MAIN ROADS

JOURNAL OF THE
DEPARTMENT OF
MAIN ROADS
NEW SOUTH WALES
SEPTEMBER, 1961

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COVER SHEET

Snow clearing in progress on Mount Kosciusko Road east of Smiggin Holes

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Australia's Road Needs Ten Year Plan

" Australia's Road Needs—Ten Year Plan " describes the results of the first detailed Australia-wide survey of road needs ever undertaken. It has been published by the National Association of Australian State Road Authorities. The survey was carried out by the individual members of the Association, namely the road authorities of each of the six States, together with the Commonwealth Department of Works which represents Commonwealth Government territories. In towns, only roads carrying substantial through traffic were included within the scope of the survey, it being considered that, in the main, the financing of other town streets was within the reasonable capacity of urban ratepayers.

The survey indicates that for the next ten years the maintenance of Australia's roads, including bridges, together with construction works necessary to replace worn-out roads and bridges and to provide improved or additional facilities to correspond with anticipated increased traffic, will cost £2,350 million. Based on current revenue conditions, the estimate of revenue likely to be available to road authorities during the period is £1,540 million. Thus for Australia to keep abreast of requirements total road expenditure should be increased by about 50 per cent. About half of this increase is required to offset anticipated future loss in the value of money.

Details of that part of the Australian road needs survey referring to the Main Roads system in New South Wales have been published separately, partly in the last issue of " Main Roads " and partly in the current issue.

The Road Needs of New South Wales

A TEN YEAR SURVEY (1960-1970)

PART 2 — PREDICTION OF REVENUE

DURING 1959-60 *a survey was made to determine the construction and maintenance needs of the roads of New South Wales for the ten-year period from the 1st July, 1960, to the 30th June, 1970. The June, 1961, issue of "Main Roads" contains an account of how the survey was made and what the needs were found to be, expressed in terms of road work and in terms of money. It was estimated that the total funds needed for the maintenance and construction of the Main Roads of the State over the ten-year period* (1960-1970) *would be* £515 *million.*

The following article describes how revenue for the ten-year period, from current revenue sources, has been estimated to be £315 *million, showing that a further* £200 *million would be needed during the ten-year period to carry out the proposed ten-year programme.*

The revenue of the Department of Main Roads, New South Wales, for expenditure on Main Roads is obtained from four main sources, as follows:—

(i) An annual tax paid by vehicle owners at the time they pay for vehicle registration and registration renewal (Motor Vehicles (Taxation) Act, 1951).

(ii) A road maintenance charge on trucks with a carrying capacity over four tons (Road Maintenance (Contribution) Act, 1958).

(iii) An annual contribution by the Commonwealth Government (Commonwealth Aid Roads Act, 1959).

(iv) Contributions by Councils within the County of Cumberland based on land valuation (Section 11 of the Main Roads Act). (Country Councils also contribute to works on Main Roads, but their contributions are not paid to the Department of Main Roads.)

Revenue from the first two of these sources is largely dependent on the number of vehicles registered and on their weights, because the scale of taxation is based on weight of vehicle. It was necessary therefore to study motor vehicle registration trends in order to estimate future revenue.

ESTIMATES OF FUTURE NUMBERS AND WEIGHTS OF MOTOR VEHICLES

(*a*) *Numbers*

The number of vehicles on the roads increases both with growth in population, and with the trend for a higher proportion of people to own vehicles. The study of probable motor vehicle registration in New South Wales over the next ten years was therefore made through an examination of population forecasts and of the trend in the relationship of vehicles to population, commonly expressed as vehicle/population ratio (number of vehicles per 100 population).

Past population figures were available from the Commonwealth Bureau of Census and Statistics, as well as predicted figures to 1970. From the Department of Motor Transport, New South Wales, figures were available up to 1959 for the numbers of vehicles registered. These two sets of figures enabled vehicle/population ratios to be derived of motor vehicles per 100 population for each year from 1930 up to 1959 (see Fig. 1).

Similar ratio figures for the United States* were available, including predicted figures up to 1975, and for New Zealand†, including predicted figures up to 1970. These two sets of ratios appear also on Fig. 1.

* Third Progress Report, Secretary of Commerce, House Doc. 91. 2·3·59.

† Roading Survey, National Roads Board 1959.

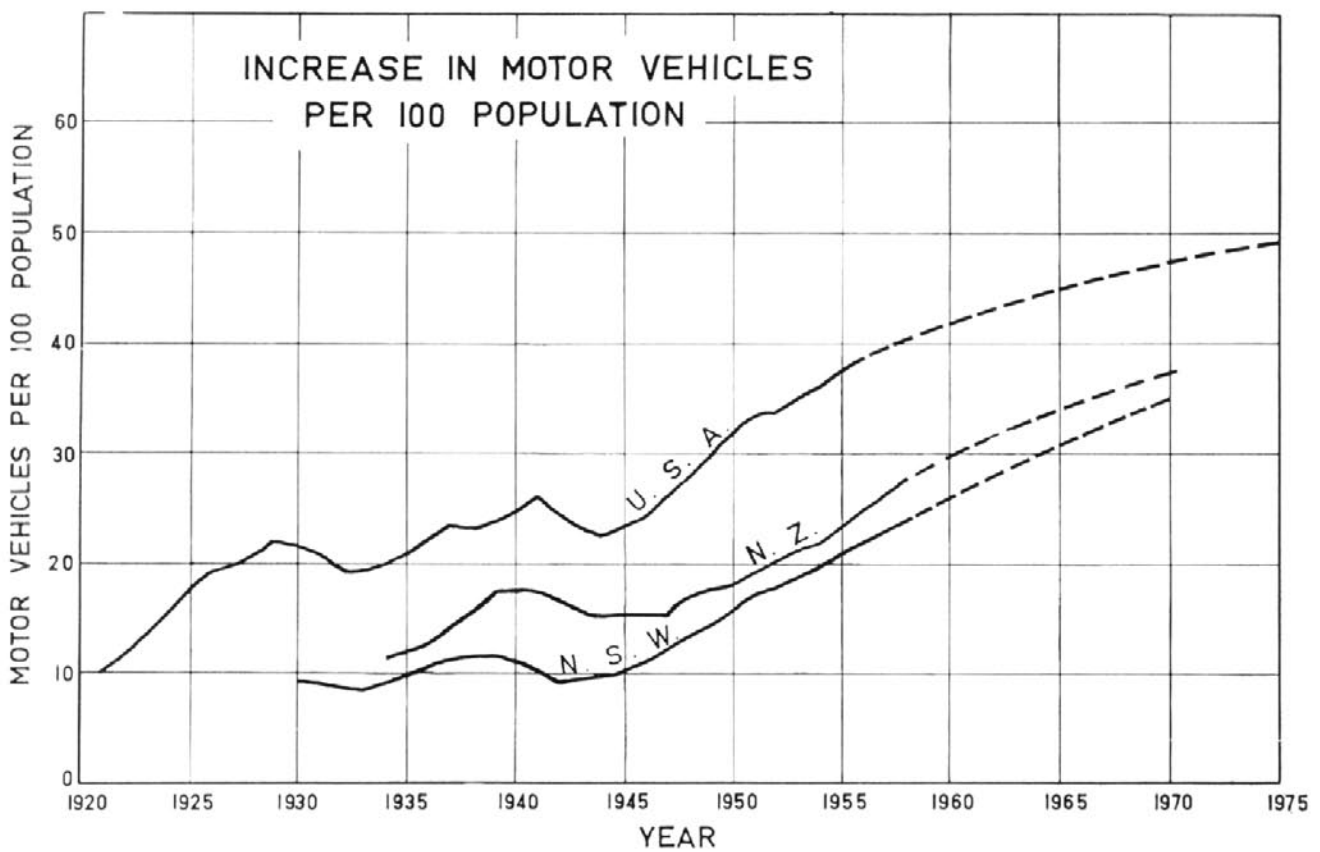


FIGURE 1

In 1945, New South Wales had 10 vehicles per 100 population whilst the United States had approximately 24 vehicles per 100 population, *i.e.* vehicle/population ratio in New South Wales was about 43 per cent of that in the United States. By 1959 this figure had increased to 61 per cent. The trend of this increase over the last 20 years has been uniform (see Fig. 2), and it was considered reasonable to assume that by 1970 the New South Wales ratio will have increased to 73 per cent of the American ratio.

The New South Wales figure for vehicles per 100 population in 1959 is 25; this is estimated to rise to 35 by 1970. By comparison the figure for the United States in 1959 was already 41, estimated to rise to 47 by 1970. Figures for some individual States in the United States of America for the year 1958 are—California 49, Illinois 36, Ohio 40, Texas 44, and Wyoming 49.

The application of these figures estimated for number of vehicles per 100 of population for New South Wales for the period 1960-1970 to the population prediction for New South Wales gave a prediction of the number of motor vehicles in New South Wales for each of the years in the period 1960-1970. The top line of the graph (Fig. 3), showing total registered vehicles, has been extended to the year 1970, using the figures obtained from this calculation.

Of the motor vehicles on the roads of New South Wales, some 2½ per cent are either Government vehicles or are otherwise exempted from contribution to the revenue of the Department of Main Roads. Excluding this 2½ per cent, records of registered vehicles, divided into various classifications, were plotted for the years 1950-1959 (Fig. 3). These various classifications divide total vehicles into—

(i) Cars: (including taxis, country buses, hire cars and tourist vehicles).

(ii) Commercial vehicles:

(*a*) Station waggons, utilities and panel vans.

(*b*) Trucks and buses.

(iii) Cycles.

The predictions shown on Fig. 3 of the number of cars, station waggons, etc., trucks and buses, and cycles, separately for each year up to 1970, were made by

extending the current trends, working within the prediction for total registered vehicles.

In 1959, there were 926,000 vehicles in New South Wales contributing to Department of Main Roads revenue. By 1970, it is estimated that this figure will rise to 1,520,000, an increase of 64 per cent.

(*b*) *Weights*

The most recent census of motor vehicles in New South Wales provides figures as at the 31st December, 1955, and from these, average weights of the various classes of vehicles were calculated. As a check on any trends since that date, average weights of the classes of newly registered vehicles were calculated over a number of sample monthly periods in 1959 and 1960, using figures available from the Department of Motor Transport. As there was no significant tendency to vary over the years 1955-1960, average vehicular weights were assumed constant for the period 1960-1970.

ESTIMATES OF REVENUE

(*a*) *Motor Vehicles (Taxation) Act*, 1951

Contributions under this Act are based on weight. Thus the tax on a car weighing 14 cwt. (say a Morris Minor sedan) would be £4 13s. 6d. p.a., on a car weighing 20·5 cwt. (Holden sedan) £6 16s. 6d. p.a., and on a car weighing 31·5 cwt. (Dodge sedan) £10 10s. 0d. p.a. This tax is in addition to the registration fee of £1 10s. 0d. p.a. per vehicle which is not available for road works. The respective contribution rates applicable to the average weights for cars, station waggons, utilities and panel vans were multiplied by the predicted numbers of vehicles of each

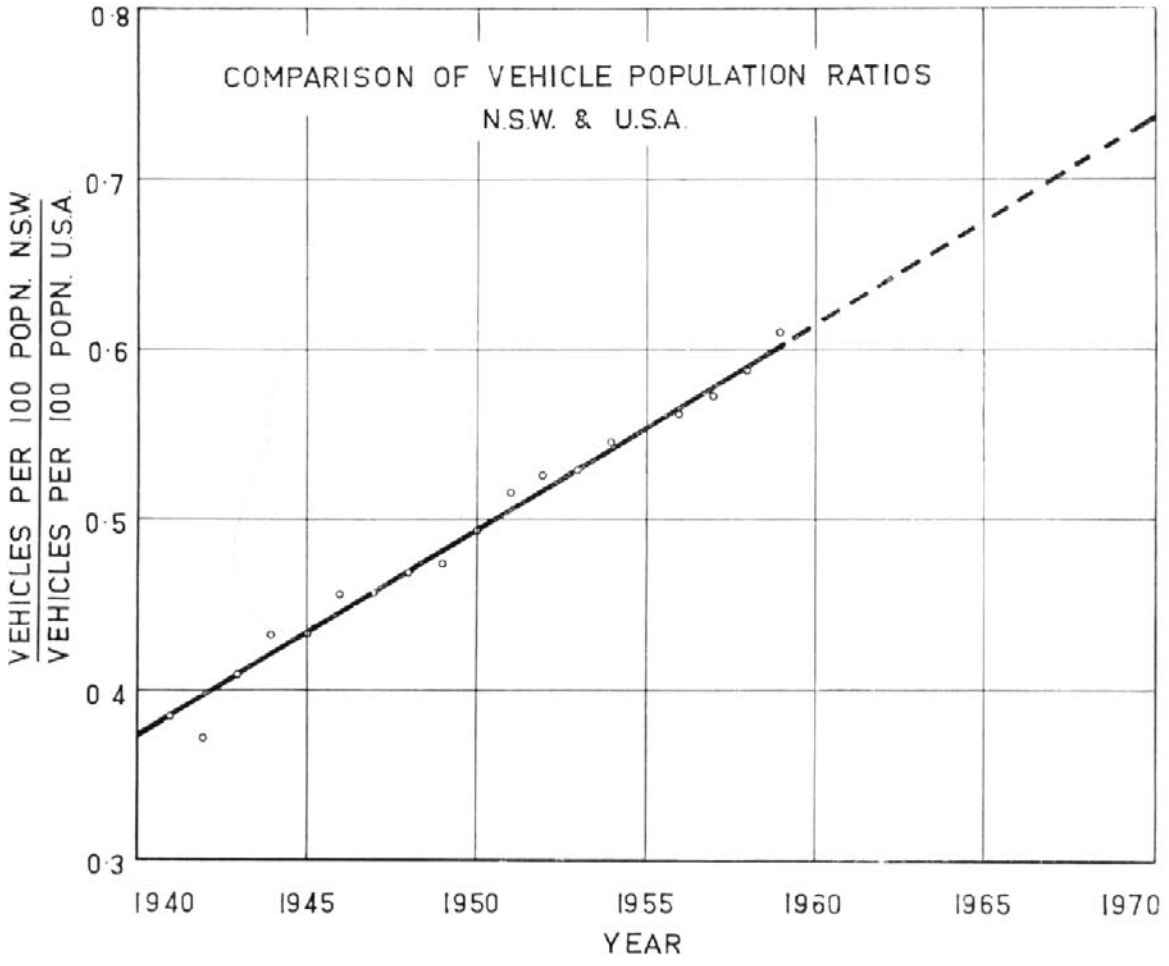


FIGURE 2

classification each year over the ten-year period. This gave estimated income under the Motor Vehicles (Taxation) Act from these vehicles.

