onto the roadway.
- ☐ Litter is expensive to collect and wastes funds and labour.

It takes time and money to collect and remove scattered litter. The more widely it is scattered the more time-consuming and, therefore, the more expensive it is to gather.

- ☐ Litter can be costly to the offender.

Dropping litter and disposing of rubbish or unwanted refuse within the road reserve is an offence which carries penalties of from $10 to $100. This is a lot to pay for an unwanted orange peel or banana skin. Nevertheless it is not unreasonable if it deters potential litter-bugs and encourages them to "think" before they "throw" or rather "think" and not "throw". From all points of view it is cheaper to be tidy.

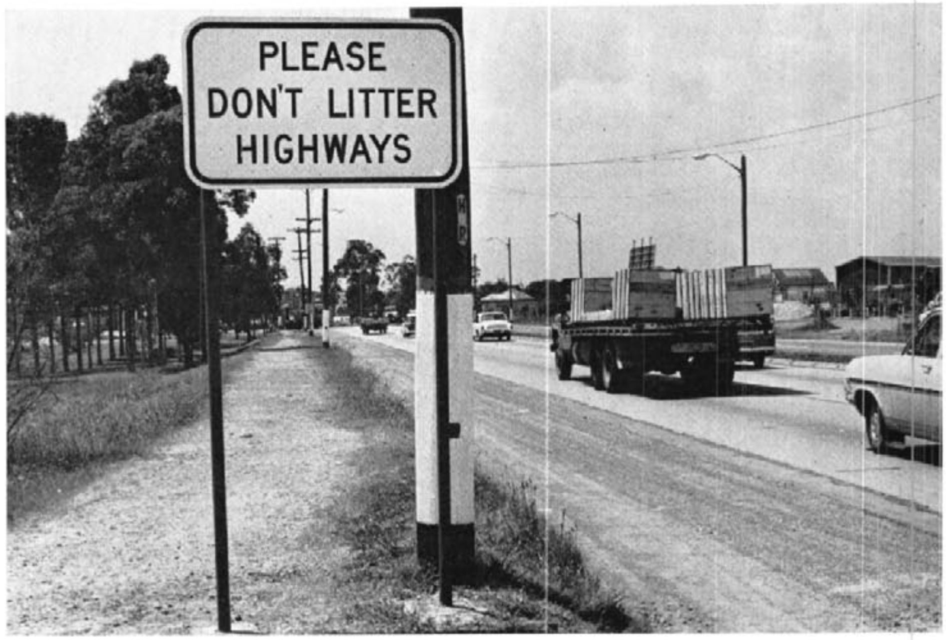
For all these reasons, it is imperative that the habit of scattering litter be curbed. If motorists will dispose of their litter by placing it in the appropriate bins, they will be assisting the Department in its campaign to provide clean and attractive highways.

So let's eliminate litter rather than "rubbish" our roads.

Litter

By involving men and vehicles in unproductive work and preventing them from carrying out their normal pavement maintenance duties, it wastes valuable time and manpower. So it is not only a matter of civic pride that the roadsides be kept clean and tidy, it is also a matter of good economy.

Where rubbish tipping occurs regularly at particular locations adjacent to Main Roads maintained by this Department, signs are erected with the wording "Department of Main Roads. Tipping of rubbish on roadsides is prohibited. By Order". Where tipping occurs on sections of Main Roads maintained by Councils,



Councils are advised to take action on similar lines.

Where a secluded area, such as a short dead end road, becomes a problem due to the tipping of rubbish, the access is fenced off, if practicable, to prevent further placing of rubbish. As can be seen from the illustration, above left, even the erection of a sign "Dumping of rubbish on this land is prohibited" is not always sufficient to discourage those people who are determined to dispose of refuse in this way.

