

MAIN ROADS

SPECIAL ISSUE



25 YEARS OF ROADBUILDING

MARCH

1950

MAIN ROADS.

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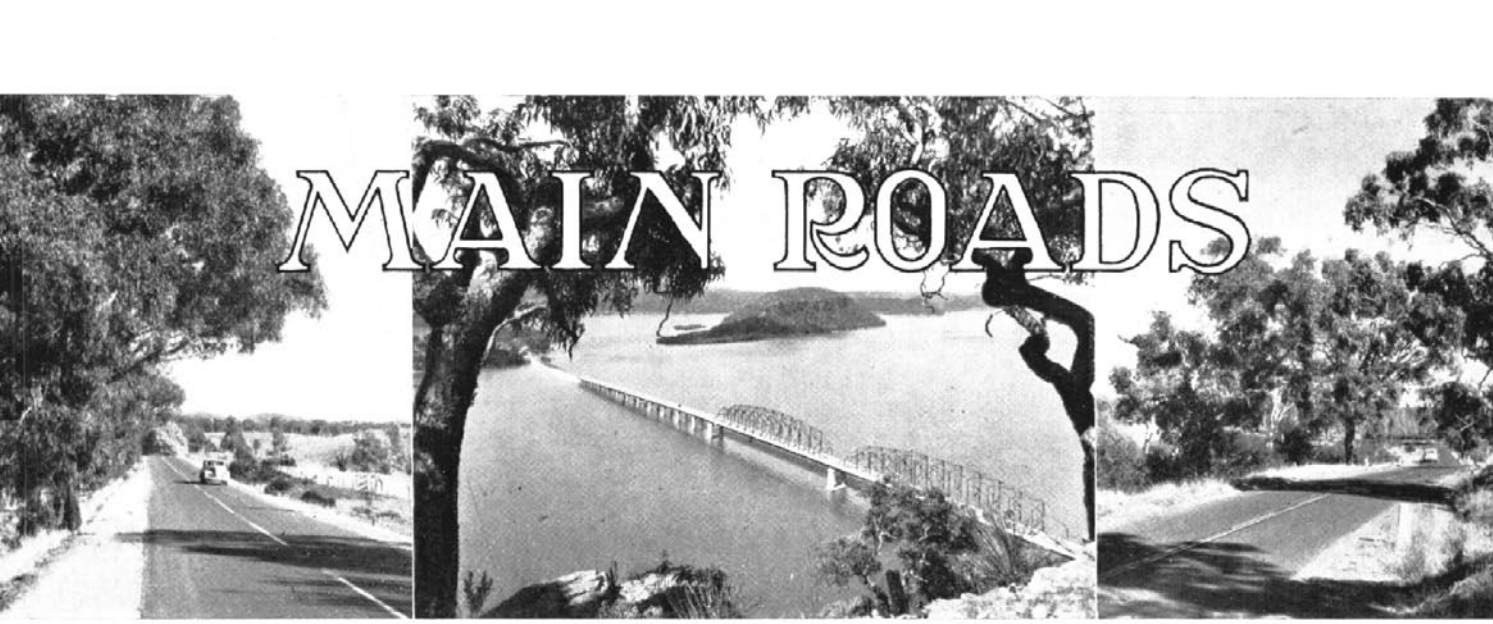
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Cover Page.

Road Building to-day on the South Coast of New South Wales. 85 H.P. Tractor hauling 8 cub.-yd. scoop on the new construction of the Prince's Highway near Cobargo.

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Main Roads of New South Wales 1925 to 1950

Development and Improvement

From the earliest times, until the coming of the railway during last century, roads provided the principal means of inland transport. With the construction of railways, long distance roads ceased to be required, and in many cases went almost out of use.

The advent of the internal combustion engine and its application to road vehicles at the beginning of this century, created a new demand for long distance travel by road. The demand for road improvement grew as the number of motor vehicles increased.

With the growth of motor vehicles and greater wear and tear brought about by the greater speed of vehicles, it became apparent that the expenditure required could not be adequately met by taxes on property owners assisted by Government subsidies, and it became necessary to transfer portion of the cost of provision and upkeep of roads to the road user.

The United States developed the use of motor vehicles more rapidly than other countries. Each American State soon found it necessary to establish a special road organisation to undertake the building and maintenance of a highway network linking the principal centres throughout the State.

The United States experience was repeated in Australia. The Country Roads Board of Victoria was created in 1917, the Main Roads Commission of Queensland in 1920, and the Main Roads Board of New South Wales, later the Department of Main Roads in 1925. The year 1950 thus marks the completion of 25 years work under the Main Roads Act of New South Wales.

The extent of the work now embraced by the Department of Main Roads may be illustrated by the amount of the expenditure for the financial year 1948-49, which totalled £5,297,000*, including £427,000 provided by Country Councils for expenditure on Country main roads.

The Main Roads Act, 1924: The essential features of the Main Roads Act, 1924, were the provision of funds for the construction and maintenance of Main Roads, and the establishment of an authority, the Main Roads Board, to administer the expenditure of the funds.

It should not be thought that in 1925 New South Wales lacked a Main Roads system. There were already 579 miles of proclaimed Main Roads in the County of Cumberland and 12,261 miles of Main Roads in the country, and there had been a regular system of main road subsidy since 1913. The Main Roads were generally trafficable, although often with some difficulty, especially in wet weather. Some sections of road, particularly in the Sydney district, had been substantially improved. By and large, however, the Main Roads system of the period was not suitably adapted to meet traffic needs resulting from the rapidly increasing number of motor vehicles in use. Further, such road improvements as had been already carried out were mainly in the nature of isolated lengths, although bridges had been built over many major streams. At some crossings on the north and south coasts ferries had been provided.

*This figure excludes interest, exchange and sinking fund payments on loan funds borrowed by the Department.



Prince's Highway, St. Peters in 1926 before widening and reconstruction.



The Highway as widened and reconstructed in 1929.

The Main Roads Act provided for two separate Main Roads Funds, viz., the County of Cumberland* Main Roads Fund and the Country Main Roads Fund, for expenditure in the corresponding parts of the State. The principal source of revenue for both funds was to be motor taxation. Half the motor taxation collected in the County of Cumberland was to be paid into the County of Cumberland Main Roads Fund; the other half, together with all the motor taxation collected in the Country, was to be paid to the Country Main Roads Fund; this resulted in approximately 24 per cent. and 76 per cent. of the total collections being paid to the County of Cumberland and the Country Main Roads Funds respectively, and these proportions still apply. Commonwealth financial assistance for road works prior to the 1st July, 1926, was comparatively small, but from then onwards the payments were linked with petrol taxation collected by the Commonwealth, and the amount devoted to main roads in New South Wales

has grown until in the year 1948-49 the proceeds of petrol taxation received from the Commonwealth Government represented more than 30 per cent. of the total revenue available for expenditure on the main roads of the State.

Provision was also made in the Main Roads Act for contributions by Councils to the cost of works, the method followed differing in the County of Cumberland from that in the Country. In the County of Cumberland, the Board was empowered to levy upon the Municipal and Shire Councils a "requisition" for a contribution calculated at a uniform rate not exceeding one-half penny in the £ upon the unimproved capital value of all ratable land. The amounts received from the levy were paid into the County of Cumberland Main Roads Fund, from which was met the full cost of all approved works on the main roads in the County of Cumberland area. There was no corresponding levy in the Country, where each Council shared with the Board the cost of each individual work of construction or maintenance.

A valuable provision in the original Main Roads Act was that which provided for the proclamation of

*The County of Cumberland, for purposes of the Main Roads Act, originally included an area of 1,673 square miles (later increased to 1,770 square miles). It extended from Broken Bay to the north of Sydney to Bulli in the south, and as far west as Mt. Victoria. It excluded the area of the Municipal Council of Sydney.

Developmental Roads. The administration of this section of the Main Roads Act is dealt with on page 83.

Initial Work of the Main Roads Board.—On account of the different methods of financing Main Roads in the County of Cumberland and the Country, it is convenient to describe separately the initial work of the Main Roads Board in each of the two areas.

In the case of the County of Cumberland, the Main Roads Board first set itself to the building of "missing links" and "missing ends." It found that there were many cases where gaps existed in stretches of improved road surface, and that in other cases the improved road surfaces did not extend to a significant point of termination. By adopting the policy of first completing missing links and missing ends, the Board rapidly increased the effectiveness of the County of Cumberland main roads.

In the case of some of the older roads which, while sound, had become rough under growing traffic loads, the Board arranged for resheeting to be undertaken with bituminous macadam, a method being evolved by which an especially smooth type of road surface was secured.

Maintenance generally was placed on a systematic basis, a detailed programme of work being drawn up and approved in advance of each year's operations, the work in progress being inspected from time to time by the Board's engineers. A Depot was established at Clyde to facilitate main road maintenance work where this was directly undertaken by the Board.

In order to provide for the future growth of traffic, the Board instituted a programme of road widening mainly by means of the "re-alignment" method, *i.e.*, new buildings must conform to the new alignment.



Hume Highway between Cross Roads and Carne's Hill in 1929 prior to construction in cement concrete.



The Highway after construction in 1930.



-----*

Typical view of a section of the Prince's Highway between Bateman's Bay and Moruya after reconstruction.

-----*

Existing main roads were usually 66 feet wide and sometimes less, whereas the Board felt that 84 feet was the width desirable as it would provide for six lanes of traffic as against four lanes in the 66 feet road. Particularly where 66 feet roads carried tram tracks there was considered to be a need for widening. A certain amount of main road widening had been instituted before the passage of the Main Roads Act, and this satisfactorily fitted into the Board's schemes.

The Board also, in planning for the future, envisaged and eventually established circumferential main roads in addition to radial main roads, a form of road layout which has since been widely adopted in the re-planning of cities overseas.