With cycles, it was found that the ratios of solo cycles (annual contribution £1 7s. 0d.) to side-car vehicles (annual contribution £2 7s. 6d.) was about 5 to 1, and on this basis the average contribution for all cycles was adopted at 30s. 0d. per vehicle. The predicted number of cycles over the ten-year period, multiplied by 30s. 0d., gave estimated income from these vehicles.

For trucks, the average contribution per truck was determined for each of the past eight years. The figures showed variations owing to changes during the period in the taxation scale and the method of its application. These variations could be allowed for. From a study of the figures, it appeared reasonable to assume that the average contribution per truck for each of the next ten years would be fairly constant. This average figure was then multiplied by the estimated number of trucks for each year of the period 1960-70 to obtain annual revenue figures.

The total estimated revenue under the Motor Vehicles (Taxation) Act for the period 1960-1970 is £112 million.

(*b*) *Road Maintenance* (*Contribution*) *Act*, 1958.

Under this Act, trucks with a load capacity exceeding four tons are rated at one-third of a penny per ton-mile on the sum of the tare weight and 40 per cent of the load capacity. The charges are collected for the Department of Main Roads by the Department of Motor Transport.

The forecast of revenue from this source was obtained by taking the net receipts for the year 1959-1960, being the first year typical of a full year's collection, and

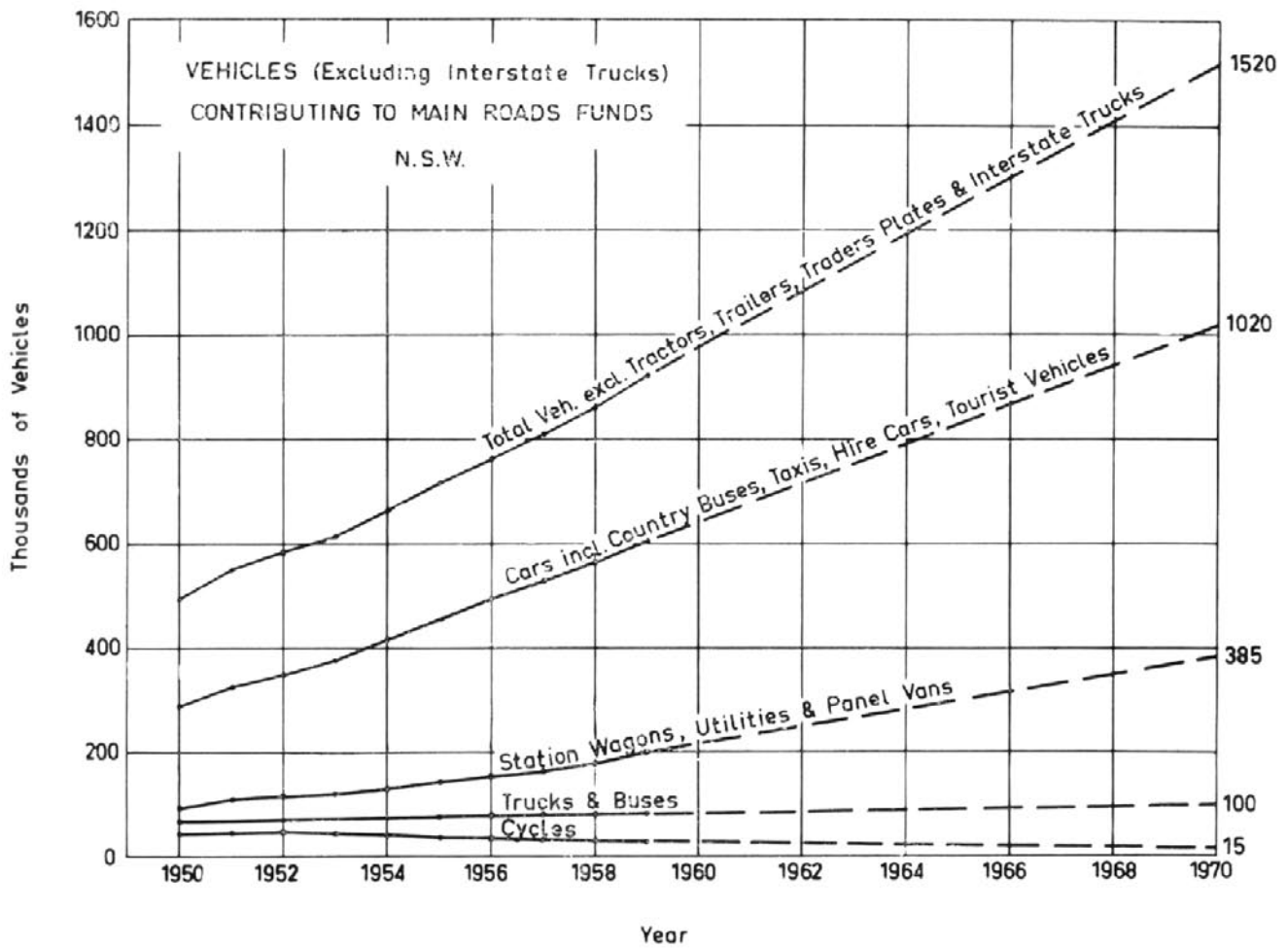


FIGURE 3

increasing these for subsequent years in proportion to the estimated number of trucks.

The estimated revenue from this source for the period 1960-1970 is £31 million. This estimate allows for administration charges which are met from revenue under the Motor Vehicles (Taxation) Act, but which are deducted here for the sake of convenience of description.

(*c*) *Commonwealth Aid Roads Act*, 1959

Prior to 1959, the Commonwealth made available to the States, for expenditure on roads, part of the Commonwealth tax on imported petrol and petrol refined in Australia. This was done under Commonwealth Aid Roads Acts.

With the passing of the 1959 Act, the Commonwealth contribution ceased to be directly related to the amount collected in petrol tax. Revenue from the Commonwealth Government for roads in the States under this Act is now fixed until June, 1964. The amount for the year 1959-1960 was £42 million, and the Act provides for increments at the rate of £4 million per annum in each of the four succeeding years. These increments, in part, are tied to limiting conditions as defined in the Act. The amount which comes to New South Wales (about 28 per cent of the whole) is fixed in relation to the other States in terms of population, area, and number of registered motor vehicles. Of the total for each State, only 60 per cent may be spent on Main Roads and 40 per cent must be spent on roads which are not Main Roads. In effect, the Department of Main Roads is eligible to receive approximately one-sixth of the total amount provided by the Commonwealth Government for the States. Revenue to the Department from this source over the four-year period June, 1960–June, 1964, is estimated to total £35 million.

Over the following six years to 1970, the assumption was made that there might be a further small progressive increase in the amount distributed under this Act. On this basis, the estimated revenue from this source to the Department of Main Roads for the period June, 1964–June, 1970, was estimated to be £76 million, the total for the ten years thus being £111 million.

(*d*) *Main Roads Act* (*Section* 11)

Provision is made in the Main Roads Act for Councils in the County of Cumberland, *i.e.* in Sydney and its rural environs, to be subject to an annual levy to provide their share of the cost of Main Road works. This levy is at the rate of a half-penny in the pound on the unimproved capital value of all lands ordinarily rateable under the Local Government Act and situated in the Councils' areas, except that the levy in the case of lands used principally for rural primary production is reduced by one-half.

The value of rateable land in the County area was plotted from 1938-1939 forwards to study the trend. From 1949-1950 to 1959-1960 it was found that the trend showed an increase in valuation of not less than 18 per cent per annum. Due to the effect of the war years, and the post-war years up to 1948-1949, when the unimproved capital value of land remained virtually constant, the high annual increases in land value over the ten years from 1949-1950 to 1959-1960 would appear to give an unrealistically high trend if simply extended to 1970.

For this reason allowances made for future increases in land valuation were at a lower rate than has been experienced over the past decade. Estimated revenue from this source for the next ten years is £34 million.

(*e*) *Total predicted revenue to Department of Main Roads*

The total predicted revenue to the Department for the ten years from 1st July, 1960, was thus estimated at £288 million, made up as follows:—

	£million
Motor vehicle taxation	112
Road maintenance contribution ..	31
Revenue under Commonwealth Aid Roads Act, 1959	111
Revenue under Section 11, Main Roads Act	34
	288

(*f*) *Revenue for Main Roads purposes available from Country Councils*

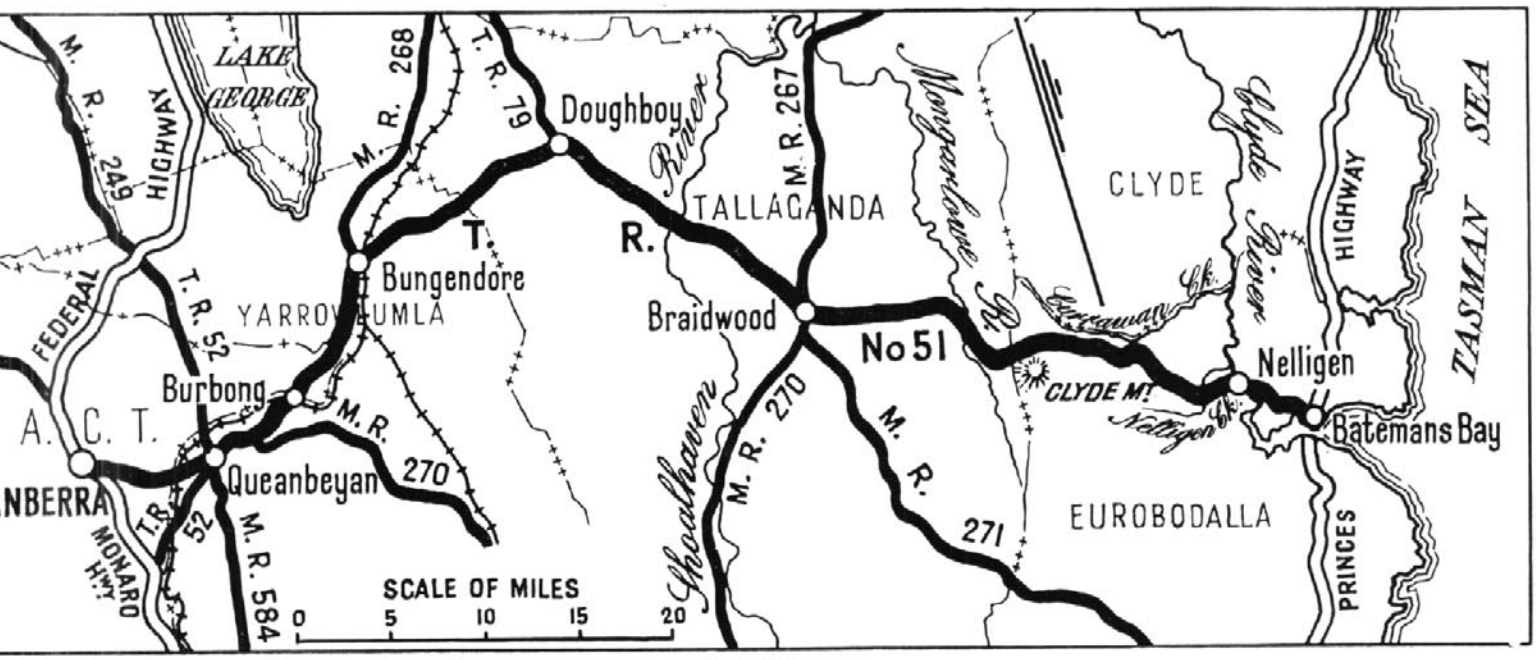
Based on present expenditure by Country Councils on Trunk Roads and ordinary Main Roads, an estimate of the probable amount which Country Councils would be reasonably capable of providing for expenditure on such roads for the next ten years was considered to be £27 million.