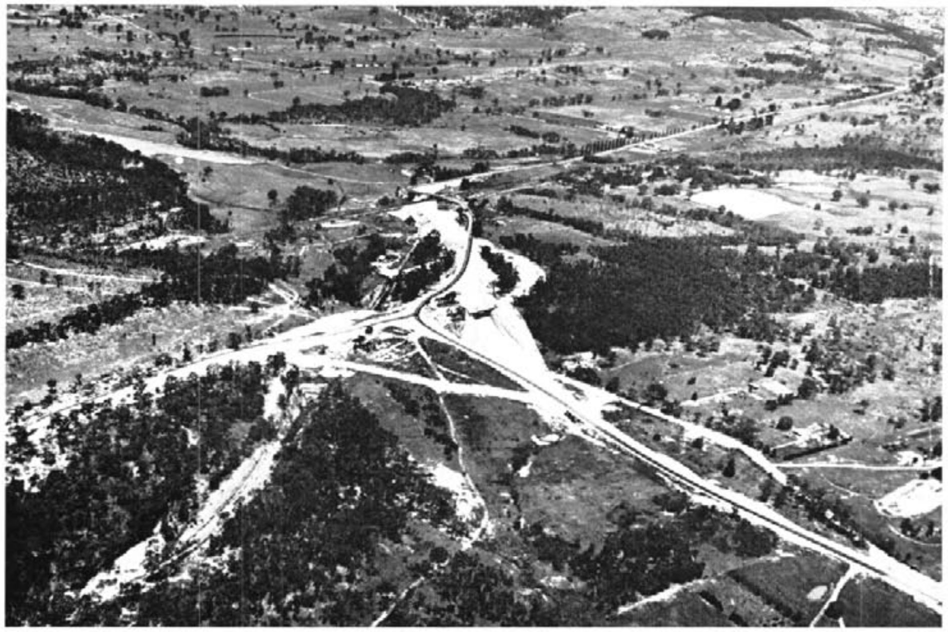
Large sums of money are being spent on highway construction to provide improved travelling conditions. In addition, rest areas have been developed at suitable locations while landscaping and beautification have been undertaken in several areas so that the highways blend harmoniously with their environment.

The Department is endeavouring to maintain all roadside areas in the cleanest possible manner. It is hoped that clean roadside areas will encourage road users to keep them clean and that the motoring public of New South Wales will react favourably and enthusiastically in support of the Department's efforts to keep our State's Highways and Main Roads litter-free.

Grade-Separated Intersection at Marrangaroo

The Department is at present undertaking the relocation and improvement of the intersection of the Great Western Highway and the Marrangaroo-Mudgee-Mullaley Road (Trunk Road No. 55).

This work, which was commenced in October, 1967, includes the construction of two new bridges. A new bridge is to be constructed by the Department, in liaison with the Department of Railways, to carry the Great Western Highway over the railway line, immediately west of the existing narrow overbridge. The other bridge will be required to carry Mudgee-bound traffic over the highway and will eliminate the existing intersection. It is being constructed by the Department across a cutting and was commenced in September, 1968. The bridge is of pre-stressed concrete design and the girders were supplied by E.P.M. Concrete Pty Ltd of Sydney. When placed in position, the end girders form cantilevers and the suspended span between them is 66 feet long.



View looking east along the Great Western Highway towards Lithgow and showing Trunk Road No. 55 on the left.

Traffic travelling towards Mudgee from Lithgow will move to the left off the highway after crossing the new railway overbridge and then travel in a right hand curve onto the new overbridge. For traffic travelling towards Lithgow from Mudgee a new one-way road will be provided and will join the highway near the new railway overbridge. Motorists using the Great Western Highway will drive through the cutting which has already been excavated. A section of relocated highway west of the cutting is already open to traffic. The cutting is through grey volcanic tuff beneath sandstone.

Closer view showing construction of the overbridge to carry Mudgee-bound traffic over the Great Western Highway.

Road and bridge works have already entailed the movement of over 170,000 cubic yards of filling and the total requirement will be approximately 216,000 cubic yards. All work is being carried out by the Department's own forces centred at Bowenfels Works Office. Thirty men are employed on roadworks and twelve men on bridge construction. The total cost of the work is expected to be $750,000.