The following are among the principal road improvement works put in hand by the Main Roads Board within a short time of its establishment:—Reconstruction of Parramatta Road, Ashfield to Parramatta; deviation of Great Western Highway at Lapstone Hill, Blue Mountains; reconstruction and widening of Cook's River Road (now Prince's Highway), Alexandria and St. Peters; reconstruction of Prince's Highway, Loftus towards Bulli; reconstruction of Pacific Highway, St. Leonards to Roseville; reconstruction between Windsor and Richmond; reconstruction of Victoria Road through Balmain, Drummoyne and Ryde to Parramatta.

In the Country, main road problems were generally of a different nature. There were many Councils lacking engineers, and it was difficult to arrange for the preparation of plans and specifications for road construction work. Road maintenance was often not systematic. V-gutters were numerous and caused

discomfort and danger to travellers. Curves were seldom superelevated.

The Board therefore set to work to establish basic standards of geometrical design, and to prepare standard specifications for construction. Maintenance work was administered on the basis of an approved annual programme.

Road reconstruction was put in hand in conjunction with the Councils concerned on the great trunk routes. Among the works first started were reconstruction of the Prince's Highway south from Bulli towards Wollongong and beyond; reconstruction of the Great Southern Road (Hume Highway) between Camden and Mittagong, between Cross Roads and Paddy's River, including also the main road through Bowral and Moss Vale, and construction of a deviation between Breadalbane and Cullerin; reconstruction of the Great Western Road extending west from Lithgow, also long lengths in the Shires of Cobbora and Timbrellongie; reconstruction between Newcastle and Maitland, and construction of a deviation of the Great Northern Road (New England Highway) over the Warlands Range south of Murrumbidgee; on the North Coast Road (Pacific Highway) reconstruction between Coff's Harbour and Woolgoolga and between Murwillumbah and Tweed Heads.

Perhaps the most important individual work put in hand by the Main Roads Board was the construction of a direct road link between Sydney and Newcastle via Peat's Ferry. Work was commenced on this road at Berowra as early as July, 1925, under the supervision of the Hornsby Shire Council, and within the following twelve months active operations were in hand at

various points between Hornsby and Gosford and in the vicinity of Catherine Hill Bay. The total length from Sydney to Newcastle by the new route is 107 miles, as against 155 miles via the old route, and apart from sections in the suburbs of Sydney and Newcastle, the bulk of the length required construction or reconstruction. The road was opened to traffic in August, 1930.

Classification of Main Roads.—In 1925, the main roads system had not been divided into classes, although certain roads were regarded as Trunk Roads, viz., the Prince's Highway, the Great Southern Road, the Great Western Road, the Great Northern Road, and the North Coast Road.

It was soon appreciated that a more comprehensive system of classification was required if the main roads system was to be developed and improved on logical lines. In May, 1928, the Minister announced the decision to classify the main roads into three classes,—State Highways, Trunk Roads and ordinary Main Roads. The object of the division into three groups was to place the roads in their order of importance, and to provide a corresponding degree of State assistance to each group. The Board advised that the Main Roads Act be amended to correspond with the classification, and this was subsequently done by Parliament. A State Highway is now defined in the Main Roads Act as any main road being a principal avenue of road communication between the coast and the interior or throughout the State and connecting with such avenues in other States, and proclaimed a State highway under this Act, or any part of such State highway. A Trunk Road means any main road being a secondary avenue of road communication forming with the State Highways and other Trunk Roads a framework of a general system of intercommunication

throughout the State and proclaimed a Trunk Road under this Act, or any part of such Trunk Road. Ordinary Main Roads comprise the balance of the system and form, together with the State Highways and Trunk Roads, a network linking the principal centres of population throughout the State.

Many of the State Highways have been named mainly after explorers or from geographical considerations.

Decentralisation of Administration.—The Main Roads Board's administration was in the first place centred on the Head Office at Sydney. Each country day-labour work was in the direct charge of a resident engineer reporting to one at the Head Office. Works carried out by Councils were inspected by visiting engineers from the Head Office.

It was soon apparent that improved administration and closer contact with Councils and their officers would be gained by decentralisation, and in 1928 six divisional headquarters were established in country towns. The work of each division was placed in charge of a divisional engineer, who was supplied with necessary assistance, and the supervision of all Departmental work in the Division was placed under his direction. In addition, he was made responsible for the carrying out of surveys and the preparation of road plans. The Divisional Engineers were given a substantial measure of responsibility in the approving of Councils' proposals.

The Divisional system has proved to be eminently successful, and all the Department's work is now administered on this basis. The total number of Divisions is now twelve. The headquarters of nine Divisions are in the country at Newcastle, Grafton, Glen Innes, Tamworth, Parkes, Goulburn, Bega,



North-eastern Divisional Office, Grafton.

Wagga Wagga and Deniliquin, respectively. The headquarters of the remaining three divisions are in Sydney, these divisions covering, respectively, the Metropolitan area, an area lying to the south and south-west of the Metropolitan area, and an area lying to the west and north of the Metropolitan area.

The Western Division, for administrative purposes, is divided into five Districts with headquarters at Bourke, Broken Hill, Cobar, Hay and Wentworth.

Rates of Financial Assistance to Country Councils.—

Whereas the full cost of all approved works on main roads in the County of Cumberland is met by the Department irrespective of the classification of the road, works on main roads in the Country are financed by a different method.

In the case of country main roads, the Main Roads Act in 1925 provided that the Board should not require a Council to contribute more than one-half of the cost of any work of construction or maintenance, but the Board might grant assistance equal to more than half the cost.

In the first place the Board decided to grant assistance on a £ for £ basis, but at an early stage the Board increased its assistance to two-thirds in the case of some work of higher standard on the great Trunk Routes.

At the commencement of the financial year 1926-27 the rates were again raised, becoming £2 by the Board to £1 by the Council in respect of all works on the Great Trunk Routes, and 30/- to the £ in the case of other Main Roads.

When the Main Roads system was classified in 1928 the rates of subsidy were increased by an amendment

of the Main Roads Act so that the Country Main Roads Fund was required to meet the full cost of works on State Highways, at least two-thirds of the cost of works on Trunk Roads, and at least one-half the cost on ordinary Main Roads. In practice, however, the rate payable for work on ordinary main roads was fixed at 30/- for each £ contributed by the Councils. A rapid falling off in revenue made it necessary in 1931 to review the rate for ordinary Main Roads and revert to the minimum rates of assistance provided by the Act. This position continued until the beginning of 1936, when the rates of assistance to Councils were increased by the Main Roads (Amendment) Act, 1936, to the level which still applies, and by which the Department of Main Roads provides the following:—

State Highways	Full cost.
Trunk Roads	Three-quarters.
Ordinary Main Roads . .	Two-thirds.

Since November, 1932, the Department of Main Roads has met the full cost of the construction of bridges on Trunk Roads, and three-quarters of the cost on ordinary Main Roads, bridge construction thus being subsidised at a higher rate than other main road works.

In addition to the foregoing, the Department of Main Roads bears the full cost of the following:—"Mountain Pass" sections of main roads, generally linking the coast and the tablelands; all roads in the Western Division of the State and not within Municipalities; all bridges and ferries whether on proclaimed main roads or otherwise which were originally "National" works, i.e., a charge on the State.



Example of reconstruction by a Council on an ordinary Main Road. Section of Main Road 211 in the Shire of Holbrook.

Mileage of Main Roads.—When the Main Roads Act came into force the mileage of main roads was 12,840 miles. By the end of 1928, and following the re-classification of the Main Roads system into State Highways, Trunk Roads, and ordinary Main Roads, the mileage of main roads had increased to 13,490 miles, comprising the following:—

State Highways	3,580 miles.
Trunk Roads	2,370 "
Ordinary Main Roads ..	7,540 "
<i>Total</i> 13,490 ..	

At the end of 1949 the mileage, now including 5,631 miles in the Western Division, had grown to 22,971 miles, made up as follows:—

State Highways	6,519 miles.
Trunk Roads	3,745 "
Ordinary Main Roads ..	12,707 "
<i>Total</i> 22,971 ..	

Thus a steady increase in the mileage of the main roads system has occurred at the same time as growth in traffic and in population. Every increase in mileage of main roads results in an additional length of road being brought within the subsidised main road network, and its organised maintenance and improvement becomes the joint interest both of the Council concerned and of the Department of Main Roads. The proclamation of an additional main road thus results in the reduction of the financial liability of Councils in respect of the road concerned, and makes it possible for Council to divert a greater proportion of its funds to roads other than main roads.

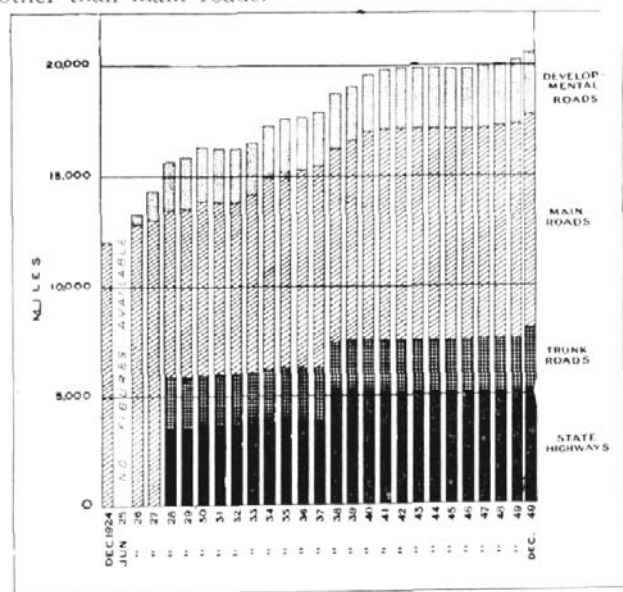


Diagram showing growth in mileage of proclaimed roads (excluding Western Division).