FUNDS NEEDED COMPARED WITH ESTIMATES OF REVENUE AVAILABLE

The total needs for Main Roads over the period 1960-1970 were estimated as requiring £515 million. Estimated income at current rates to meet these needs is only £315 million (Department £288 million, Councils £27 million), so that an additional £200 million will be required.

The accuracy of this estimate of revenue needed is necessarily dependent on the accuracy with which the future numbers and weights of motor vehicles have been estimated. Fewer vehicles would mean less revenue but also a somewhat lesser need. On the other hand if vehicle numbers should increase more than predicted, revenue would be greater than estimated but would be offset by a corresponding increase in road needs.

The figure of £200 million may be regarded as being a reliable estimate of the additional funds needed, additional to ordinary revenue, to meet the needs of Main Roads of New South Wales for the ten-year period from 1st July, 1960, to 30th June, 1970, the manner of determination of needs having been described in detail in the preceding number of " Main Roads ".



CANBERRA–BATEMAN'S BAY TRUNK ROAD

RECONSTRUCTION AND BITUMEN SURFACING APPROACHING COMPLETION OVER 77 MILES

FOR a number of years the Department of Main Roads and the three Shire Councils concerned, Eurobodalla, Tallaganda and Yarrowlumla, had under consideration the reconstruction and bitumen surfacing of this Trunk Road linking the tablelands and the coast, a distance of 85 miles. In 1955, a conference between representatives of these Councils and of the Department of Main Roads at Braidwood agreed generally that, on completion of some other Main Road works in their respective areas judged to be more urgent, the Councils, with the financial assistance of the Department of Main Roads, would endeavour to arrange to commence a long period co-ordinated programme for the reconstruction and bitumen surfacing of the Trunk Road over a total length of 77 miles.

Reconstructed road near Bungendore

The Canberra-Coast Trunk Road is one on which the cost of road works is normally shared between the Councils concerned and the Department of Main Roads, the Councils being subsidised to the extent of 75 per cent. In addition, the Department pays the full cost of bridge construction and the full cost of all work on a " mountain pass " section which comprises the descent on Clyde Mountain from the tableland to the coastal area, a length of 13·2 miles.

In 1957, the Commonwealth Government developed an interest in this Trunk Road, serving as it does not only to link the Australian Capital Territory with Commonwealth territory at Jervis Bay, but also to provide the main outlet from Canberra to the holiday resorts on the south coast of New South Wales. As a result the Commonwealth offered to contribute £300,000 towards the cost of the reconstruction and bitumen surfacing of the road. This enabled the work which the Councils and the Department of Main Roads desired to carry out to be undertaken sooner than would otherwise have been the case, and a programme was drawn up providing for reconstructing and bitumen surfacing the road over a period of three years commencing 1st July, 1958, together with provision over a longer period of a large bridge over the Clyde River at Nelligen to take the place of an existing ferry. The total estimated cost of all these works was £1,150,000, towards which, as indicated above, £300,000 would be provided by the Commonwealth Government. The remainder of the cost is being shared as follows: £37,500 total by the three Councils, and the balance, estimated at £812,500, by the Department of Main Roads.

The reconstruction generally follows along the line of the old road, but improvements are being effected to curvature, width, etc., throughout the length. The steep grade comprising the Clyde Mountain ascent is being retained, because the cost involved in any departure from this line would be excessive, having regard to the rugged nature of the country traversed.

It was arranged that the Department of Main Roads should carry out by day labour the work required on the more mountainous section of the road over a total length of approximately 21 miles, including the ascent up the mountain. The remainder of the road work is being carried out by the three Councils concerned, mainly by contract.

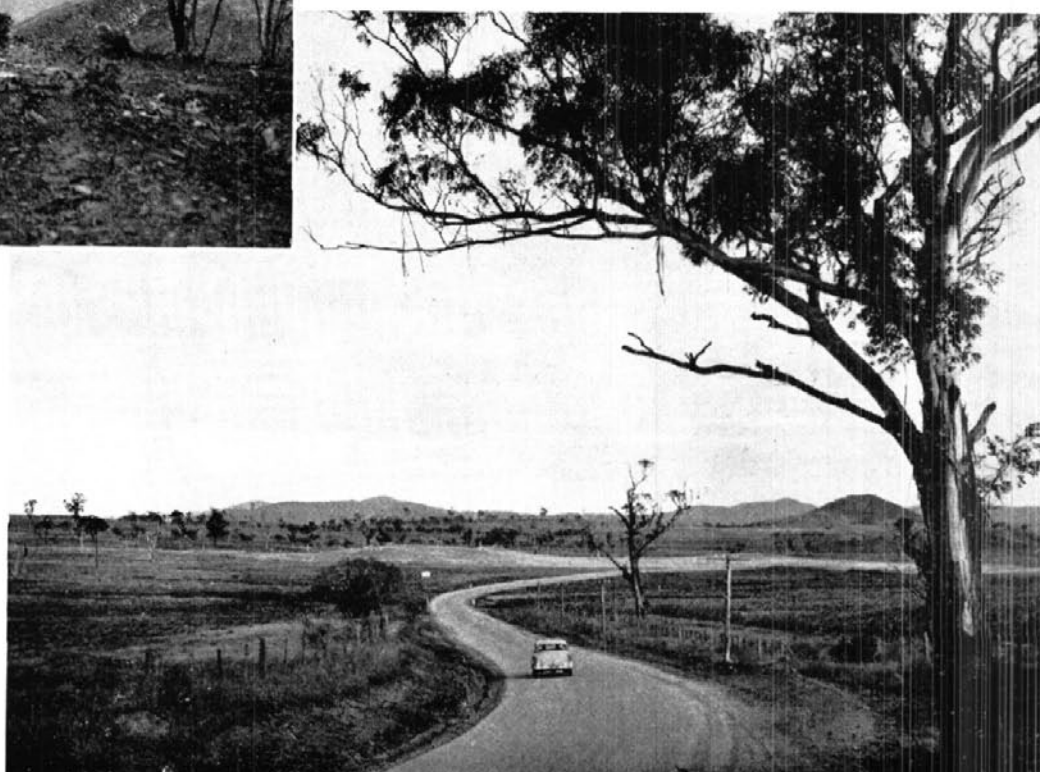
It is anticipated that the whole of the work on the Trunk Road will be completed early in 1962 with the exception of the large bridge over the Clyde River at Nelligen.

The work carried out or in progress in the three Council areas is outlined briefly below.

YARROWLUMLA SHIRE

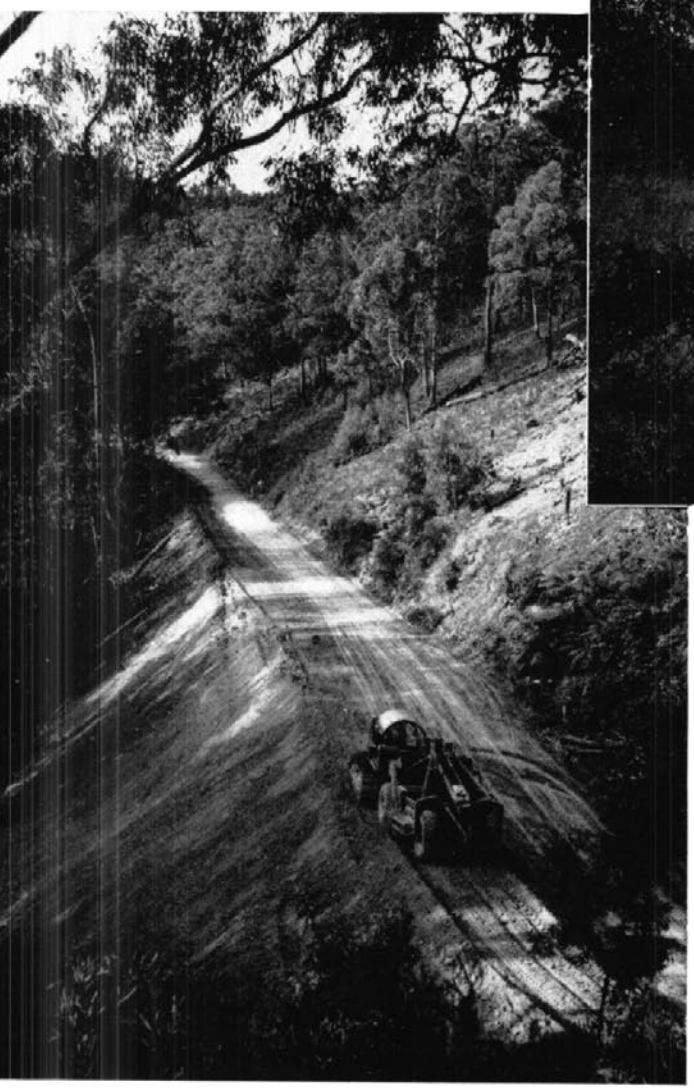
From its commencement at Queanbeyan to the Tallaganda Shire boundary, Trunk Road No. 51 extends a distance of 24 miles. Of this length 2 miles are in the Municipality of Queanbeyan and 5 miles between Burbong and Brooks' Hill, are in the Australian Capital Territory.

Reconstructed road between Bungendore and Doughboy



A view of the new work east of Braidwood

General view from Clyde Mountain looking east towards Bateman's Bay



Reconstruction on Clyde Mountain

Reconstruction and bitumen surfacing of the length between Queanbeyan Municipal boundary and Burbong have been completed by Yarrowlumla Shire Council and this length connects with the bitumen surfaced road in the Australian Capital Territory. At Brooks' Hill, the construction of a deviation just over a mile long is now proceeding. The work is being carried out to base course stage by contract to Council, which will carry out bitumen surfacing of the deviation by day labour.

Between the end of this deviation and Bungendore, 1·6 miles of the Trunk Road have already been reconstructed and bitumen surfaced by Council, leaving a length of 2·4 miles yet to be strengthened and sealed.

At Turallo Creek immediately east of Bungendore, a bridge 99 feet with a carriageway 24 feet wide is being constructed by contract to Council. The approaches to the bridge and the deviation on which it is sited will be built by Council by contract. The reconstruction and bitumen surfacing of the remainder of the Trunk Road beyond Turallo Creek to the boundary with Tallaganda Shire have been completed by Council by contract and day labour. Included in this length are bridges over Moura Creek and Deep Creek each 24 feet wide and 50 feet and 100 feet long respectively.

TALLAGANDA SHIRE

The length of Trunk Road No. 51 within the Shire of Tallaganda is 33 miles. From the boundary with Yarrowlumla Shire to Doughboy, a distance of 5 miles, reconstruction and bitumen surfacing of the Trunk Road have been completed by Council, the work having been carried out partly by contract and partly by day labour.

The length of 17 miles between Doughboy and Braidwood had been provided with a bitumen surface before the current programme of improvement was put in hand.

East of Braidwood, a length of 5 miles has been provided with a bitumen surface by Council by day labour following strengthening, and reconstruction for a further 5 miles has recently been completed by contract (4·5 miles) and day labour (·5 of a mile) and is now being bitumen surfaced by Council's own day labour forces. Completion of the section will extend the reconstructed Trunk Road to the approaches to the site of a new bridge to be built over the Mongarlowe River.

Between Queanbeyan and the Mongarlowe River, the stage has been reached when there is a continuous bitumen surface between Queanbeyan and Brooks' Hill and from 1·7 miles east of Bungendore to 5·0 miles east of Braidwood, a distance of 45 miles.

Construction in progress on deviation at Currawan Creek, 15M. west of Bateman's Bay

New concrete and steel bridge over Nelligen Creek, 3M. west of Nelligen

MONGARLOWE RIVER TO BATEMAN'S BAY

East of the Mongarlowe River there is a length of 5 miles of the Trunk Road within the Shire of Tallaganda. Thence to Bateman's Bay is a length of 23 miles situated in the Shire of Eurobodalla.

For construction purposes, the length from Mongarlowe River to Bateman's Bay has been divided into the following four sections:—

A reconstructed section near Bateman's Bay

Section 1—Mongarlowe River to Nelligen Creek—20·25 miles.

Section 2—Nelligen Creek to Nelligen—2·5 miles.

Section 3—Nelligen to 4·5 miles west of Bateman's Bay—·75 of a mile. This includes the crossing of the Clyde River.