MAIN ROADS FUND

Receipts and Payments for the period 1st July, 1969 to 31st December, 1969

Receipts	County of Cumberland Main Roads Fund	Country Main Roads Fund
	$	$
Motor Vehicle Taxation (State)	3,819,133	15,276,533
Charges on heavy commercial goods vehicles under Road Maintenance Contribution Act, 1958 (State)	1,625,806	6,503,073
Commonwealth Aid Roads Act, 1969	12,270,000	6,600,000
From Councils under Section 11 of Main Roads Act and/or for cost of work	5,055,571	22,035
Other	439,720	404,773
Total Receipts	**23,210,230**	**28,806,414**

Payments	County of Cumberland Main Roads Fund	Country Main Roads Fund
Maintenance and minor improvements of roads and bridges	3,808,185	10,552,148
Construction and reconstruction of roads and bridges	7,062,399	12,938,712
Land acquisitions	2,212,286	442,406
Administrative expenses	1,021,430	1,839,843
Loan charges, payment of interest, exchange, management and flotation expenses—State Loans	93,560	439,435
Interest and provision for repayment of Loan Borrowings under Section 42A of the Main Roads Act	548,739	181,773
Miscellaneous*	1,427,955	2,033,973
Total Payments	**16,174,554**	**28,428,290**

* 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, 1969 to 31st December, 1969

Receipts	$
Road tolls	2,289,242
Contributions—Railway passengers	142,484
Omnibus passengers	13,426
Rent from properties	75,786
Miscellaneous	—
Loan Borrowings for the Warringah Expressway Approach	—
Total Receipts	**2,520,938**

Payments	$
Cost of collecting road tolls	343,716
Maintenance and minor improvement	305,264
Alteration to archways, etc.	34,542
Provision of traffic facilities	84,936
Administrative expenses	19,905
Loan charges, payment of interest exchange, management and flotation expenses—State Loans	595,100
Interest and provision for repayment of Loan Borrowings under Section 7 of Sydney Harbour Bridge Administration Act	565,312
Miscellaneous	2,903
Transfers to Expressway Fund	—
Total Payments	**1,951,678**

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 for the three months ended 31st December, 1969.

Road No.	Work or Service	Name of Successful Tenderer	Amount
			$
State Highway No. 2	Hume Highway. Shire of Kyeamba. Manufacture, supply and delivery of 95 precast, pretensioned bridge units for the construction of a bridge over Tarcutta Creek Flood Channel at Tarcutta.	Rocla Concrete Pipes Ltd	11,254.65
State Highway No. 4	Snowy Mountains Highway. Shire of Snowy River. Manufacture, supply and delivery of 42 precast, pretensioned bridge planks for the construction of the bridge over Bullock Head Creek 0·5 miles west of Kiandra.	Humes Ltd	24,150.00
State Highway No. 9	New England Highway. Shire of Uralla. Construction of 4 cell 8 feet by 8 feet reinforced concrete box culvert over Church Gully 50·41 miles north of Tamworth.	Enpro Constructions Pty Ltd	15,767.48
State Highway No. 9	New England Highway. City of Newcastle. Haulage of up to 34,000 tons of slag products from B.H.P. Ltd, for the construction of a deviation of the New England Highway at Beresfield.	W. D. Smith Constructions Pty Ltd.	27,540.00
State Highway No. 10	Pacific Highway. Shire of Lake Macquarie. Supply and delivery of up to 500 cubic yards of 2·5 K ready mixed concrete and up to 800 cubic yards of 2·5 K extrusion mix to State Highway No. 10 between Ida Street, Charlestown and Kahibah Road, Highfields.	Newcastle Lime and Cement Co. Ltd.	18,095.00
State Highway No. 10	Pacific Highway. Shire of Tintenbar. Replacement of timber piles, fenders and dolphins with steel pipes, fenders and dolphins on the bridge over the Richmond River at Wardell.	Sydney Bridge and Wharf Pty Ltd	248,524.00
State Highway No. 16	Bruxner Highway. Shire of Ashford. Construction of a 6 cell 10 feet by 5 feet reinforced concrete box culvert, 68 feet long, at 6·42 miles west of Bonshaw and construction of a single cell 15 feet by 8 feet reinforced concrete box culvert, 16 feet 9 inches long, over East Oaky Creek 11·84 miles west of Bonshaw.	Enpro Constructions Pty Ltd	23,755.40
State Highway No. 22	Silver City Highway. City of Broken Hill. Manufacture, supply, and delivery of steelwork for the construction of a bridge over the railway lines in South Road, Broken Hill.	May Bros Pty Ltd	18,438.72
State Highway No. 22	Silver City Highway. City of Broken Hill. Construction of a 2 span steel and reinforced concrete bridge, 140 feet long, over the railway lines in South Road, Broken Hill.	A. Cipolla & Co.	79,978.00
Trunk Road No. 57 and Main Road No. 231.	Shire of Lachlan. Bitumen sealing between 16 miles and 20 miles south of Condobolin on T.R. 57 and bitumen sealing between 21 miles and 24 miles east of Lake Cargelligo on M.R. 231.	Allen Bros Pty Ltd	14,611.12
Main Road No. 199 and Main Road No. 315.	Municipality of Kogarah. Supply and lay asphaltic concrete on Rocky Point Road between Fitzgerald Avenue and Hastings Road, Kogarah on M.R. 199 and supply and lay asphaltic concrete on King George's Road between Greenbank Street and Joffre Street, South Hurstville on M.R. 315.	Bituminous Pavements Pty Ltd	20,305.12
Main Road No. 251	Shire of Gunning. Construction of a 5-span reinforced and prestressed concrete bridge, 255 feet long, over Jerrawa Creek between Dalton and Narrawa.	R. Orford	64,933.50
Main Road No. 593	Municipality of Rockdale. Construction of a 6 span reinforced and prestressed concrete bridge, 690 feet long, over the Cooks River near the International Airport Terminal.	Central Constructions Pty Ltd	1,262,746.00
Various	Shire of Jemalong. Bitumen sealing and resealing at various locations.	Allen Bros Pty Ltd	12,763.18