National Works: Western Division; Sydney Harbour Bridge.—Prior to the passage of the Main Roads Act, the State had built and was maintaining and controlling a series of works throughout New South Wales known as "National Works". These comprised mainly large bridges, ferries, and certain roads. In some cases

they formed part of proclaimed main roads, but in many cases were on unclassified roads.

In 1928, National Works on main or developmental roads were passed to the control of the Department of Main Roads and became a charge on the Main Roads Funds.

In 1932 the control of the Sydney Harbour Bridge and the lands resumed in connection with its construction, the maintenance of the structure, and the collection of tolls, were transferred to the Department of Main Roads. The financing of the Sydney Harbour Bridge is entirely independent of the Main Roads Funds.

Roads in the Western Division, other than those within Municipalities, have always been accepted as a State responsibility. In 1935, the control of these roads, totalling about 6,000 miles, was passed to the Department of Main Roads. At the same time, the remaining National Works, *i.e.*, those on roads other than main roads, were also made a responsibility of the Department of Main Roads.

Co-operation With Councils.—As 85 per cent. of the mileage of the Main Roads system (excluding roads in the Western Division) is under the care and control of Councils, it is essential, if the best results are to be secured, that there should be the closest co-operation between the Department of Main Roads and the Councils. It was to aid in this that the Department of Main Roads administration was decentralised.

Results obtained on main roads under the control of Councils testify to the harmonious working of the Main Roads Act. Councils are regularly visited by officers of the Department of Main Roads. Common problems are discussed and solutions arrived at.

Representatives of a Council also may visit a Department of Main Roads Divisional Office, or the Head Office, particularly when special representations are made. In the course of general inspections of main road works in a district, the Commissioner for Main Roads and the Assistant Commissioner normally visit Councils in the area.

By these and other means, there is secured a harmonising of objectives, and the establishment of a joint purpose in the solution of main road problems.

The Department of Main Roads assistance to Councils is primarily financial. Less obvious, but yet of considerable importance, is the technical assistance given directly and indirectly, as a result of test, experiment and research carried out by the Department, and by the development of methods and standards of work on sections of road under the Department's direct control. Standard specifications and instructions have been prepared and are utilised by Councils in most phases of main road construction.

Works Carried Out Directly by Department of Main Roads.—The sections of main road under the direct control of the Department of Main Roads are mainly

lengths of State Highways which present, or have presented, some special difficulty, *e.g.*, due to the need for heavy construction or for intensive maintenance and improvement. Apart from these aspects, however, it has always been regarded by the Department of Main Roads as essential that it control directly some portions of the Main Roads system, in order that its staff will, by



The Yass-Canberra Highway built to serve the Australian Federal Capital typifies modern road construction.

having direct responsibility for road work, thereby be in a position better to carry out their duties in relation to main roads under the direct control of Councils. At the same time, it provides an opportunity for the Department to experiment, and to test new materials and methods—both in relation to road maintenance and road construction.

The Department's employees engaged on roads and bridges and on plant repair work numbered approximately 3,000 during 1949.

The principal features of the Department's day-labour works are heavy earthworks construction on the coast and tablelands, reinforced concrete bridge construction, bituminous surfacing, the construction and maintenance of gravel and soil road surfaces principally in inland districts, and the construction of concrete and bituminous road pavements in the Metropolitan area. In all cases the work is mechanised to the greatest possible extent and, more and more road workers are occupied in the operation and servicing of machines, rather than in unskilled manual work.

The Department of Main Roads' constructional units proved of the greatest value during the war years, especially in the initial stages. These units were readily diverted to road and aerodrome construction, and made it possible for the Department of Main Roads to play an active part in the construction of the Alice Springs-Darwin highway and other roads and aerodromes in the Northern Territory, as well as carrying out further defence works in Norfolk Island, New Caledonia, Queensland and New South Wales.

Special Activities Associated With Road Construction and Maintenance.—The Department is required under the Main Roads Act to exercise a measure of control over other features on main roads, including road openings, tree preservation and planting, advertising hoardings, erection of structures such as petrol pumps,

roadside stalls and electricity lines, loaded weights of vehicles, and prevention of damage to road surfaces.

In the case of utility services on main roads, a number of agreements have been entered into with the principal bodies who use the road for water, gas and electricity services, whereby the cost of removing mains into footways prior to carriageway reconstruction is shared on an equitable basis.

The co-operation of telegraph, telephone and electricity transmission line authorities has also been generally obtained to assist in preserving the natural surroundings on roads.

It has been the aim of the Department of Main Roads to preserve to the greatest possible extent the natural flora on roads in rural areas. Roadside trees are not only pleasing in appearance, but provide useful shade, and play an important part in erosion prevention. Tree planting on rural roadsides has been carried out to a limited extent on main roads. Roadside conditions in the country are a severe test for planted trees and maintenance is costly. For this reason, the Department's efforts are at present concentrated on the care of the trees already planted, and few extensions are being made.

The weight of vehicular loads on main roads in New South Wales is controlled under the Local Government Act—Ordinance 30c. A similar Ordinance (No. 30D) applies to roads other than proclaimed main roads. These Ordinances have been in force since 1934 and are designed to protect roads and bridges from excessive wear and tear due to overloading of vehicles. The introduction of semi-trailer vehicles and other multiple axle units during and since the war has accentuated this problem, and the Department has, in conjunction with authorities in other States, applied itself to the question of securing uniformity in the administration of regulations dealing with the limitation of vehicular loads on main roads.

Publications.—At an early stage in the operations of the Main Roads Board it became apparent that something more than an annual report to Parliament was required to keep the Councils and general public informed as to the activities and policies of the Board and Councils on main and developmental roads, and to disseminate descriptions of improved methods and processes of road construction and maintenance. Further, the decentralisation of staff effected by the establishment of Divisions had necessitated the devising of means to enable each Divisional staff to be kept informed of the operations in the other Divisions and of the progress of road works and methods generally throughout the State.

In view of these considerations, publication of the journal "Main Roads" was commenced in September, 1929. Publication continued at monthly intervals until August, 1933, and thereafter at quarterly intervals up to August, 1940, when as a result of the war, it was suspended. Publication was resumed in September, 1946.

The journal is used primarily to supply information regarding the Department's and Councils' activities on main and developmental roads, and to describe new road-making practices and other matters of interest to those concerned with roads and road transport. The contents include general and technical information relating to road and bridge planning design, construction and maintenance; the results of research work; the operation of vehicles and mechanical equipment; road finance, and descriptions of particular works.

The Department of Main Roads issues also for the use of Councils, various publications dealing with administrative and engineering procedure, together with standard specifications and technical instructions.

The Main Roads System To-day.—The main roads system is a State-wide network of roads linking centres of population and comprising 22,971 miles of road. Its layout is largely influenced by the distribution of population and by topography. Its standard of construction varies from high class pavements in cities to simple earth formations in western areas, the pavement type being generally adapted to the nature and volume of the traffic carried by the particular road.

The system is classified and main road subsidies are paid to the local governing authorities on the basis of classification.

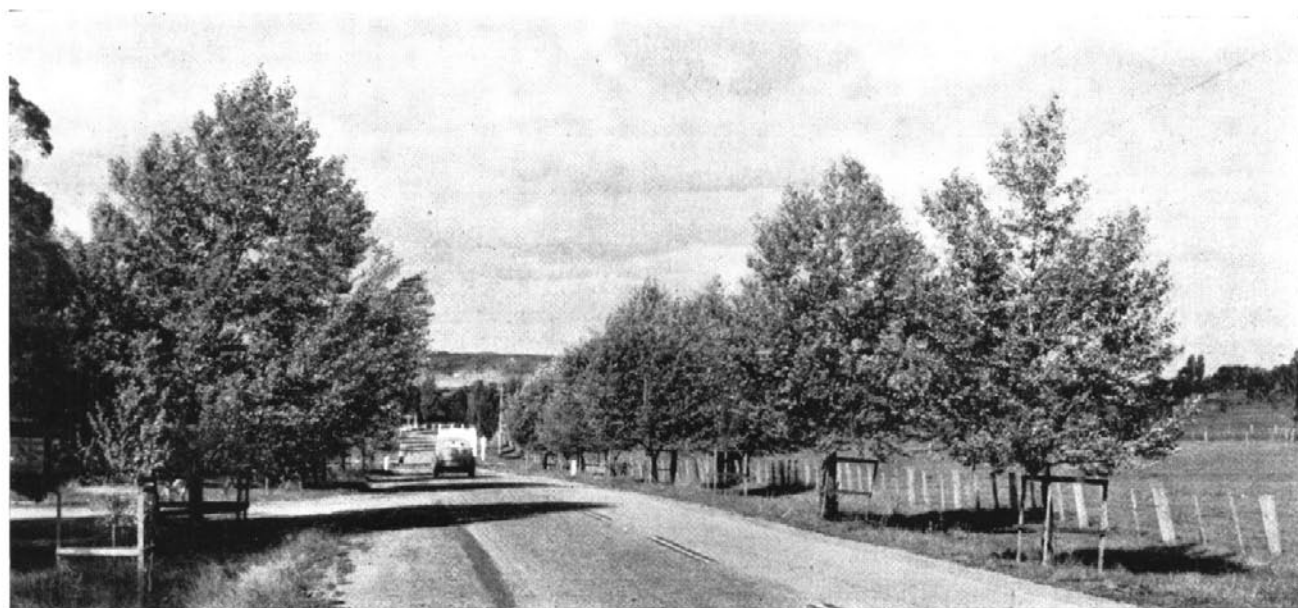
A unique feature of the New South Wales Main Roads system is its incorporation of the principal arterial roads of the Metropolitan area, with the exception of those in the inner part of the City of Sydney.