Section 4—From the Clyde River crossing to Bateman's Bay—4·5 miles.

Work on Sections 1 and 3 is being carried out by the Department of Main Roads and on Sections 2 and 4 by the Eurobodalla Shire Council.

Section 1. *Mongarlowe River to Nelligen Creek*

The reconstruction work on Section 1 is the most difficult as it involves the ascent of Clyde Mountain, the main ascent being between 15·5 miles and 23·0 miles from Bateman's Bay, where the total climb is about 2,000 feet, the steepest section being between 20·0 miles and 23·0 miles where the average grade is approximately 9 per cent.

The earthworks on the ascent of Clyde Mountain comprised mainly the widening of the existing road, but the rate at which the work could be carried out was slowed down by the need to make provision for traffic at all times while construction was proceeding. Care was also required in blasting operations to avoid disturbance of the batters, as the material in places dipped steeply towards the road. A major rock slide took place in December, 1959, near the summit when approximately 40,000 cubic yards of material came down from above the road, closing it for about four weeks.

A major deviation from the original route of the road was made between 13·0 miles and 15·0 miles from Bateman's Bay to avoid two crossings of Currawan Creek. The deviation, which partly followed an old high-level road, not only eliminated the creek crossings,

but also provided an improved alignment. Earthworks on this deviation were the heaviest on the Trunk Road and averaged approximately 42,000 cubic yards per mile, the material being mainly shale and quartzite.

Earthworks on Section 1 have been completed and a dustless surface has been provided over a length of 5 miles between the Currawan Creek deviation and Nelligen. The provision of a dustless surface over the full length of this Section will be undertaken during the coming summer.

At Cabbage Tree Creek near the Currawan Creek deviation, a pre-stressed concrete bridge 156 feet in length and 24 feet between kerbs, is being built by the Department of Main Roads by day labour.

Immediately west of Nelligen, a steel and concrete bridge, 225 feet long with a carriageway 24 feet wide, has been constructed over Nelligen Creek by the Department of Main Roads by day labour.

Included in the work yet to be carried out on this Section is the replacement at a later stage of the existing timber bridge over the Mongarlowe River.

Section 2

The route of the Trunk Road on Section 2 follows the old road very closely along the southern bank of the Clyde River, minor deviations only having been made to give a flood-free road.

The earthworks and the construction of culverts on this section are being carried out by contract to the Eurobodalla Shire Council and are nearing completion. Council has commenced the provision of a gravel pavement on this section, following the completion of which a dustless surface will be laid.

Section 3

The work on Section 3 comprises the construction of a bridge over the Clyde River and the approaches to it.

It is proposed to span this crossing with a pre-stressed concrete bridge 824 feet in length having a carriageway width of 24 feet. Tenders for the construction of this bridge have been invited. The bridge will replace a ferry service.

Section 4

Reconstruction of Section 4 was generally along the old route of the Trunk Road. The earthworks were carried out by the Eurobodalla Shire Council partly by contract and partly by day labour. A gravel pavement and a bitumen surface have also been provided by Council over this length.

The work being carried out by the Department of Main Roads between Mongarlowe River and Bateman's Bay is under the supervision of the Department's Divisional Engineer, Bega—Mr. R. Fitzhardinge.

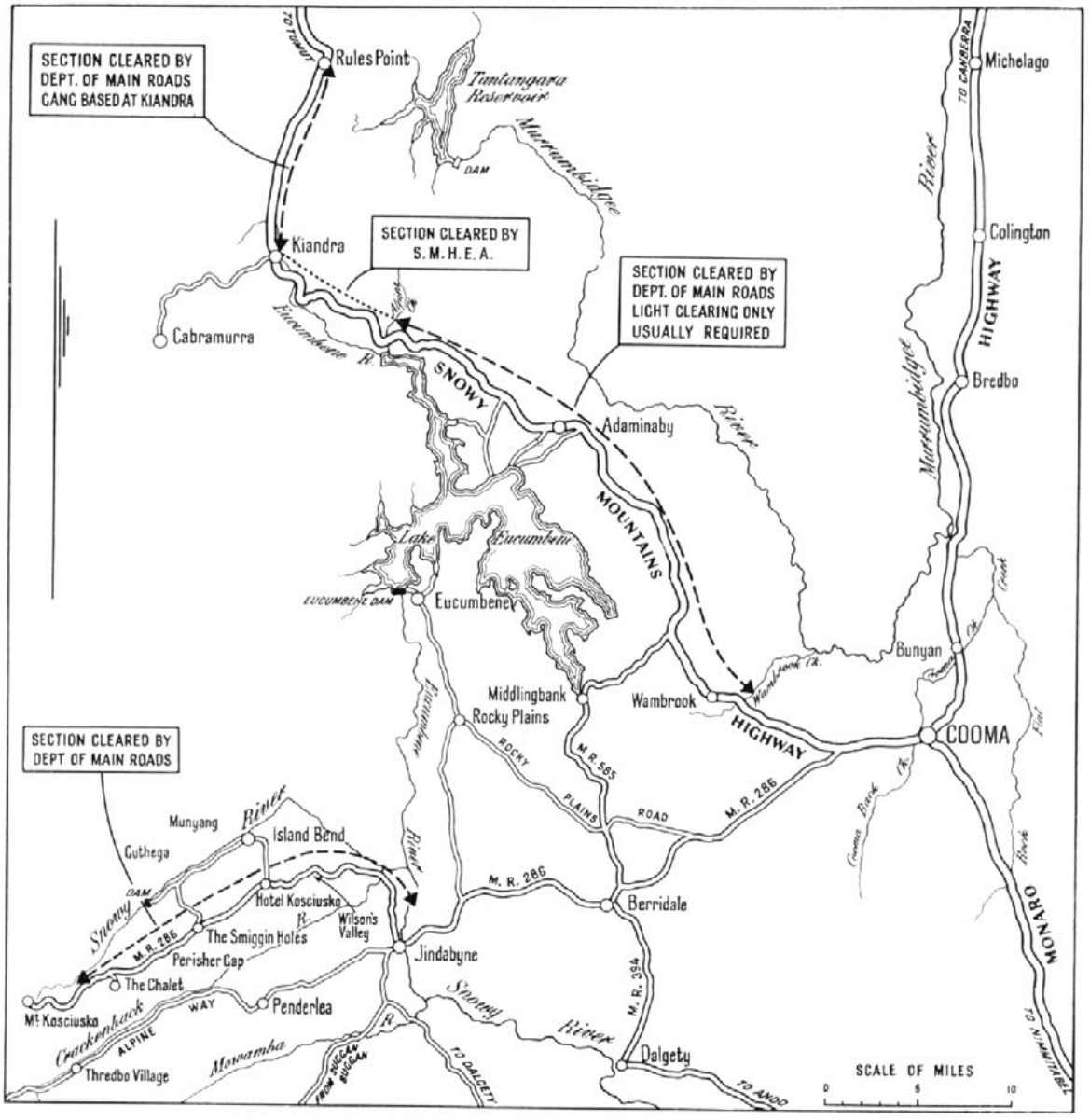
PROPOSED BRIDGE OVER GEORGE'S RIVER AT TAREN POINT

Model showing design of bridge to be built over George's River between Rocky Point and Taren Point, at Sans Souci, Sydney. Tenders were recently invited for the work

SNOW REMOVAL

ON MAIN ROADS

Locality map of Snowy Mountains area showing Main Roads where snow removal is undertaken



Snow clearing by dozer on Mount Kosciusko Road east of Smiggin Holes

THERE are only two Main Roads in New South Wales where special action is required each year to remove snow. The roads concerned are the Snowy Mountains Highway between Wambrook and Talbingo, a distance of 78 miles, the principal snow clearing operations being between Alpine Creek, Kiandra and Rules Point, a distance of 18 miles, and the Jindabyne-Mount Kosciusko Road between Wilson's Valley (12 miles from Jindabyne) and Smiggin Holes, a distance of 7 miles. Some snow falls over a length of about ten miles of road approaching Wilson's Valley, but its removal presents no special difficulty.

The highest elevation on the Snowy Mountains Highway is 4,900 feet at Sawyer's Hill and Bullock Hill, near Kiandra. The elevation of Kiandra is 4,600 feet. The elevations on the length cleared of snow on the Mount Kosciusko Road are—Wilson's Valley, 4,800 feet, and Smiggin Holes, 5,500 feet.

From June to September, there is usually permanent snow above altitude 4,300 feet. Snow clearing is aimed at keeping the Snowy Mountains Highway available throughout for traffic at all times, and at keeping the Mount Kosciusko Road open as far as Smiggin Holes. In both cases, vehicles using the cleared road need to be fitted with chains.

Light snow regularly falls on a number of other Main Roads in the same region, and on other Main Roads situated at elevated localities to the west of Sydney and on others again on the northern tablelands of New South Wales, but these falls do not usually cover the roads sufficiently to bring about the need for special snow removal measures.

Snow removal work on the Snowy Mountains Highway and on the Mount Kosciusko Road has been carried out by the Department of Main Roads for many years past. During recent years more intensive removal work has been necessary on account of two developments, namely—(1) the setting up of the Snowy Mountains Hydro-Electric Authority and the traffic arising from the extensive works which the Authority is carrying out in the Kiandra area and to a lesser extent in the Mount Kosciusko area, and (2) the rapid development of snow sports, especially on Mount Kosciusko. Skiing centres served directly or indirectly by the Mount Kosciusko Main Road comprise Smiggin Holes, Perisher Valley, and Charlotte Pass where a Government Chalet is situated.

In the case of the Snowy Mountains Highway, snow clearing between Alpine Creek and Kiandra (9 miles) is carried out at the cost of the Department of Main Roads by the Snowy Mountains Hydro-Electric Authority in conjunction with its snow clearing operations on its own subsidiary access roads. By this means the Authority has the opportunity to be solely responsible for maintaining its own main line of communication. Snow which falls on the Snowy Mountains Highway between Wambrook and Alpine Creek (33 miles) is usually less significant. West of Kiandra through to Rules Point, a distance of 12 miles, snowfall is especially severe. West of Rules Point snowfall gradually tapers off to Talbingo (24 miles).

V-snow plough in operation at Dainers Gap, Mount Kosciusko Road

The Department of Main Roads carries out the work on the Snowy Mountains Highway between Wambrook and Alpine Creek and between Kiandra and Rules Point. Snow removal on the length between Rules Point and Talbingo is dealt with on behalf of the Department by the Tumut Shire Council, which has a small snow plough fitted to a lorry.

In the case of the Mount Kosciusko Road, all the work involved is carried out by the Department of Main Roads.

The nature of snow in New South Wales appears usually to be wetter and heavier than snow in colder countries, and while methods of removal are generally similar, they are not always identical.

The equipment used by the Department of Main Roads is of four main types as follows:—

(1) Heavy duty 4-wheel drive graders.

(2) V-Snow Ploughs, either truck-mounted or mounted on 4-wheel drive grader.

(3) Crawler angle dozers with modified tracks.

(4) Blower-type snow plough.

Snow removal on Mount Kosciusko Road using V-plough on motor grader

Heavy Duty 4-Wheel Drive Graders

Heavy duty graders are used for clearing the lighter snowfalls and can readily handle up to one foot of loose snow. A four-wheel drive, four-wheel-steer grader is more easily controlled in snow than a tandem grader.

Graders are also used for trimming and widening cleared areas after the use of a snow plough and dozer. The grader is operated in the normal manner, but chains are necessary on all wheels to give traction. The blade can be used in a battering position for widening.

V Snow Ploughs

The V ploughs used are either mounted on 4-wheel drive trucks or in front of a four-wheel drive grader. V Ploughs are used for snow up to about 4 feet deep, the speed of operation varying from about 15 m.p.h. in snow 18 inches deep to 2 to 3 m.p.h. in snow 4 feet deep. The point of the V snow plough enters under the snow, and the double mouldboard rolls the snow outward and upwards on either side of the machine, clearing a width of about 10 feet.

In deep snow a following grader is necessary to clear the spillage over the end of the plough to the low side. As the deep snow is generally in drifts against side cuttings, ploughing is started on the side against the cutting so that the clearing can be widened by taking a second cut, using half-blade only, on the low side of the road.

To prevent a plough from tearing the pavement, shoes are fitted under the wings of the plough which keep it up about 3 inches above the pavement. On bitumen pavements this 3 inches of snow can be subsequently removed by grading, but on gravel roads it is left if frozen solid, as gravel would be pulled up with the frozen snow. It is for this reason that chains are generally required on vehicles using gravel roads where snow is being cleared.

Crawler Angle Dozers with Modified Tracks

Where snow is too deep to be handled by V ploughs a tractor-dozer is used. Again the widening is started on the high side of the drift. Wherever possible the dozer is worked down hill, and the first pass is a light cut only to provide an even footing. Once a safe footing is obtained, dozing is carried out much as in the same manner as normal side casting in earth moving.