TENDERS ACCEPTED BY THE DEPARTMENT OF MAIN ROADS—*continued*

Road No.	Work or Service	Name of Successful Tenderer	Amount
			$
Various	Shire of Crookwell. Bitumen surfacing and re-surfacing at various locations.	Allen Bros Pty Ltd	26,547.21
Various	Shire of Coolah. Bitumen sealing and resealing at various locations.	Shorncliffe Pty Ltd	40,318.25
Sydney-Newcastle Expressway.	Shires of Hornsby and Gosford. Construction of the foundations for the proposed new bridge over the Hawkesbury River.	John Holland (Constructions) Pty Ltd.	1,330,629.00
Western Expressway	City of Penrith. Manufacture, delivery and erection of 16 precast prestressed concrete girders, 56 feet 6 inches long, and 8 precast, prestressed concrete girders, 102 feet long, for the construction of the bridge over Mulgoa Road.	Transbridge Pty Ltd	80,556.00
Western Expressway	City of Penrith. Construction of foundation piling including excavating and concreting piles for twin bridges over Mulgoa Road.	Frankipile Australia Pty Ltd	47,696.80
Southern Cross Drive	Municipalities of Randwick and Botany. South Dowling Street extension. Supply and erection of manproof boundary fencing from Epsom Road, Rosebery to near Wentworth Avenue, Mascot.	Sydney Gate and Fence Co. Pty Ltd.	15,697.50

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 31st December, 1969.

Council	Road No.	Work or Service	Name of Successful Tenderer	Amount
				$
Coolah	Various	Supply and delivery of 2,236 cubic yards of aggregate to stockpiles at various locations.	Furney Bros Pty Ltd	12,517.01
Ku-ring-gai	S.R. 2043	Reconstruction and widening between Grosvenor Street and Hornsby Shire Boundary.	Bituflex Pty Ltd	38,487.00
Namoi	M.R. 343	Winning, placing and compaction of earthworks between 0·77 miles and 1·45 miles and between 1·77 miles and 6·40 miles west of Wee Waa.	Ted Bawden Pty Ltd	13,905.05
Newcastle	S.H. 10A	Widening of the present 2 span concrete bridge, 43 feet 6 inches long, over Cottage Creek with precast, pretensioned bridge units and bridge planks.	J. V. Harris	23,415.00
Nundle	Various	Bitumen seals and reseals totalling 83,188 sq yards at various locations.	Shorncliffe Pty Ltd	11,721.68
Rylstone	Various	Bitumen surfacing and resurfacing at various locations.	Boral Road Services Pty Ltd	13,573.18