The improvement of main roads during the past 25 years has not been due only to the building of new main roads or the rebuilding of old roads. Perhaps in greater part, improvement has been achieved by systematic maintenance work, by small improvements from time to time, each directed at achieving some planned end, by the use of better technical processes, and by the wider use of trained engineers.

The improvement of main roads during the past 25 years has raised the standard of main road surface types to a marked degree, as will be seen from the following comparison of the position today with that in 1931 (1925 figures are not available):—

*Pavement types	Miles of Main Roads	
	1931	1950
Bituminous and other dustless surfaces ...	992	4,379
Gravel, stone and sandy loam ...	8,540	12,010
Earth ...	4,290	951

*Excluding roads in the Western Division.



Avenue of Silver Poplars on New England Highway in approach to Armidale.



Reconstruction with bituminous surfacing on the Wellington-Parkes Main Road carried out by the Macquarie Shire Council.



Reconstruction on the Orange-Parkes Trunk Road by the Canobolas Shire Council.

There is in the country a great need for the further extension of bituminous surfaces on those roads carrying substantial traffic volumes, and this need is being increasingly recognised by Councils in the allocation of funds for this class of work on Trunk and ordinary Main Roads. A similar need exists on some of the State Highways, especially the Prince's and Pacific Highways which together form a continuous route along the coast from the south to the north of New South Wales.

Other urgently required works include the provision of additional bridges. Many are needed to replace existing structures which can no longer carry the required loads, others are wanted to replace bridges destroyed by flood, and others again for the bridging of streams never yet bridged.

The further improvement of main roads in the

Western Division of New South Wales is also much needed to assist those who live far from many of the amenities available to those in other parts of the State.

While these represent broadly the likely trend of future improvement on the main roads system, it has to be emphasised that roads are not permanent. Not only does obsolescence occur due to changing nature of demand, but the effect of traffic on a road is to destroy its structure over a longer or shorter period. Already there is ample evidence in New South Wales of the effect of heavy long-distance lorry traffic on roads. So the main roads of New South Wales today present a twofold problem, embracing both further road and bridge building, while at the same time devoting increasing attention to the strengthening and rebuilding of main roads which have deteriorated under years of traffic or have become obsolescent.

Growth of Motor Vehicle Traffic in New South Wales.

There are now five times as many vehicles registered in New South Wales as there were when the Main Roads Board was formed 25 years ago. At the start of 1925, 95,941 vehicles had been registered. The following 25 years saw a rise to 473,256 vehicles providing one vehicle for every 6.6 persons in the State. (See Diagram No. 1.)

MOTOR VEHICLES REGISTERED IN N.S.W.
31ST DECEMBER

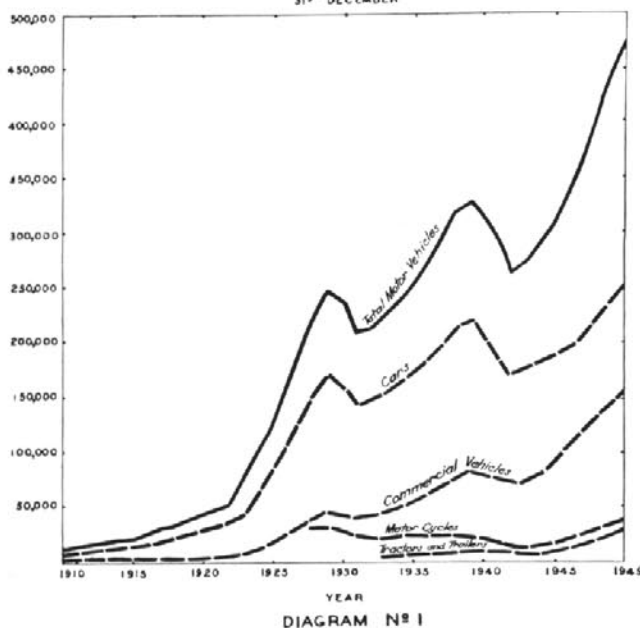


DIAGRAM N° 1

During recent years there has been a particularly rapid expansion of the use of motor vehicles for commercial purposes. The early motor vehicles were almost entirely cars and cycles, used mainly for pleasure, for touring or for racing and other sporting trials. Even in 1910, of 4,478 registered motor vehicles in New South Wales, only four were commercial vehicles.

By the beginning of 1925, the number of registered commercial vehicles had grown to 13,999, or 15 per cent. of all vehicles registered at that time. At the end of 1939, commercial vehicles numbered 78,364 or 24 per cent. of all vehicles. At the 31st December, 1949, there were 150,766 commercial vehicles registered in New South Wales, representing 32 per cent. of all registered vehicles. (See Diagram No. 2.)

In other words, between the beginning of 1925 and 1950, the number of commercial vehicles has multiplied more than ten-fold, while the number of other vehicles has nearly quadrupled. But this is

not the whole story, because many of the 294,317 cars and motor cycles on the roads of New South Wales are also used either solely or partly for business purposes. Available figures indicate that during recent years, 45 per cent. of *all* registered vehicles are used solely for business purposes, and a further 26 per cent. are used partly for business and partly for pleasure. Only 29 per cent. are used for pleasure purposes only.

VARIATION IN PROPORTION OF COMMERCIAL VEHICLES
TO TOTAL VEHICLES REGISTERED
31ST DECEMBER

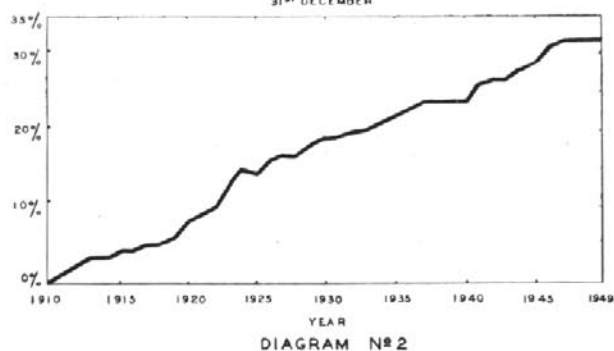


DIAGRAM N° 2

So we have come a long way from 1910 when there were only four registered commercial vehicles.

An indication of the considerable growth in the use of roads by heavy vehicles since the end of the war is provided by information gathered at Peat's Ferry Bridge on the Pacific Highway between Sydney and Newcastle during the last half of each of the years 1945 and 1949. This discloses that the lighter type of traffic—cars, motor cycles and utilities increased by 180 per cent., whereas lorry traffic increased by 611 per cent. from 9,269 to 65,885. The increase in the number of heavy lorries as distinct from the lighter lorries is still more marked. Lorries of up to 3 tons inclusive tare weight increased by 427 per cent., while those of over 3 tons tare weight increased by 1,338 per cent. from 1,867 to 26,852.

THE TRAFFIC ON THE ROADS.

The volume of traffic travelling over the roads of a country depends partly on the number of registered vehicles, and partly on the extent to which the vehicles are used. We can deduce with reasonable accuracy that the total annual mileage of road travel in New South Wales at present is about 2,720,000,000 vehicle-miles, corresponding to an annual petrol consumption of 160,000,000 gallons. Twenty-five years ago, the petrol used in a year was only 30,000,000 gallons. We can



Wool being hauled to Sydney on the Great Western Highway.

say then, not with strict accuracy but as a reasonable approximation, that vehicle-miles of travel on our roads has increased more than five times since the Main Roads Board was established.

The average daily traffic across the Sydney Harbour Bridge in 1949 was 28,500 vehicles. The daily traffic over the bridge in 1933, the year after it was opened averaged 11,650 vehicles, so that the traffic is now two and a half times its earlier amount.



Fruit haulage on the Pacific Highway in Hastings Shire.

At the George's River Bridge on the south of Sydney (Prince's Highway), the traffic in 1949 was nearly two and a half times greater than the traffic in 1930, the year after the bridge was opened.

At the Hawkesbury River Bridge at Peat's Ferry (Pacific Highway), the traffic in 1949 was almost four times the traffic in 1931, the year after the direct Sydney—Newcastle road was opened, there being a ferry service at Peat's Ferry in the first place.

Traffic growth in the Newcastle district is typified by the Hunter River ferry crossing at Newcastle where the 1949 traffic was more than twice that of 1935.

On the South Coast, the traffic at Bateman's Bay ferry in 1949 was three times that of 1935.

Traffic to the west is typified by counts at Victoria Pass, the western descent from the Blue Mountains.



Timber haulage on the Prince's Highway, South Coast.

Here traffic on a typical day in 1949 was almost three times that of a count taken on a typical day in 1934.

The traffic on the main roads today is predominantly business traffic. Cost of transport forms a significant part of the cost of every economic activity. Good roads mean reduced road transport costs. The benefit of the savings so made reaches to every man, woman and child in the community.

Improvements in main roads during the past twenty-five years have made possible the vast growth of road traffic in New South Wales. But roads wear out, and with the continued growth of traffic and the increased use of heavy freight vehicles, major roads must in many cases be strengthened, widened, straightened and made safer.

Road Building Becomes Mechanised

Among films produced by the Department of Main Roads is one showing the construction in 1929 of the Razorback Deviation on the Hume Highway, then the Great Southern Road, between Camden and Picton. The work involved 143,000 cubic yards of excavation, both rock and earth, and 115,000 square yards of bituminous penetration surface course laid on a hand-packed 8-inch Telford base. (See Fig. 1).

It is interesting to compare the plant used for that work with the plant available today. There was a tractor fitted with a blade on the job, and a steam shovel as well as a few motor trucks to augment the tip drays. But these machines were as radically different from modern machines in appearance, power, and ease of operation as were the cars of 20 years ago compared with the cars of today.