One of the disadvantages of the use of a tractor-dozer for snow clearing is that the tracks pack the snow into hard ice, and once a drift has been started with a tractor dozer the snow plough will not work efficiently in the hard-packed snow under the dozer tracks.

A disadvantage of all "displacement" type snow clearing units (graders, ploughs and dozers) is that the snow is merely displaced sideways and that if a snowfall is prolonged, the windrow built up becomes high and difficult to move back.

Under normal circumstances, displacement units can handle snow encountered up to about 5,300 feet, although in very heavy falls it might be necessary to clear only a single lane.

Blower-type Snow Plough

A snow blower has the advantage that the snow is moved only once, and is discharged 20 feet away from where it is picked up. A snow blower was obtained in 1959, but to date results obtained have not been altogether satisfactory, largely, it is thought, due to the heavy and wet nature of the snow encountered locally.

The blower plough has a rotor with two contra-rotating screws, so that the snow is fed to the centre of the rotor, where it is forced by an impeller through a chute, with a cowling similar to an air vent on a ship which can be rotated to direct the blown snow.

The output of the blower has to date proved disappointing, probably due to the nature of the snow, and is only about one-quarter that obtained by other methods.

All plant is equipped with front and rear lamps for night operation.

During blizzard conditions (i.e., heavy snow fall, strong wind and low visibility) or other period of heavy snow drift, a build-up of snow can occur at up to 2 feet per hour, and great care must be exercised not to isolate machines and operators.

A dozer unit is normally stationed beside the road near known heavy drifting areas, and should blizzard conditions occur it can be brought into immediate use. A skilled operator on the dozer can usually remove very deep drifts without fear of bogging his machine, but special care is always required.

Apart from the usual problem of freezing of the water in engines, special precautions are necessary when operating crawler tractors in snow. These include the prevention of building up of ice between the tracks and the sprockets which would soon cause failure of the track system. This can be done by either cutting a hole in each track plate so that the built-up ice can be forced through by the rotation of the sprockets, or alternatively by the fitting of specially made sprockets and tracks which prise out the ice. At the end of each day's work, and if necessary during the day, the ice built up around top track carrier rollers should be removed, otherwise it will freeze during the night, locking the rollers so that they do not revolve when used the next morning, which naturally leads to early failures.

Snow conditions often make it difficult for both operators and motorists to be certain of the position of the edges of the road formation. To aid traffic generally, all guide posts above the snow line are painted orange with a black band at the top. As a further aid to operators, snow poles 8 feet high, also in orange with black tops, have been erected at frequent intervals along the roads above the snow line.

On the length of the Snowy Mountains Highway between Alpine Creek and Kiandra where snow removal is carried out by the Snowy Mountains Hydro-Electric Authority, snow clearing is carried out usually by heavy 6-wheel dump trucks fitted with grader blades. The blade is fitted ahead of the truck at an angle of about 80 degrees to the direction of travel, and is about 10 feet long. The blade " floats " on the road surface when in use, and can be raised by a cable attached to the front of the dump body, the driver operating the hoist. The trucks are of over 200 horse-power, fitted with automatic gear boxes, and a working speed of over 20 m.p.h. can be maintained, even on grades up to 10 per cent. During heavy snowfalls the trucks work continuously. In the event of windrows becoming too big, they are handled either by motor grader or by tractor-dozer.

With the great increase in tourist traffic on the Mount Kosciusko Main Road, it has become necessary, in co-operation with the Kosciusko State Park Trust, to institute various traffic controls, and barrier gates have been erected at several points to prevent traffic proceeding further while snow clearing is in progress.

Morning scene at Smiggin Holes following heavy snowfall

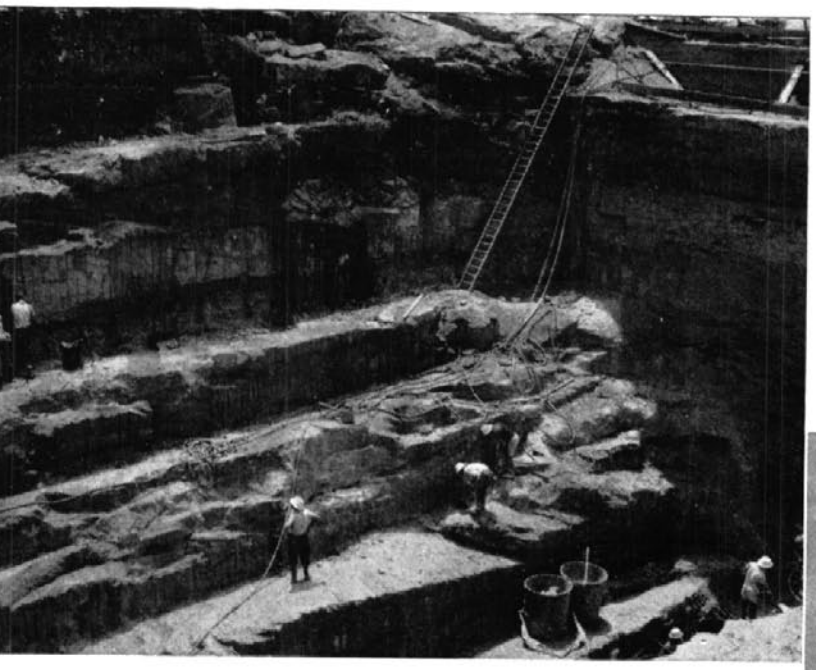
NEW GLADESVILLE

PROGRESS

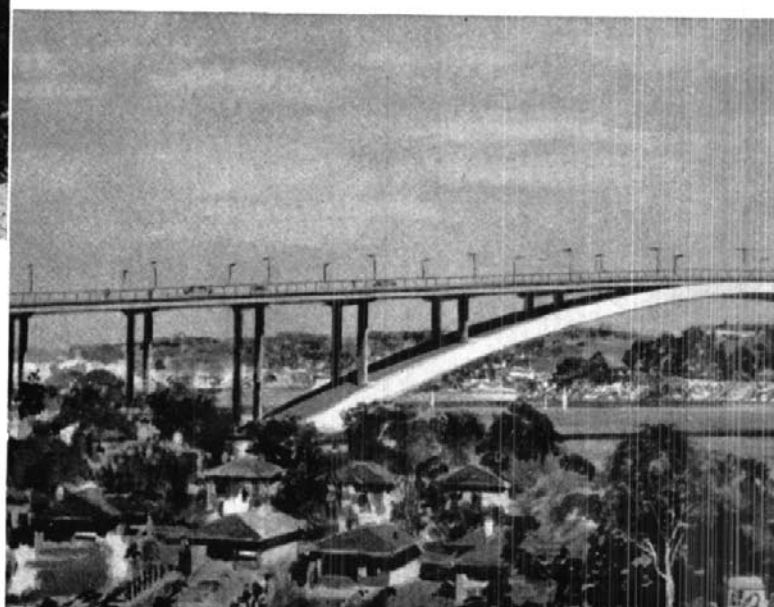
IN June, 1959, a contract was let by the Department of Main Roads to a partnership of Reed & Mallik Ltd., of Salisbury, England, and Stuart Bros. Pty. Ltd., of Sydney, for the construction of a six-lane high level concrete arch bridge over the Parramatta River, the main arm of Sydney Harbour, at Gladesville, a suburb of Sydney. The bridge is both to replace an existing low level two-lane opening span bridge already carrying 33,600 vehicles per average week day, and to form part of a planned expressway serving the north-western part of the Sydney metropolis. The new Gladesville Bridge will take some of the traffic which otherwise would use the Sydney Harbour Bridge, which already carries 85,500 vehicles per average week day.

The contract, which is on the basis of design by the Contractor, was originally for a 910-foot arch span. However, at the Contractor's request, the Department agreed to an increase in length of main span to 1,000 feet. The Contractor's designers are Messrs. G. Maunsell & Partners, of London.

Excavation for arch abutment on Gladesville side



Artist's impression of completed bridge



BRIDGE

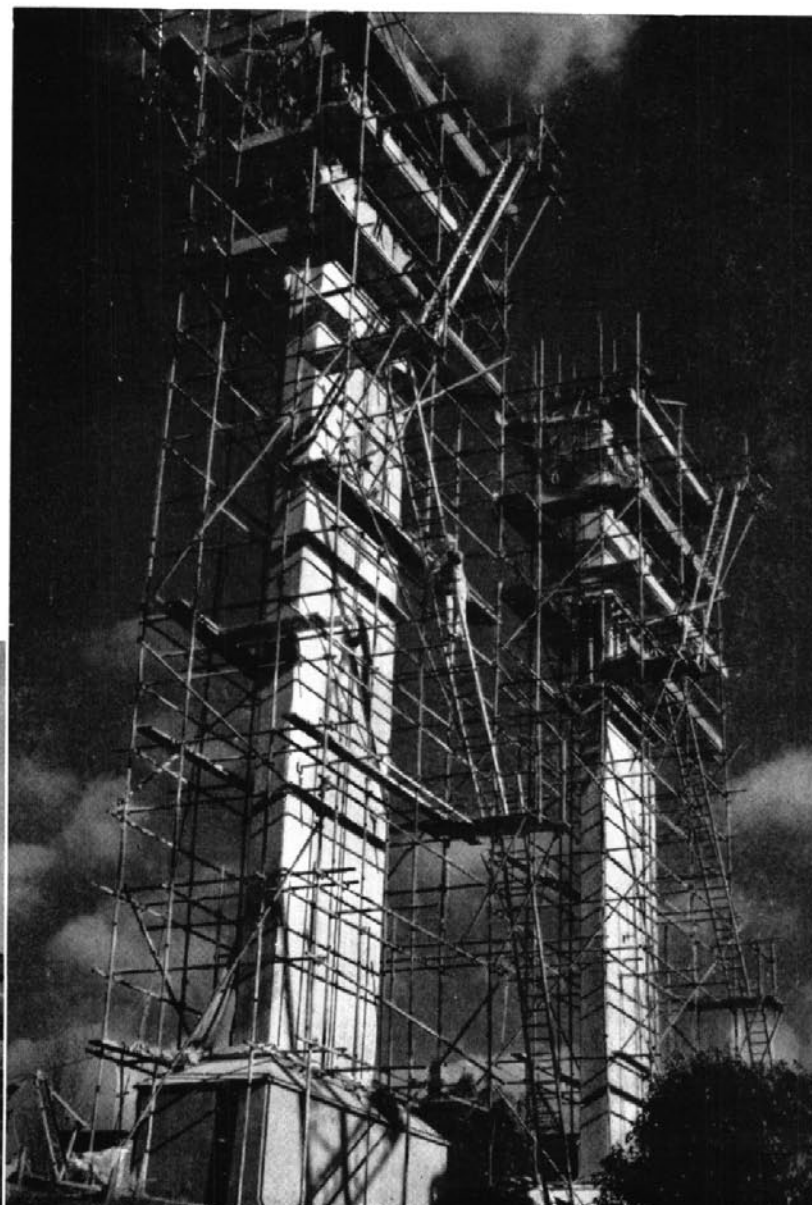
F WORK

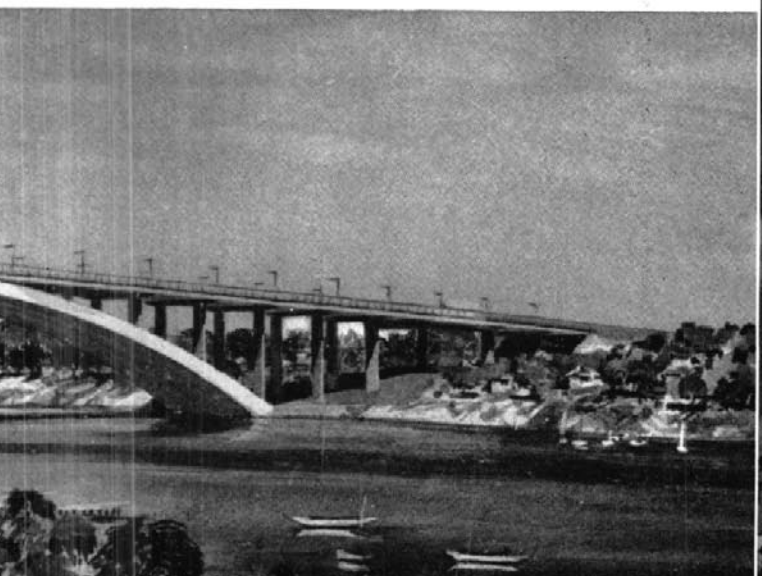
Falsework being erected

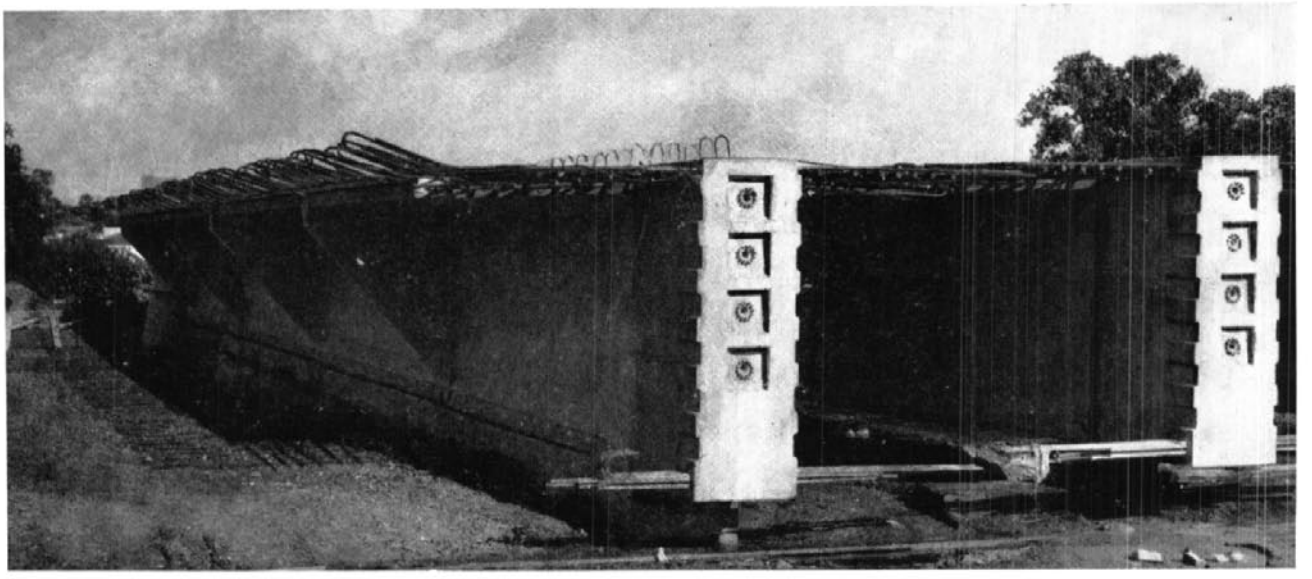
Consultants to the Department of Main Roads in respect of the design have been Professor J. W. Roderick and three members of the staff of the Civil Engineering Department of the University of Sydney, and the celebrated French engineer, Inspector-General Freyssinet and his consulting firm, Société Technique pour L'Utilisation de la Précontrainte, of Paris. Professor Roderick and Mr. Campbell-Allen of his staff, and S.T.U.P. are acting as consultants in respect also of certain aspects of construction.

As the span of 1,000 feet is the largest concrete arch span yet constructed in any country, special interest attaches to the work. In addition to the main arch span, the bridge will have four approach spans 100 feet long on each side of the river. The total length of the bridge will be 1,900 feet between the faces of the two end abutments on either side of the river. The carriageway will have a minimum width of 72 feet between kerbs and there will be a footway 6 feet wide on each side. The underside of the arch will be more

A pier under construction







Typical deck girders

than 120 feet above high water level for a width of 200 feet in its middle section, the maximum clearance being 135 feet.

The arch itself will consist of four identical separate ribs, each designed as a hollow concrete box section. Each rib will be put together in sections on steel falsework and then jacked off the falsework by means of a battery of Freyssinet flat jacks at the quarter points of the span from either end. After all ribs are freed from the falsework they will be transversely stressed together through internal concrete diaphragms.

The deck system of the bridge will consist of prestressed concrete girders supported on prestressed concrete double-column piers each column being of thin plate section. The columns in the approach spans rest on the sandstone of the river banks, the columns over the arch rest on the arch ribs themselves. Over the central portion of the arch the deck rests directly on the arch ribs. The girders are prestressed in the Freyssinet system and the columns in the Lee-McCall system.

Construction of the bridge involves the following main operations:—

(1) Excavation in earth and rock for the arch abutments on either side of the river at the shoreline and partly below water.

(2) Excavation in earth and rock for the deck abutments.

(3) Excavation in earth and rock for the piers of the approach spans, there being three of these piers on either side of the river in approach to the main arch span.

(4) Concreting of the arch abutments, deck abutments and piers.

(5) Driving of falsework piles and construction of pile caps in the river, and erection of steel falsework thereon.

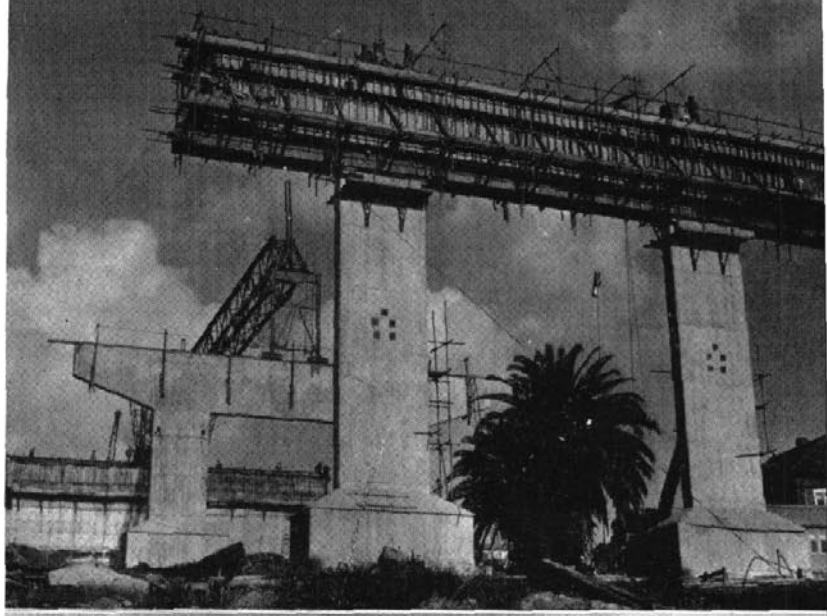
(6) Fabrication and erection of the arch rib sections, erection of arch ribs, jacking of the arch ribs into position and the construction of diaphragms on the arch.

(7) Casting of deck beams on either side of the river.

(8) Erection of deck beams.

(9) Construction of deck and final completion of the superstructure.

The Contractor has completed the excavation work for the arch abutments, deck abutments and approach piers. Approximately 1,300 yards of earth and 9,000 yards of sandstone rock were excavated for the arch abutments. About 400 yards of earth and 550 yards of sandstone rock were excavated for the deck abutments and approximately 400 yards of earth and 1,150 yards of sandstone rock were excavated in the pier foundations. The concrete work in the arch abutments is now complete and this has involved the placing of some 14,500 cubic yards of concrete. The whole of both deck abutments has been completed, comprising approximately 700 cubic yards of concrete in the Drummoyne abutment and 1,500 cubic yards of concrete in the Gladesville abutment. The piers for the approach spans are well advanced, the three piers on the Drummoyne side having been completed and the three piers on the Gladesville side are nearing completion. The total quantity of concrete involved is approximately 3,000 cubic yards. The construction of deck beams is being undertaken in casting yards established on either side of the river and there are some 131 beams to be cast, each being 100 feet long and weighing 65



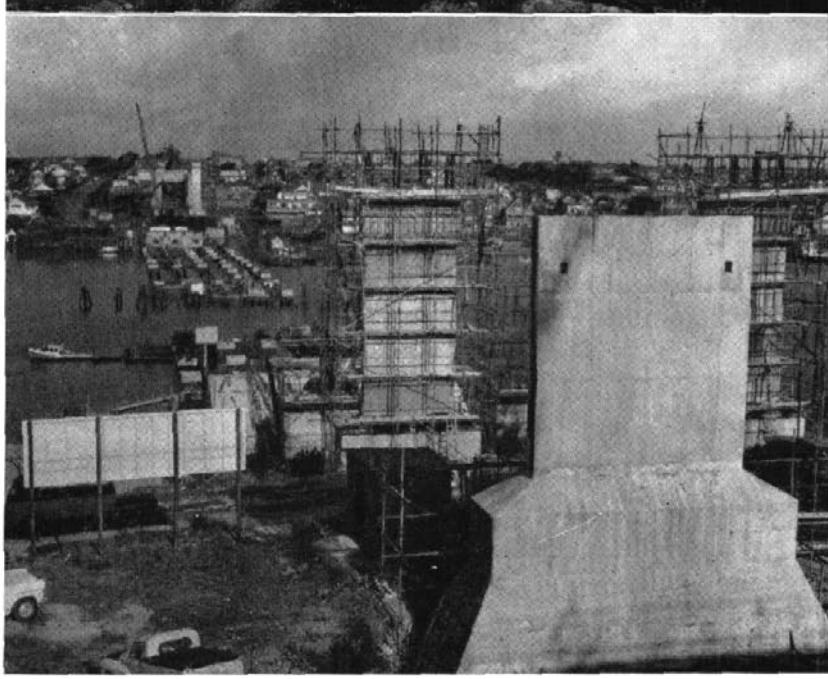
Piers 1 and 2 on the Drummoyne side

tons. Sufficient beams have been cast for two spans on the Drummoyne side of the river and casting of the first span on the Gladesville side of the river is in progress. Erection of deck beams in the first approach span on the Drummoyne side of the river has been commenced. The beams contain diaphragms and end blocks which have been precast off the site.

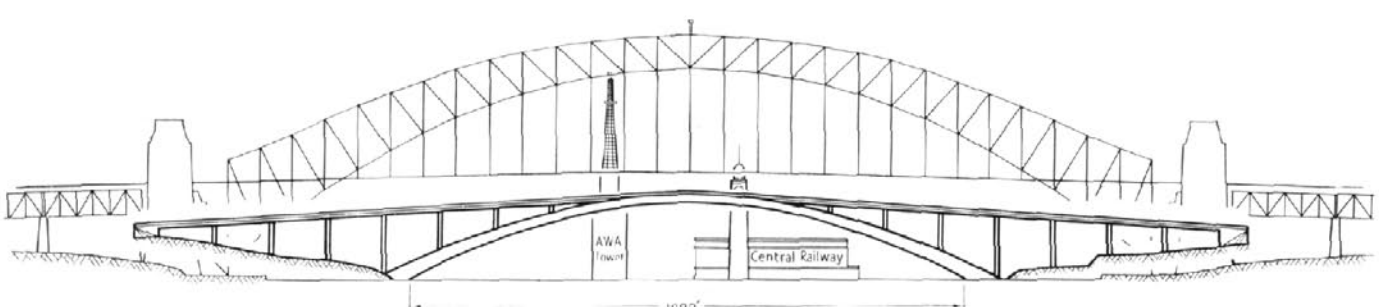
Driving of steel tubular piles in the river to carry the falsework on which the arch ribs will be erected has been substantially completed. A total of 290 piles, varying in length from 33 feet to 165 feet, have been driven to rock below the bed of the river. Concrete pile caps connected by steel R.S.J. headstocks have been constructed on the top of these piles to carry the arch rib falsework. The Contractor constructed a special pile driving rig to handle the driving of these steel piles.

Fabrication of the steel work for the falsework to support the arch ribs in the river span was carried out off the site and delivery and erection of this falsework is now well in hand. Sufficient falsework is being erected to carry one rib at a time, only. The falsework will be moved laterally along the pile caps and head stocks to support each of the four ribs in turn.

The construction of the sections of the arch ribs is being carried out by the Contractor in a casting yard at Woolwich, some 2 miles downstream from the bridge site. The arch rib sections will be conveyed to the site by barge and erected from a special erection tower incorporated in the falsework. Casting of the arch rib sections is proceeding at Woolwich and sufficient sections for the first arch rib may be ready for erection by the end of 1961.



Piers 13 and 14 on the Gladesville side



Comparison of Gladesville Bridge with Sydney Harbour Bridge, Sydney Central Railway Tower, and A.W.A. Tower, Sydney

A site at which portable loadometers were tested

ORDINANCE No. 30c under Local Government Act, 1919 is designed to protect Main Roads and structures thereon from damage, and active enforcement of the limitations laid down under the Ordinance is the responsibility of the Department of Main Roads.

Trained Inspectors, who are all certified weighmen, are utilised to intercept heavy commercial vehicles, and after interrogating operators as to the loading being transported, it often becomes necessary to weigh either one or more of the axles on a particular vehicle. The means of check weighing are, of a necessity, restricted to either weighbridges or portable weighing devices.

A weighbridge is the most convenient means of weighing heavy loads, but weighbridges are not always available, particularly in the country districts of this State. Ordinance No. 30c provides for the diversion of a vehicle for a distance of three miles from the point of interception, unless the vehicle is proceeding to a destination which necessitates the operator driving it through a location where a weighbridge is situated.

The alternative method of ascertaining axle loads is to utilise portable weighing devices, and the Department uses loadometers. This type of weighing device is, in fact, a minature weighbridge and operates on exactly the same principle as an ordinary weighbridge. Two sets of loadometers were obtained in 1950, and after extensive tests they were placed in operation in December, 1952. The Department now has thirty-six loadometers on issue to Inspectors.