In those days, in organising an earthwork job, it was the availability of men which was the main factor



Fig. 1.—Laying hand-packed basecourse, 1929.

in determining the rate of progress. Today it is the machines.

The 30 h.p. tractor shown in Fig. 2 was fitted with one of the first blades used by the Department of Main Roads. It was a forerunner of the modern angle-dozer, but it was primarily designed as a back-filler, and as such was capable only of rough trimming and of moving small volumes of well loosened material. The shovel ($\frac{1}{2}$ cubic yard) shown in Fig 3 may not appear to be very different in its essential features from the machines of today. In the case of shovels, the improvement over the last 20 years has been due to the change from steam driven to high efficiency diesel prime movers, ease and speed of operation and a complete departure from the "shanty" on tracks type of superstructure to the compact, well-designed cabin, giving greatly improved comfort for the operator and protection for the engine, as shown in Fig. 4.

In the last 20 years the cost of labour has risen by approximately 110 per cent., and the cost of work



Fig. 2.—30 h.p. Tractor fitted with blade, at work, 1929.

still largely carried out by manual labour, such as reinforced concrete bridges, has risen almost proportionately to the cost of labour. On the other hand the cost of earth moving has increased only by roughly 20 per cent. The difference is wholly due to the large advance in the mechanisation of earth moving. This virtual reduction in the cost of earth moving has made economically possible the construction of roads to meet the high speeds of which the modern motor vehicle is capable. The power-weight ratio of the present day motor vehicle is many times greater than the most advanced design of the 1920's, and this, added to refinements in springing and control, enables high speeds to be comfortably maintained by the average driver. Although the greater power and better braking of the modern vehicle has eased the problem of grades for the road builder, yet, to maintain with safety the higher cruising speeds, and to take advantage of the capabilities of the modern engine, the road user must be provided with longer sight distances over crests and around curves, and with larger radius



Fig. 3.— $\frac{1}{2}$ cubic yard Steam Shovel in use, 1929.



Fig. 4. Modern Diesel Shovel loading rock on new highway under construction between Glen Innes and Grafton.

curves. As an example of how these requirements affect the volume of earthwork involved in road construction, a typical straight road passing over a crest is shown in Fig. 5. The two grade-lines show the difference in the cut required to give the desirable minimum sight distance for 30 m.p.h. and 50 m.p.h. The 50 m.p.h. requires 7,900 cubic yards more excavation than that for 30 m.p.h. That is not the whole story, because frequently the deeper the cut, the greater the proportion of rock as compared with earth.

As mentioned above, two of the requirements for the safe operation of present day vehicles are adequate sight distance and large radius curves. Two further requirements are dustless surfaces and smooth pavements, and, as the number of vehicles on the roads has

increased, so has the necessity to find means to meet these latter two requirements become more urgent.

The Department of Main Roads has attacked these two problems, and as a result of the work done it can be said that some degree of success has been achieved. However, the major problem of a reduction in unit cost sufficient to enable the demand for smooth dustless surfaces to be satisfied from present revenues, has not yet been solved. It did appear in the early 1930's that a partial solution was in sight. At that time, in New South Wales and in other States very long lengths of thin gravel pavements sealed with bitumen were laid, and for some years they gave satisfactory service at low maintenance costs. There were then ample supplies of gravel still available close to the roads, and the traffic, both in number and in the average weight of the vehicles, was much lighter than it is today. Incipient failure of such pavements as these became evident in Australia and elsewhere prior to the war. This led to intensive research, particularly in the United States, into the properties of road gravels and soils, and the thicknesses and quality of materials necessary to give long-life pavements under present day loading. The investigations

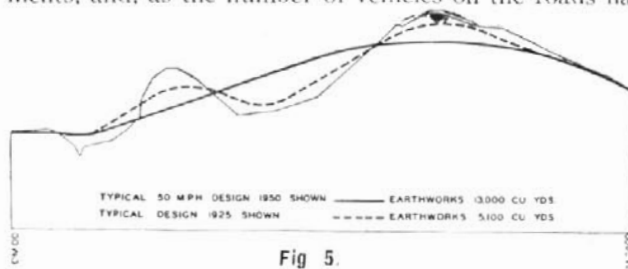


Fig 5.

of the Department of Main Roads were commenced in 1938, and involved the analysis of some thousands of samples taken from satisfactory and unsatisfactory sealed and unsealed pavements and comparison of the results with the service history of the pavements. Preliminary conclusions and standards developed from these investigations were used by the Department from 1942 onwards, and were progressively amended and developed as further data was collected. The conclusions were brought to a satisfactory working basis in 1946 and they were published in 1947.

One of the Department of Main Roads developments in which both improved riding qualities and reduced costs have been achieved, is in the laying of premixed macadam by means of the drag-spreader. Prior to 1932 all premixed macadam surface and smoothing course work was carried out by hand-spreading and raking, but during that year experiments were carried out in laying the macadam by tipping through the tail-board of a lorry into a simple drag attached behind. The improvements which have been introduced by the Department's field staff since this method was first adopted have resulted in major decreases in man-hours



A recent plant development. Pneumatic tyred 132 h.p. Tractor-Dozer acquired by the Department early in 1950.

Unfortunately, these investigations proved that there is no easy and cheap method of providing dustless road pavements of long life. On the contrary, the types of gravel and sandclays which are now considered suitable for bitumen surfacing are strictly limited, blending of materials is frequently necessary and greater thicknesses are required than in earlier years. Strict field control of the materials is now an indispensable condition in such work. The result is that, although the continuing failure of such pavements is being gradually arrested, the initial cost has been increased.

required per unit of surface, and a high standard of work, particularly in respect of smooth riding qualities.

In referring above to the Razorback Deviation on the Hume Highway, it was stated that the availability of manpower was then the main factor in determining the rate of progress, and that today it is the machine. This change in the factors determining the rate of work has been a gradual one, and it is a result, in part, of the demand created by the progressive improvement in motor vehicles for roads of a standard suitable for higher speeds. As the motor vehicle



A Bulldozer at work on road improvements near Mt. Kosciuszko.

increased in power, speed and control, a parallel evolution was taking place in the road building equipment up to the stage where today one operator may have under his control a tractor of over 100 h.p. weighing more than 16 tons.

As an indication of the growth of mechanisation, records show that at the end of the year during which the Main Roads Board began its activities (1925) the total horsepower of all engines in its equipment, excluding motor vehicles, was 400. One year later this figure had increased to 1,400 horsepower. Today the Department of Main Roads has in its service no less than 22,000 horsepower (excluding motor vehicles) in a comprehensive variety of plant unheard of in the Department's infancy.

A few examples of road-building equipment will help in some measure to indicate the lines along which improvements have been made.

The tractor which is now seen in the field is a precision engineered piece of equipment into which are built parts manufactured to a high degree of accuracy. The Main Roads Board purchased its first tractor, fitted with a 25 h.p. petrol engine, in 1926. Today it has many crawler tractors exceeding 16 tons in weight and of over 100 horsepower, including the giant tractor dozer on massive pneumatic tyres approximately 7 feet in diameter. This unit, weighing 14 tons, can travel at speeds up to 15 miles per hour.

The attachments for tractors have been developed from the elementary dozer previously mentioned, which was primarily a back filling attachment comprising a blade mounted on two light side arms with

counterweights secured in position by means of a chain. Today the angle and tilt dozer is an accurate piece of mechanism with simple controls requiring little effort on the part of the operator.

Tractors now in use by the Department load and haul scoops of 12 cubic yards (324 cubic feet), whereas the horse-drawn scoops could carry only 4 to 5 cubic feet, or approximately $1/84$ of the present scoop capacity. In the United States scoops up to 30 cubic yards capacity are in use on major earth moving works. Rippers also have developed from the horse-drawn rooter plough to the modern $6\frac{1}{2}$ ton rippers, with several tynes capable of ripping up heavy gravel deposits and the softer rocks.

The grader of the early days with its 6 feet long blade, manually controlled, and drawn by horses or tractor, has now been replaced with a high powered diesel-engined machine carrying a 12 ft. blade and scarifier, all controls being power operated and the operator comfortably accommodated in a weatherproof cab.

The loading of lorries, once carried out by manual labour, is now done with front-end loaders mounted on tractors, by mechanical shovels, by continuous bucket elevators, and by other mechanical equipment. Special rollers fitted with pneumatic tyres or with



Tractor-loader engaged in gravel loading.

— * —
Heavy motor grader
 used both on construc-
 tion and maintenance.



projecting feet or angle iron cleats have been developed for the compaction of subgrades and gravels.

Development in size and gross weight of equipment has its limits. For instance in the restricted width of road cuttings an excavator could be too large to swing or perform its movements efficiently. In addition, although the Department of Main Roads operates a fleet of modern vehicles and transporters for carrying heavy plant, limits must be placed on the axle loads and overall dimensions. The transporting of large equipment, therefore, presents a problem which must be considered both by the manufacturer and the user when new equipment is being developed.

The development and increase in number of road-making machines have correspondingly increased the

plant repair work. The first plant repair depot of the Main Roads Board was established at Clyde, a suburb of Sydney. This was shortly transferred to a larger site in the same vicinity at Granville, which is still in use and which has been further developed with factory type buildings and machine tools. These workshops are fully equipped for all normal repairs, as well as for the manufacture of a large range of spare parts which, during recent years, have been in short supply.

Field workshops are now provided to enable repairs to be carried out on the job, thus reducing the idle time and expense involved in transporting heavy equipment to the Central Workshop at Granville. This also enables the Central Workshop to concentrate



Transport of heavy plant on lorry-drawn low-loading float.



Department of Main Roads, Central Workshop, Granville. View in Machine Shop.

mainly on repairs of a major nature. Field workshops commenced with the simple blacksmith's hand forge for the sharpening of picks and drills. To these simple tools have been added such equipment as electrically driven lathes, bench drills, grinders, large (300 amp.) petrol-electric welding sets and special hand tools. All tools where possible are electrically or pneumatically operated. Where a town electricity supply is not available, a generating set is installed to provide power.

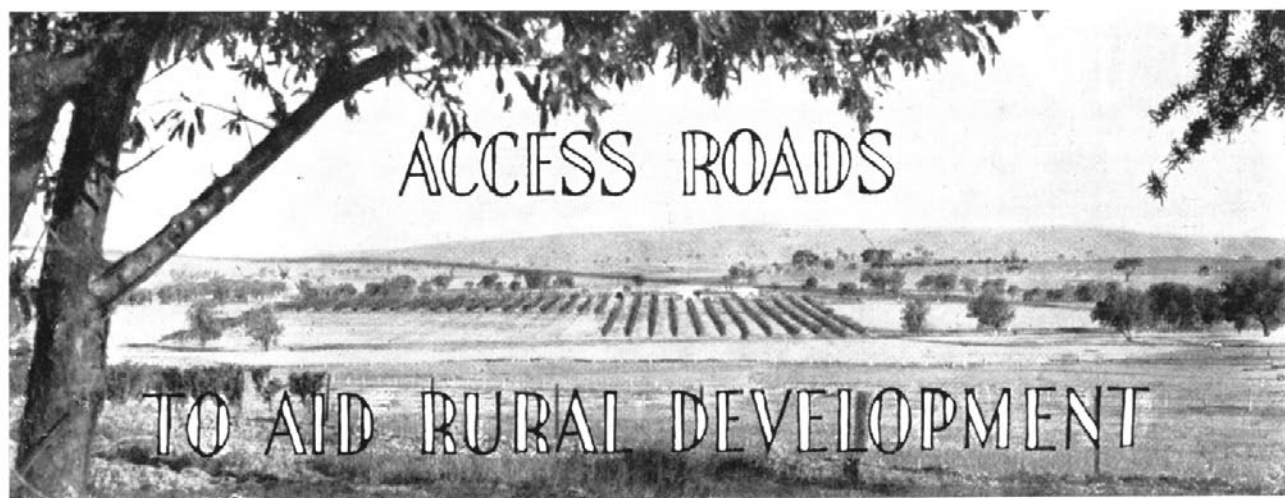
The static field workshop has been supplemented by mobile workshops for the servicing and repair of plant working in isolated areas. The mobile workshops are equipped with similar equipment to that of the static workshops, such as lathes, drills and grinders, but on a smaller scale. The mobile workshops are mounted on lorry chasses, and their mobility saves many delays, and reduces plant transportation problems.

To assist the operators of all types of equipment, servicing instructions for each item of plant and a general Plant Manual have been prepared. These set out the periods of servicing, lubricants to be used, and the basic principles to be observed in obtaining the maximum efficiency and output. The information in

these instructions has been obtained from all possible sources and from the specialised experience gained by technical officers of the Department of Main Roads.

A tractor of 130 h.p. fitted with a dozer blade today costs in the region of £8,000. The interest alone on this capital investment is £5 per week. Although the machines are ruggedly built for hard work, misuse and oversteering can easily result in very expensive damage as well as a reduction in effective output. Therefore, as the cost and size of machines have risen, so has the importance of well trained and efficient operators. As a result, the old system of training an operator by trial and error methods by his companion operators on the job is no longer acceptable.

In 1943, the Department of Main Roads established a School of Plant Instruction. For some years this school was located at the Department's Central Workshop at Granville, but it has since been found preferable to take the school to the jobs. The instructional staff consists of two foremen experienced in the servicing, maintenance and operation of all items of plant. As far as possible, every operator is visited at regular intervals and, in addition to giving primary instruction to new operators, new methods and practice are passed on to experienced operators by means of lectures, demonstration and by films.

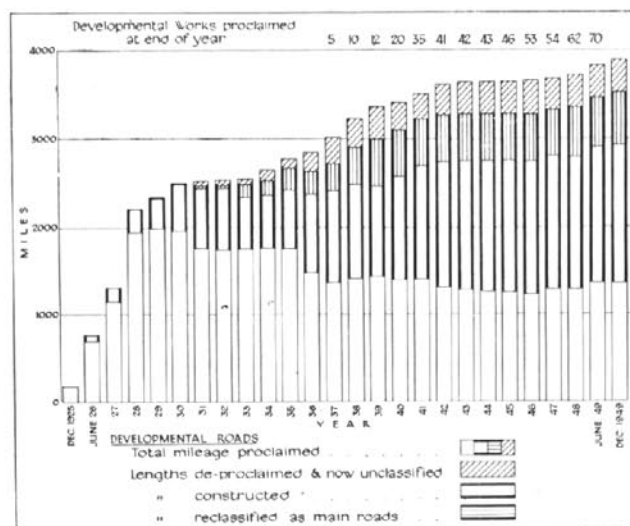


Developmental Roads are roads, so proclaimed under the Main Roads Act, which if constructed, "will serve to develop or further develop any district or part of a district: or will serve to develop any area of Crown or private land by providing access to a railway station or shipping wharf." The Main Roads Act makes special provision for a "Developmental Roads Fund," to be administered by the Department of Main Roads, for expenditure in the construction of roads proclaimed as "developmental." When so proclaimed, the relevant provisions of the Act enable the full cost of construction works on the road to be granted to the Councils concerned to the extent that funds are available. The care and control of a proclaimed Developmental Road remains with the council concerned, but in accepting a grant for developmental construction, the Council is required to undertake to maintain the work after construction, to the satisfaction of the Department of Main Roads.

The Developmental Road provisions of the Main Roads Act are intended as a means whereby the State may assist the growth of settlement and production and may be regarded as a recognition that, in undeveloped and under-developed areas, the cost of providing the necessary access roads may be beyond the resources of country Councils.

Under the original provisions of the Main Roads Act, 1924, assistance to Councils from Developmental Roads Funds was confined to roads not previously constructed. As a result of experience in the operation of the Act, it was found that on some roads which had been constructed in earlier years there yet remained obstacles to modern vehicles sufficient to impede the development of the areas depending on the road for access. Such obstacles included open stream crossings; excessive grades; low-lying sections subject to flooding; etc. In 1937 the Act was amended to provide that an isolated work such as a bridge, road deviation, or a length of heavy construction, might be proclaimed a Developmental work in circumstances similar to those governing the proclamation of Developmental Roads.

The construction of Developmental Roads in accordance with the provisions of the Main Roads Act has proceeded steadily during the past 20 years, although the rate of progress was slowed down during the war and immediate post-war years. The total mileage of Developmental Roads proclaimed up to the end of 1949 was 3,894 miles, and of this total 2,165 miles had been constructed. Seventy (70) Developmental Works had been proclaimed up to the end of 1949, and of this total fifty-five (55) had been constructed or were in process of construction.



Growth in mileage and progress in construction of Developmental Roads.

The standards of construction adopted for developmental roads vary according to anticipated developments in the area served and the nature and volume of traffic it is expected the road will be required to carry. In general the construction standards are lower in respect of width, alignment and grading than on Main Roads in like areas.

Selection of Developmental Roads and Works.—The responsibility for the selection of Developmental Roads and Works rests with the Department of Main Roads. Before recommending proclamation it is necessary to ensure as far as practicable that the productive possibilities of the area to be served are reasonably commensurate with the expenditure of public funds involved in the construction of the road. When submitting an application for proclamation of a Developmental Road or Work, a Council is required to furnish information about the extent and capabilities of the area affected and the road works considered necessary. The proposal is then investigated by a Departmental Officer taking into account the following:—

- (i) The extent of the area depending upon the road for access.
- (ii) Existing land settlement and production, the present use of land and the purposes for which it is best adapted.
- (iii) Existing means of transport and communication other than by road.
- (iv) The extent to which development may be dependent upon public works other than road works and any public works in contemplation.
- (v) Existing conditions in respect of road access and communication and the nature and cost of necessary construction works.

In some cases Developmental Roads tend to be in the nature of spur access roads leading from main roads or from local distributor roads into and along isolated valleys on the Coast, or into other areas inadequately equipped with means of access to road, rail or market town. In other cases the developmental road, in conjunction with another road or roads, either existing or projected, may be the nucleus of a new through route, although essentially developmental in its early stages. Such roads may later qualify to be classified as main roads, and this has already occurred in the case of 750 miles of Developmental Road, which

provides an indication of the successful development and traffic growth which have followed the original "developmental" construction.

In yet other cases, developmental roads have been proclaimed as part of the establishment of a general network of main and developmental roads to aid rural development throughout a large tract of country. An example of this is the Developmental Road construction carried out in the upper valleys of the Clarence and Richmond Rivers referred to later.

While some Developmental Roads and Works have been proclaimed in pastoral districts, proclamations mainly have been in areas to be occupied in smaller holdings, as in dairying, wheat and mixed farming districts. Substantial benefit has accrued to forestry as a result of Developmental Road construction. Horticulture, viticulture and the tourist industry have also benefited to some extent.

During the war a large number of applications from Councils for the proclamation of new Developmental Roads or Developmental Works accumulated, as conditions prevented their examination. Since the war further applications have been received. These applications have now all been examined or are in process of examination. While there are many applications which cannot be recommended by the Department of Main Roads, there are many others where the circumstances are considered fully to justify proclamation. There is an especial and continuing need for new access roads to be provided in the case of areas or districts where closer settlement is occurring as a result of the cutting up of large estates, whether as a result of soldier settlement, irrigation development or other causes. Available funds have not been such as to warrant proclamation at this stage of all those roads or works deemed worthy of proclamation. With the funds available every effort has been made to provide for access to areas made available by the Crown for War Service land settlement.