During the eight years that check weighings have been effected on loadometers there have been several challenges in the Courts regarding their accuracy, particularly in cases where weighings were conducted on sites where road cambers or crossfalls were involved and also, in certain cases, where there was a rise or fall in the horizontal plane, i.e. where the axle being weighed was higher or lower than other axles on the

Accuracy of Portable

vehicle or vehicle combination. Despite such challenges, inaccuracy of weights recorded on loadometers was not substantiated.

In June, 1959, a publication titled "Truck Weighing" was produced by the Long Distance Road Transport Association of Australia. It was based on a special report prepared by the editors of the U.S.A. publication "Fleet Owner". It was mainly devoted to explaining why a vehicle, or vehicle combination, could not be correctly weighed unless all axles fitted thereto were weighed simultaneously. It also contained certain recommendations to vehicle operators and weighing authorities as to precautions which should be taken when axle loads were ascertained on weighing devices.

Prior to the issue of "Truck Weighing", the Department had offered to demonstrate publicly the method used by Inspectors in weighing vehicles on portable weighing devices, and was prepared to have weights recorded compared with similar weighings on a registered public weighbridge.

Arrangements were made to conduct a series of tests in the presence of representatives of truck owners at Granville on the 15th August, 1960, under the supervision of the Superintendent of Weights and Measures.

For the purpose of these tests the Department provided all available weighing devices and personnel to operate the machines in accordance with normal weighing procedure. Vehicles used were provided by members of the Long Distance Road Transport Association of Australia, and the Association's representatives were entitled to select any of the loadometers available for any particular weighing. The selection of various weighing sites was also the prerogative of the Association, but in this regard the Department reserved the right to veto any particular site if it was considered to be unsafe or the slope in the horizontal plane was such that an ordinary check weighing on the open road would not, under any circumstances, be effected.

Loadometers being placed in position to weigh tandem axle load

Numerous tests were conducted on both single axles and tandem assemblies, and the weighing sites used ranged from normal roadside conditions to readily noticeable longitudinal grades and crossfalls of up to 9 inches in 7 feet 4 inches as compared with 2¾ inches in 7 feet 4 inches, which is the standard crossfall for a bitumen pavement. In most instances, individual axles were weighed at least twice on different loadometers, and the weights recorded were compared with weights obtained at a registered public weighbridge at Granville.

With one exception, which was due entirely to the mechanical construction of the tandem trailer assembly fitted to the vehicle combination concerned, the weights recorded on loadometers showed a maximum variation of MINUS 2.0 PER CENT as compared with weights obtained on the weighbridge, and, in general, the variation was of the error of 1.0 per cent or less.

Loadometers in position

Weighing Devices

FIELD TEST

TRAFFIC COUNTING EQUIPMENT

Improvement to Pneumatic System of Pneumatic–Electric Vehicle Detectors

The most commonly used method of detecting and recording the passage of a road vehicle is the pneumatic-electric system, in which air impulses caused by the wheels of a vehicle passing over a pneumatic tube are used to operate an electric switch in a recording device.

The accuracy of traffic counters depends on the accuracy of vehicle detection and, in the past, considerable difficulty has been experienced with pneumatic detectors, particularly in preventing overcounting. This overcounting has occurred because of secondary impulses, due to the air wave caused by a tyre passing over the pneumatic detector tube rebounding from the closed end of the tube, being recorded by the counter.

To overcome the difficulty, the Road Research Laboratory in Great Britain made a small opening in the end of the tube remote from the counter. This is not completely effective, because of the wide range of impulse intensity from that generated by a fast passage of a motor cycle to that of a slow passage of a heavily-laden transport vehicle.

One make of traffic counter has a by-pass valve incorporated in the counter mechanism to eliminate the effect of the secondary impulse. This leads to difficulties in adjusting the counter and also necessitates an undesirably slow counting action.

Because of the unsatisfactory aspects of available vehicle detectors, the Department of Main Roads has carried out considerable investigation and has developed an improved system which has been found to be effective and reliable.

The improvement results from the use of the following:—

(*a*) a one-way inlet valve incorporated in or located near the pneumatic-electric switch mechanism in the counter, and

(*b*) a non-return outlet valve (similar to a respirator outlet valve) fitted at the far end of the detector tube, to allow air to "breathe" through the detector as the vehicle wheels pass over it.

The detector consisting of a rubber tube or rubber section A—B, shown on accompanying drawing, is placed across the road pavement at right angles to the direction of traffic. To the end A is fitted a pneumatic electric switch (C), containing a rubber disc or similar one-way inlet valve and to the end B, a rubber or similar non-return outlet valve (D).

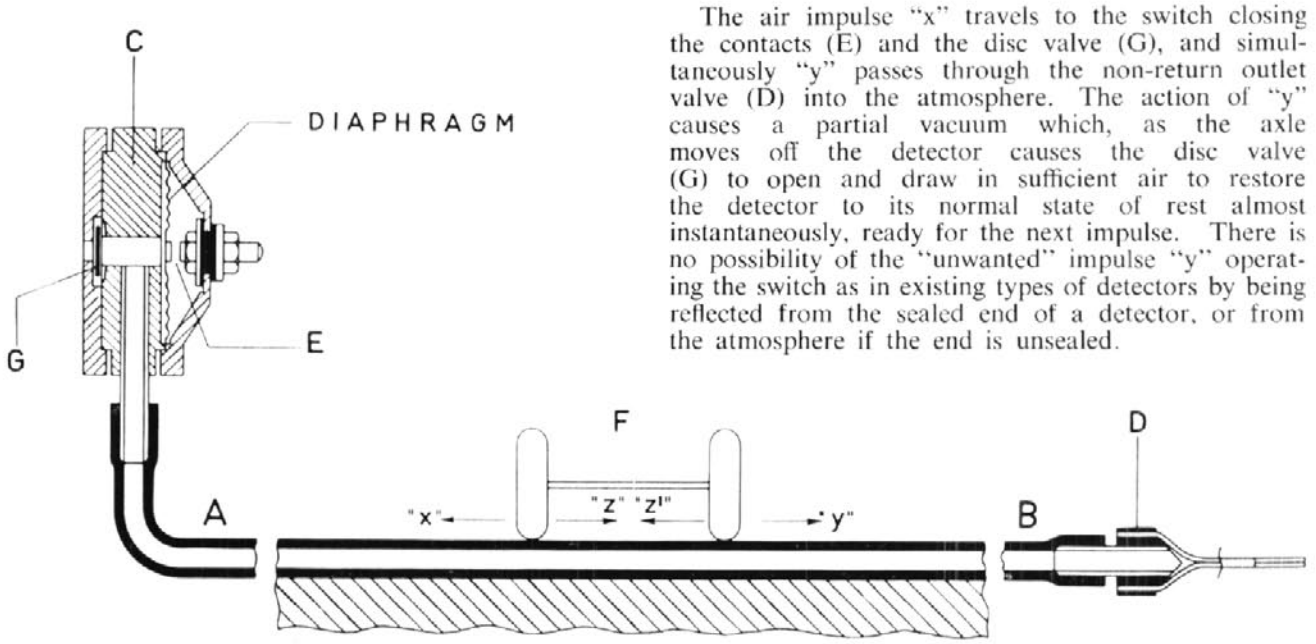
The wheels of an axle (F) passing over the detector create:—

(*a*) an air impulse "x" in the direction of the switch;

(*b*) an air impulse "y" in the direction of the non-return outlet valve; and

(*c*) two equal and opposite air impulses "z" and "z!" which eliminate each other.

The air impulse "x" travels to the switch closing the contacts (E) and the disc valve (G), and simultaneously "y" passes through the non-return outlet valve (D) into the atmosphere. The action of "y" causes a partial vacuum which, as the axle moves off the detector causes the disc valve (G) to open and draw in sufficient air to restore the detector to its normal state of rest almost instantaneously, ready for the next impulse. There is no possibility of the "unwanted" impulse "y" operating the switch as in existing types of detectors by being reflected from the sealed end of a detector, or from the atmosphere if the end is unsealed.



This system:—

(*a*) delivers one impulse per axle to the pneumatic-electric switch;

(*b*) eliminates secondary impulses or "overcounting" due to reflected impulses;

(*c*) enables the contact gap of the pneumatic-electric switch to be kept constant under all traffic conditions, thus eliminating tedious field adjustment for heavy, light, fast or slow traffic volumes;

(*d*) can be used for a greater range of pavement widths, as the length of detector is not critical and a greater range of detector lengths is possible;

(*e*) can be used in conjunction with high speed equipment because of the high degree of discrimination between successive impulses at short interval.

The improved system cannot be claimed to ensure complete accuracy, because undercounting can still occur due to two or more vehicles crossing the tube at the same instant, but it does provide for a high degree of accuracy. It permits high speed counting and is suitable for use for high volumes of traffic on multi-lane roads, *i.e.*, conditions under which the detector systems of most counters give rather inaccurate results.

The Department's system is adaptable to all types of vehicle detection. In particular, there may be a field for use of the improved system in the detector pads and controller units of vehicle-actuated traffic signals.

Main Roads Funds

Receipts and Payments for the financial year ended 30th June, 1961

General Purposes

Heading	County of Cumberland Main Roads Fund	Country Main Roads Fund
RECEIPTS—	£	£
Motor Vehicle Taxation (State)	1,783,331	7,133,325
Charge on heavy commercial goods vehicles under Road Maintenance (Contribution) Act, 1958 (State)	703,132	2,812,528
Commonwealth Aid Roads Act, 1959	1,522,637	5,890,549
From Councils under Section 11 of Main Roads Act and for cost of works	1,824,190	34,688
Other	129,199	99,636
Total Receipts £	5,962,489	15,970,726
PAYMENTS—		
Maintenance and minor improvement of roads and bridges	1,054,493	5,003,462
Construction and reconstruction of roads and bridges	3,997,813	9,858,602
Land acquisition	901,968	112,052
Administrative expenses	215,150	697,525
Loan charges—		
Payment of interest, exchange, management and flotation expenses	16,673	210,565
*Miscellaneous	238,142	179,541
Total Payments £	6,424,239	16,061,747

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

Sydney Harbour Bridge Account

Receipts and Payments for the financial year ended 30th June, 1961

Receipts	£	*Payments*	£
Road tolls	1,469,283	Cost of collecting road tolls	162,737
Contributions—		Maintenance and minor improvement	244,613
Railway passengers	149,384	Interest, exchange and management expenses on loans	383,580
Omnibus passengers	15,475	Provision of traffic facilities	34,474
Rents from properties	25,067	Alterations to archways for occupation by tenants	14,789
Other	3,917	Alterations to toll office, toll gates, etc.	7,292
		Administrative expenses and miscellaneous charges	16,687
		Transfers to Expressways Fund	673,000
	£1,663,126		£1,537,172

at the southern end, each 38 feet long, with a roadway 22 feet wide. The 10-foot diameter cylinders of the main piers are founded on rock.

Construction of the bridge was carried out under contract by Giovenco Constructions Pty. Ltd. to the Department of Main Roads, the Department supplying the Callendar-Hamilton trusses. The approaches were built by the Department by day labour.

Total cost of the bridge and approaches was about £180,000. As it replaced a bridge which had been built and maintained at the cost of the State, the Department of Main Roads met the full cost of the work.

NEW BRIDGE OVER GOULBURN RIVER NEAR SANDY HOLLOW

On the 29th June, 1961, the Minister for Highways, the Hon. P. D. Hills, M.L.A., officially opened a new bridge over the Goulburn River near Sandy Hollow on the Muswellbrook-Mudgee Main Road (Main Road No. 208) in the Shire of Muswellbrook. The Goulburn River is one of the principal tributaries of the Hunter River which enters the sea at Newcastle.

The new bridge is a steel and concrete structure, 575 ft. 6 in. long, comprising four Callendar-Hamilton truss spans each 120 feet long and two approach spans

The first bridge across the Goulburn River near Sandy Hollow was constructed of timber and was built in 1894. In 1955 it was partly destroyed by flood. Pending replacement, it was repaired by the erection of 240 feet of Bailey bridging across the portion washed away and one of the timber truss spans was strengthened with 99 feet of Bailey bridging.

The new bridge was built under the supervision of the Department of Main Roads Divisional Engineer, Newcastle, in the first place Mr. R. J. Butler and more recently Mr. N. F. Hatcher.

THESIS ON ROAD MATERIALS EARNS MASTER'S DEGREE

A thesis entitled "The Physical Properties of Road-making Aggregates in relation to their Petrological Characteristics" has earned a Master of Science Degree in the University of New South Wales for Mr. E. J. Minty, a geologist on the staff of the Department of Main Roads. The thesis was based on materials investigation work carried out by Mr. Minty in the course of his duties with the Department as an "Engineering Analyst". During his service Mr. Minty has been stationed for lengthy periods at Parkes and Wollongong and has served in other parts of New South Wales.