Developmental Road in the western portion of Burrangong Shire. An extensive wheat growing and wool producing area. Provides access to silos at Bribbaree Railway Station.



✱

Typical dairy farming scene in the area served by a Developmental Road in the Kyogle Shire dairying district. (This road has now been proclaimed a Main Road.)

✱

Trunk Road No. 83.) A similar length was formed only. The dairying industry was established in areas accessible from Casino and Kyogle by these roads, and hardwood and softwood timber was being drawn, largely by bullock teams, from the more accessible State Forests. Apart from this, the area generally was sparsely settled and used for cattle raising.

In the areas to which dairying had already extended the need for improved access roads was apparent and, in order to stimulate production in these areas and to promote further development, seven Developmental Roads, about 150 miles in all, were proclaimed between 1926 and 1929, with a view to construction as Funds became available.

For some time attention had been focussed on the possibilities of large-scale development of the Upper Valleys of the Clarence and Richmond Rivers, and in 1928 the Department of Main Roads undertook a comprehensive investigation to obtain information about the resources of the largely undeveloped part

of the area to the west of the Richmond Range and to ascertain the access needs of that area and the likely cost of necessary road works. The investigation included a topographical survey of about 2,000 sq. miles.

The climate is generally one of warm to hot summers and mild winters. In the Clarence Valley, winter temperatures are more extreme and frosts are common. The average annual rainfall ranges from about 38 inches in the west to nearly 60 inches in the north-east with a summer-autumn maximum throughout. The area contains a wide variety of soil types, ranging from red-brown loams and clay-loams developed on basaltic lavas to grey sands and sandy loams associated with Jurassic sandstones. The most fertile soils are the deep well-drained alluvials which occupy restricted areas along the courses of the rivers and larger tributary streams. The natural physical endowment of the area suggests suitability for dairying and the intensive cultivation of summer-growing fodders on the flats



Developmental Road up the Main Arm of the Brunswick River in Byron Shire serving the Dairying Industry.



Developmental Road providing access to the fertile Kindee Valley, Shire of Hastings. View from the road.

and lower slopes of the valleys, and for forestry and range grazing in the more rugged watershed sections. A classification of the land showed that throughout this tract of country, but chiefly between the Tenterfield-Casino Road and the Queensland Border, there were more-or-less extensive areas along the river and tributary streams well adapted for dairy farming and, in the vicinity of Tabulam, a considerable area of rich alluvial land suitable for intensive cultivation. Along the Richmond Range and elsewhere on the higher slopes were large areas of hardwood and softwood forests for the most part untapped.

Only by the provision of suitable access roads could the productive possibilities of the area be realised, and it was apparent that many miles of new roads would ultimately be required for full development of this area and country in the Richmond River Valley to the east of the range. A scheme of roading was prepared for the whole of the area in question and three additional Developmental Roads having a total length of 35 miles were subsequently proclaimed.

By the end of 1932 sections of Developmental Roads amounting to about 50 miles in all, had been constructed. The New England Highway, passing through the northern part of the area, had been completed and the construction of Main Road No. 140 had been extended from Wiangaree for about 10 miles towards Woodenbong. In that year the Unemployment Relief Council approved of the construction of an additional 50½ miles in extension of the Developmental roads and of about 17¼ miles of the main road, then unformed from Kyogle to Woodenbong, these being the lengths considered necessary at that stage to complete the framework of a road system for the area. These works were completed in 1935, and a further 15¼ miles of Developmental road was completed prior to 1940. The total length of Developmental road constructed in the area between 1926 and 1940 was 115¼ miles, together with about 43 miles of new main road. During the same period numerous minor access roads

were provided by the Shire Councils as feeders to these new roads. The map on page 85 shows the roads constructed in the area in question during the period mentioned.

The development following the road construction was spectacular. Although statistics applicable to the whole area are not available, the following figures relating to Kyogle Shire which embraces 1,342 sq. miles of the total, are indicative of the extent to which settlement and production has increased. According to



A Developmental Work. Bridge over Cox's Creek in Yallaroi Shire.

official statistics, the population of Kyogle Shire increased from 7,190 to 12,750 (77%) between 1925 and 1940. During this same period the area under cultivation increased by 75% from 10,670 acres to 18,633 acres, and butter production increased by 56% from 4,424,267 lbs. to 6,892,266 lbs. Annual timber production from the State Forests served by Developmental roads increased by 275% from 3,006,600 super feet in 1925 to 11,285,100 super feet in 1948. Although the growth of population and production was arrested during the war years, recent statistics again show an upward trend.

Bridging The Rivers.

During the past 25 years the Department of Main Roads in co-operation with the Councils has constructed 1,254 bridges, totalling 23.48 miles in length and involving an expenditure of approximately £4,000,000.

Prior to the establishment of the Main Roads Board in 1925, New South Wales had already built many fine road bridges, most of which had been constructed by the Department of Public Works during the period 1859-1925.

When the Main Roads Board was formed, beam bridges throughout the State were mainly of timber construction, while most of the larger streams were bridged by timber or composite timber-steel truss spans. There were some wrought iron and steel truss spans over major streams, and a few reinforced concrete beam bridges over smaller streams.

Bridges in the country had generally been built to a width of 15 feet between kerbs, although on some roads carrying heavy traffic greater widths had been used. Most bridges had been designed for a vehicular load of 16 tons, of which $9\frac{1}{2}$ tons was on one axle, and for a distributed load of 84 lbs. per square foot.

Policy Adopted by Main Roads Board.—The policy adopted by the Main Roads Board in respect of bridges provided for the replacement of bridges which had ceased to be able to fulfill their purpose; the erection of bridges across streams not previously bridged; and the substitution of bridges for ferries where this was economically feasible and was warranted by traffic.

It was decided by the Board to base the width of structures on the required number of traffic lanes, with

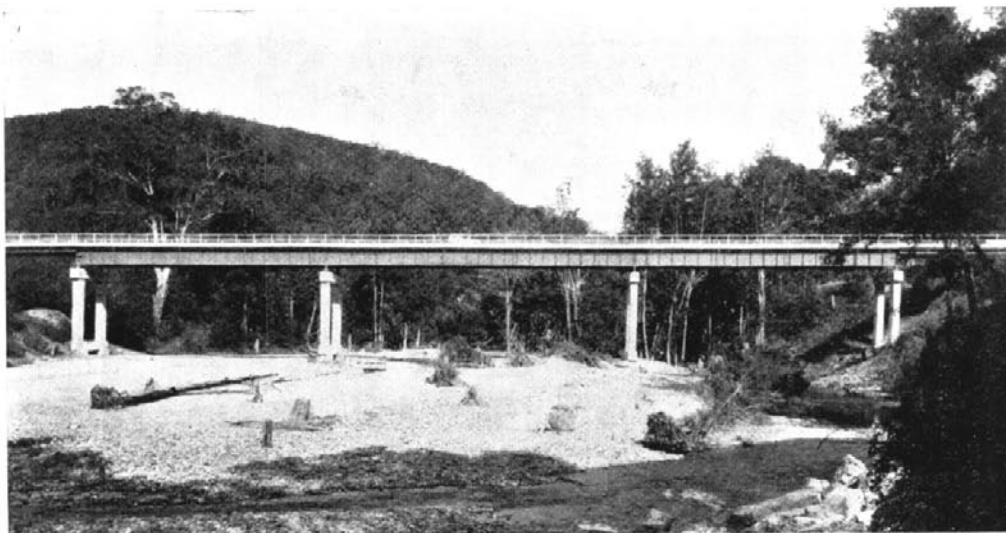
a minimum of two lanes. A standard design loading was adopted incorporating axle loads of 10,000 lbs. and 30,000 lbs. preceded and followed by a uniformly distributed load. This loading has been amended from time to time to conform to the development of road vehicles, and to secure uniformity with other States, the present standard providing for three axle loading—8,000 lbs., 32,000 lbs. and 32,000 lbs., and for alternative loadings it conforms closely to the United States standard loading for highway bridges, "H20—S16—44"

Bridge Types.—The principal types of structure adopted by the Main Roads Board comprised reinforced concrete beam bridges; steel truss bridges on concrete piers; and timber beam spans. With improvements in design methods and details, these continue to represent the principal bridge types built at present. Reinforced concrete arches, both fixed-end and bow-string, have been built, the largest arch span being 367 feet, situated at Northbridge, a suburb of Sydney. Steel plate girder bridges have also been used on a number of occasions and also steel joist bridges. Steel bridges usually have a concrete deck.

A feature of reinforced concrete bridge design on Main Roads has been the extensive use, where conditions permit, of monolithic rigid-frame construction. This was adapted from European practice, and the first bridge of this type was designed in 1926. The use of frame designs results in a substantial reduction in the amount of material required for building a concrete bridge, and improved appearance in comparison with simple beam spans. Difficulty in obtaining skilled tradesmen and suitable timber for formwork



Reinforced Concrete Arch Bridge, Stringy Bark Creek. On Main Road No. 373, Municipality of Lane Cove.