Australian Road Statistics

The following road statistics have been compiled for the National Association of Australian State Road Authorities from data supplied by the individual State Road Authorities and the Commonwealth Department of Works.

1. Mileages of roads in Australia at 30th June, 1960

State or Territory	Mileage				Percentage of Total Mileage		
	A Classified State Highways Trunk and Main Roads	B Other roads controlled and/or subsidised by State Road Authorities	C All other roads	Total	A	B	C
	miles	miles	miles	miles	per cent.	per cent.	per cent.
New South Wales	22,411	3,877	100,700	126,988	18	3	79
Victoria	13,596	26,295	64,739	104,630	13	25	62
Queensland	18,698	2,043	98,827	119,568	15	2	83
South Australia	8,188	15,000	39,257	62,445	13	24	63
Western Australia	10,881*	21,187	59,199	91,267	12	23	65
Tasmania	1,842	373	9,701	11,916	15	3	82
Sub-totals States	75,616	68,775	372,423	516,814	15	13	72
Australian Capital Territory ..	80	489	....	569	14	86	....
Northern Territory	1,246	11,751	....	12,997	10	90	....
TOTALS	76,942	81,015	372,423	530,380	15	15	70

* Includes 7,440 miles of Important Secondary Roads.

2. Ratio of mileage of roads to area at 30th June, 1960

State or Territory	Area	Mileage of roads per 100 square miles		
		Classified State Highways, Trunk and Main Roads	All other Roads	Total
	square miles	miles	miles	miles
New South Wales	309,433	7	34	41
Victoria	87,884	15	104	119
Queensland	667,000	3	15	18
South Australia	380,070	2	14	16
Western Australia	975,920	1*	8	9
Tasmania	26,215	7	38	45
Sub-totals States	2,446,522	3	18	21
Australian Capital Territory	939	9	52	61
Northern Territory	523,620	.....	2	2
TOTALS	2,971,081	3	15	18

* Basis includes 7,440 miles of Important Secondary Roads.

3. Number of persons per mile of road at 30th June, 1960

State or Territory	Population (Estimated as at 30th June, 1960)	Length of road			Persons per mile of road		
		Classified State Highways Trunk and Main Roads	All Other Roads	Total	Classified State Highways Trunk and Main Roads	All Other Roads	Total
		miles	miles	miles	persons	persons	persons
New South Wales	3,828,315	22,411	104,577	126,988	171	37	30
Victoria	2,891,748	13,596	91,034	104,630	213	32	28
Queensland	1,463,245	18,698	100,870	119,568	78	15	12
South Australia	945,247	8,188	54,257	62,445	115	17	15
Western Australia	730,581	10,881*	80,386	91,267	67	9	8
Tasmania	347,438	1,842	10,074	11,916	189	34	29
Sub-totals States	10,206,574	75,616	441,198	516,814	135	23	20
Australian Capital Territory	52,368	80	489	569	655	107	92
Northern Territory	21,800	1,246	11,751	12,997	17	2	2
TOTALS	10,280,742	76,942	453,438	530,380	134	23	19

* Includes 7,440 miles of Important Secondary Roads.

4. Proclaimed State Highways, Trunk and Main Roads—Mileage of concrete and sealed pavements at 30th June, 1960

State or Territory	Total length of Classified State Highways, Trunk and Main Roads	Classified State Highways, Trunk and Main Roads constructed in cement concrete, bituminous concrete or other bituminous material	
	miles	miles	per cent.
New South Wales	22,411	8,210	37
Victoria	13,596	10,060	74
Queensland	18,698	5,514	29
South Australia	8,188	3,077	38
Western Australia	10,881*	4,395†	40
Tasmania	1,842	970	53
Sub-totals States	75,616	32,226	43
Australian Capital Territory	80	66	83
Northern Territory	1,246	1,246	100
TOTALS	76,942	33,538	44

* Includes 7,440 miles of Important Secondary Roads.

† Includes 1,361 miles of Important Secondary Roads.

5. Registration of motor vehicles in Australia at 30th June, 1960

State or Territory	Number of Vehicles					Percentage of total vehicles			
	Cars	Other vehicles (including lorries, utilities, trailers, tractors and omnibuses)	Sub-total	Motor Cycles	Total	Cars	Other vehicles (including lorries, utilities, trailers, tractors and omnibuses)	Sub-total	Motor Cycles
						per cent.	per cent.	per cent.	per cent.
New South Wales ..	628,020	419,534	1,047,554	28,773	1,076,327	58	39	97	3
Victoria	646,387*	187,787	834,174	21,968	856,142	75	22	97	3
Queensland	240,937	183,150	424,087	17,901	441,988	55	41	96	4
South Australia ..	192,525	121,255	313,780	15,916	329,696	58	37	95	5
Western Australia ..	127,863	102,517	230,380	13,609	243,989	52	42	94	6
Tasmania	64,681	36,020	100,701	3,119	103,820	62	35	97	3
Sub-totals States ..	1,900,413	1,050,263	2,950,676	101,286	3,051,962	62	35	97	3
Australian Capital Territory	12,408	5,261	17,669	382	18,051	69	29	98	2
Northern Territory ..	4,370	5,525	9,895	717	10,612	41	52	93	7
TOTALS ..	1,917,191	1,061,049	2,978,240	102,385	3,080,625	62	35	97	3

* Registration is according to purpose of use, consequently the figure for cars includes commercial vehicles registered for private use.

6. Ratio of registered motor vehicles to population at 30th June, 1960

State or Territory	Number of registered motor vehicles (including trailers and motor cycles)	Population (Estimated as at 30th June, 1960)	Number of motor vehicles per 100 persons	Number of persons per motor vehicle
New South Wales	1,076,327	3,828,315	28	3·6
Victoria	856,142	2,891,748	30	3·4
Queensland	441,988	1,463,245	30	3·3
South Australia	329,696	945,247	35	2·9
Western Australia	243,989	730,581	33	3·0
Tasmania	103,820	347,438	30	3·3
Sub-totals States	3,051,962	10,206,574	30	3·3
Australian Capital Territory	18,051	52,368	34	2·9
Northern Territory	10,612	21,800	49	2·1
TOTALS	3,080,625	10,280,742	30	3·3

7. Ratio of registered motor vehicles to mileage of roads at 30th June, 1960

State or Territory	Number of registered motor vehicles (including trailers and motor cycles)	Mileage of roads		Number of motor vehicles per mile of road	
		Classified State Highways, Trunk and Main Roads	All roads	Classified State Highways, Trunk and Main Roads	All roads
	vehicles	miles	miles	vehicles	vehicles
New South Wales	1,076,327	22,411	126,988	48	8·5
Victoria	856,142	13,596	104,630	63	8·2
Queensland	441,988	18,698	119,568	24	3·7
South Australia	329,696	8,188	62,445	40	5·3
Western Australia	243,989	10,881*	91,267	22	2·7
Tasmania	103,820	1,842	11,916	56	8·7
Sub-totals States	3,051,962	75,616	516,814	40	5·9
Australian Capital Territory	18,051	80	569	226	31·7
Northern Territory	10,612	1,246	12,997	9	0·8
TOTALS	3,080,625	76,942	530,380	40	5·8

* Includes 7,440 miles of Important Secondary Roads.

8. Receipts of State Road Authorities from State Motor Vehicle Taxes and Grants under the Commonwealth Aid Roads Acts during 1959/60

State or Territory	Amount			Percentage of Total Motor Vehicle Taxes and Commonwealth Aid Roads Grants	
	State Motor Vehicle Taxes	Commonwealth Aid Roads Grants	Total	Motor Vehicle Taxes	Commonwealth Aid Roads Grants
	£'000	£'000	£'000	per cent.	per cent.
New South Wales	11,850	12,173*	24,023	49	51
Victoria	11,511	8,660†	20,171	57	43
Queensland	5,406	7,838¶	13,244	41	59
South Australia	3,942	4,923	8,865	44	56
Western Australia	2,561‡	7,963	10,524	24	76
Tasmania	1,113	2,183	3,296	34	66
TOTALS	36,383	43,740	80,123	45	55

* Includes:—

(*a*) £4,344,073 paid by the State to Department of Public Works for expenditure on non-main roads.

(*b*) £200,000 transferred to Department of Public Works for work connected with transport by water.

(*c*) £109,000 transferred to Department of Motor Transport for Public Vehicles Fund.

† Includes £199,201 paid directly to Department of Public Works for work connected with transport by road or water.

¶ Includes £1,703,300 paid into the Commonwealth Aid Local Authority Roads Fund for expenditure on non-main roads in rural areas.

‡ Includes £1,089,560 collected and retained by Country Local Authorities outside the Metropolitan Traffic Area.

9. Ratio of receipts of State Road Authorities from State Motor Vehicle Taxes and Commonwealth Aid Roads Grants during 1959/60 to number of registered motor vehicles

State or Territory	Number of motor vehicles (See Table No. 5)	Receipts (See Table No. 8)			Per Motor Vehicle		
		State Motor Vehicle Taxes	Commonwealth Aid Roads Grants	Total	Motor Vehicle Taxes	Commonwealth Aid Roads Grants	Total
		£'000	£'000	£'000	£	£	£
New South Wales	1,076,327	11,850	12,173*	24,023	11	11	22
Victoria	856,142	11,511	8,660*	20,171	14	10	24
Queensland	441,988	5,406	7,838*	13,244	12	18	30
South Australia	329,696	3,942	4,923	8,865	12	15	27
Western Australia	243,989	2,561*	7,963	10,524	10	33	43
Tasmania	103,820	1,113	2,183	3,296	11	21	32
TOTALS	3,051,962	36,383	43,740	80,123	12	14	26

* See notations below Table No. 8.

10. Total payments by State Road Authorities during 1959-60 on State Highways, Trunk and Main Roads

State or Territory	Total payments*	Mileage of State Highways, Trunk and Main Roads	Payments per mile of State Highways, Trunk and Main Roads
	£'000	Miles	£
New South Wales	19,640	22,411	876
Victoria	13,606	13,596	1,001
Queensland	12,551	18,698	671
South Australia	6,228	8,188	761
Western Australia	6,060	10,881†	557
Tasmania	3,239	1,842	1,758
Sub-totals States	61,324	75,616	811
Australian Capital Territory	82	80	1,025
Northern Territory	1,542‡	1,246	1,238
TOTALS	62,948	76,942	818

* Includes a proportion of administrative charges but excludes other indirect charges such as loan repayments, advances, purchases of plant and plant maintenance, etc.

† Includes 7,440 miles of Important Secondary Roads.

‡ Includes payments in respect of roads other than State Highways, Trunk and Main Roads.

11. Payments on all roads during 1959-60*

State or Territory	Payments by—				Percentage of Total Payments from all Sources		
	State Road Authority	†Local Authorities	†Other Authorities	Total	State Road Authority	Local Authorities	Other Authorities
	£'000	£'000	£'000	£'000	per cent.	per cent.	per cent.
New South Wales	24,980‡	18,350	2,586	45,916	54	40	6
Victoria	20,554	13,410	1,102	35,066	59	38	3
Queensland	14,763	5,746	626	21,135	70	27	3
South Australia	8,650	4,700	55	13,405	65	35	....
Western Australia	8,619	3,605	104	12,328	70	29	1
Tasmania	4,654	1,733	§	6,387	73	27	....
Sub-totals States	82,220	47,544	4,473	134,237	61	36	3
Australian Capital Territory ..	....	....	1,167	1,167	....	....	100
Northern Territory	....	50	1,542	1,592	....	3	97
TOTALS	82,220	47,594	7,182	136,996	60	35	5

* Includes administrative charges but excludes other indirect charges such as loan repayments, advance, purchase of plant and plant maintenance, etc.

† Some of the amounts in these columns represent payments in respect of previous years which is the latest information available.

‡ Includes payments in respect of roads other than Main Roads from Commonwealth Aid Roads grants. In New South Wales most of such payments are made by the Public Works Department but have been included under " State Road Authority " for comparative purposes.

§ Not available.

12. Payments on all roads during 1959-60 per head of population, per motor vehicle and per mile of road.

State or Territory	Payments per head of population by—				Payments per motor vehicle	Payments per mile of road
	State Road Authority	Local Authorities	Other Authorities	Total	Total	Total
	£	£	£	£	£	£
New South Wales	6·5	4·8	0·7	12·0	43	362
Victoria	7·1	4·6	0·4	12·1	41	335
Queensland	10·1	3·9	0·4	14·4	48	177
South Australia	9·1	5·0	0·1	14·2	41	215
Western Australia	11·8	5·0	0·1	16·9	51	135
Tasmania	13·4	5·0	.....	18·4	62	536
Sub-totals States	8·0	4·7	0·4	13·1	44	260
Australian Capital Territory ..	.....	.....	22·3	22·3	65	2,051
Northern Territory	.....	2·3	70·7	73·0	150	122
Averages	8·0	4·6	0·7	13·3	44	258