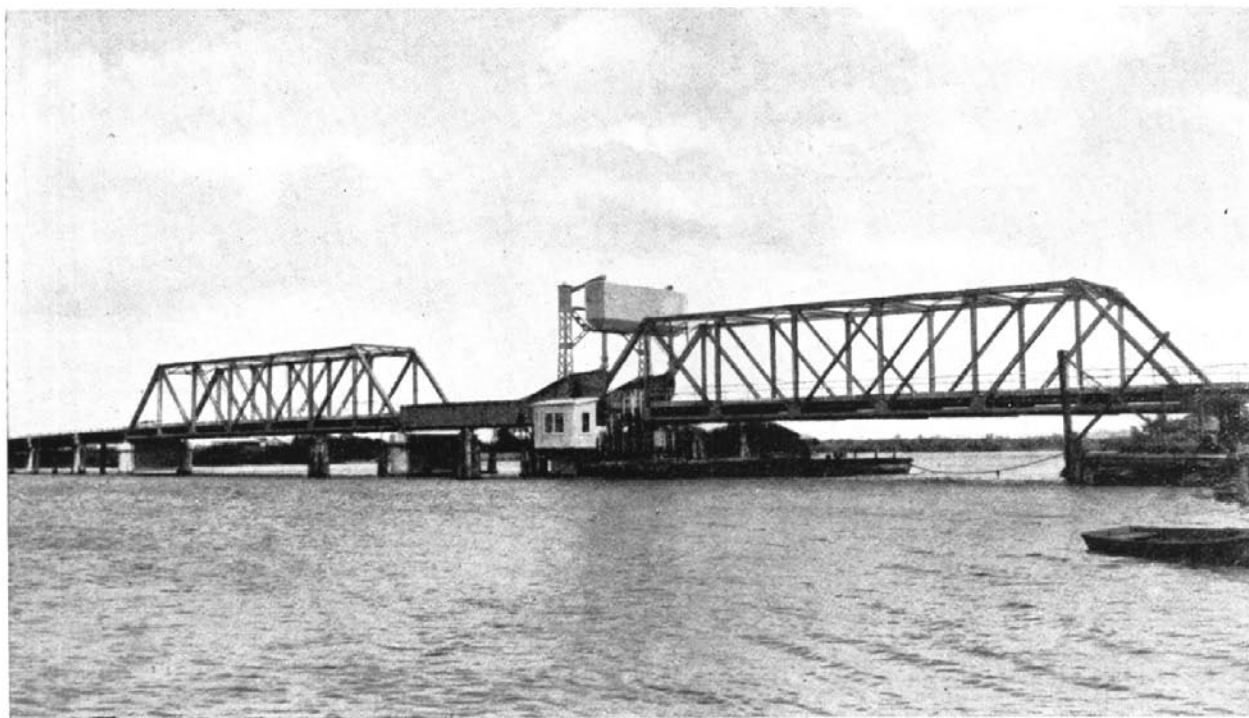
A continuous Plate Girder Bridge with concrete piers and deck over the Brogo River, Prince's Highway.

has, since the war, increased the costs of reinforced concrete bridges, particularly those involving complicated formwork, and in many cases simple rolled steel joist or concrete slab designs are at present being used in lieu of reinforced concrete girder and frame designs. Concrete structures are still used under favourable site conditions, however, but designs are being prepared in such a way as to permit the greatest possible repetition use of formwork.

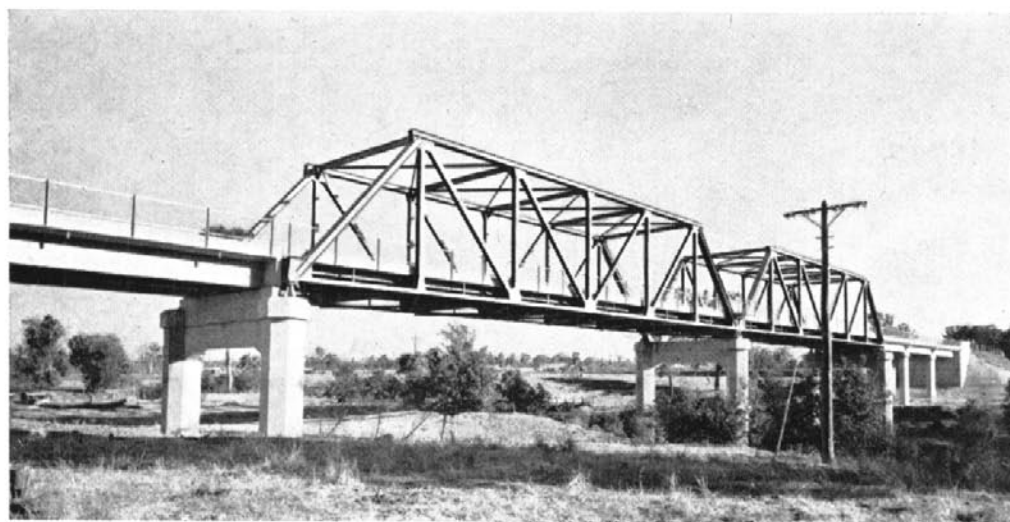
In the case of steel truss bridges, the shop work has been welded since 1936 on structures built by the Department of Main Roads. All field connections are

rivetted. The welding of steel bridges has necessitated new design methods affecting both the strength of the connections and the shape of the structural sections. The largest trusses constructed in this way are the 438 feet spans of the bridge over the Hawkesbury River at Peat's Ferry. Plate girder construction is also welded, the largest span so constructed being 90 feet long.

Bridges in New South Wales in a number of cases require opening spans to enable shipping to pass. Two varieties of opening span have been generally used by the Department of Main Roads, namely



Steel Truss Bridge with bascule opening span. Located at the crossing of the Tweed River by the Pacific Highway, between Murwillumbah and Tweed Heads.



— * —
**Welded Steel Truss Span
 Bridge over the Orara
 River at Coutt's Cross-
 ing. Armidale-Grafton
 Road.**
 — * —

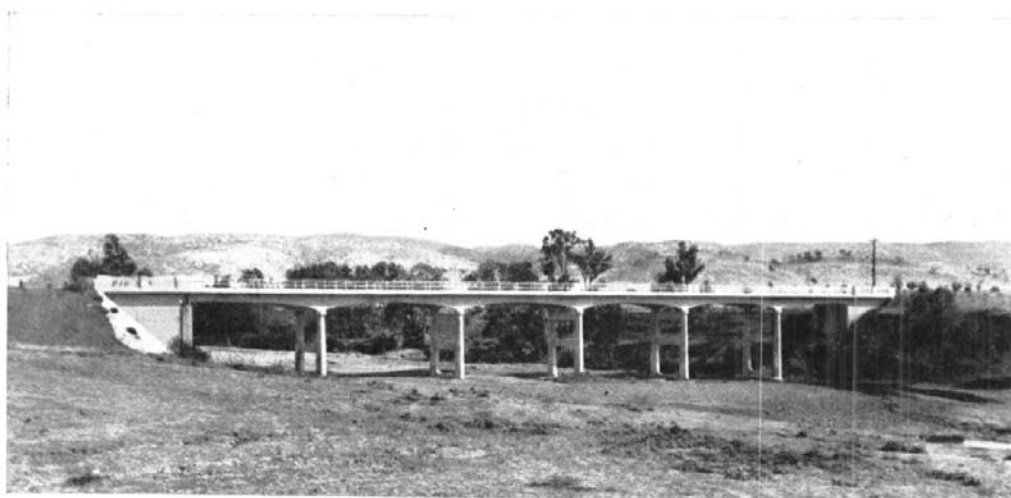
the bascule span and the vertical lift span. The design selected depends on the circumstances of the site and the nature of shipping requirements.

Foundations for bridges across the estuaries of coastal rivers in New South Wales are frequently difficult and costly to construct on account of the considerable depth of silt overlying rock. In such cases foundation work frequently has to be carried out under compressed air. The depth of one of the piers of the bridge over the Hawkesbury River at Peat's Ferry was too great for working under air pressure, and was built by excavation through open wells. The depth of this

continue in use, mainly on the North Coast, the Murray River and its tributaries, and in the County of Cumberland. Power operation has been installed on ferries in lieu of manual operation where warranted.

Maintenance.—The maintenance of bridges and ferries is a task of considerable magnitude, as the total number of bridges on the Main Roads system is 3,895. The Department of Main Roads maintains most of the major bridges throughout the State and many smaller structures. The remaining main road bridges are maintained by Councils. The total number of main road bridges maintained by Councils exceeds the

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**A reinforced concrete
 continuous beam bridge
 across the Manilla River
 at Upper Manilla.**
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pier is exceeded only by that of the San Francisco Bay Bridge, U.S.A.

Ferries.—Since 1925, fourteen ferries on Main Roads have been replaced by bridges, and at the present time bridges are under construction to replace ferries at Hexham on the Hunter River (Pacific Highway) and at Bateman's Bay on the Clyde River (Prince's Highway). Investigations regarding bridges to eliminate certain other ferries have been undertaken. As ferry crossings are usually on major streams, the provision of bridges is costly, and such work can be carried out only gradually. In the meantime, 32 ferry services

number maintained by the Department. The Department is responsible for the maintenance of the Sydney Harbour Bridge.

Bridge maintenance work is carried out by skilled gangs with necessary equipment working from bridge to bridge on a pre-arranged programme. The programme is based on the results of detailed inspections and testing of structures. The work of bridge gangs is mechanised as far as possible, but necessarily involves a fairly high proportion of manual work. Ferry vessels are docked or slipped annually for overhaul.



Since its inception 25 years ago as the Main Roads Board, the Department of Main Roads has regarded road safety as one of its principal considerations, and in the design and construction of new main road works the Department and Councils have constantly endeavoured to provide "in-built" safety.

On those roads not being rebuilt, local improvements have been carried out to assist traffic safety, including such works as the widening and easing of curves, the removal of obstructions to visibility, the widening and improving of approaches to bridges and subways, and so on.

Work done in the construction of main road works and in the local improvement of main roads has been supplemented by the installation of safety furnishings on main roads, including road warning signs, centre-line marking, guide posts and protection fencing and other means.

Main Roads are thus built, improved and furnished in such a way as to facilitate their safe use, and to aid the drivers of vehicles in the safe operation of their vehicles. In the final analysis, however, it is the judgment and care of the individual driver and of the individual pedestrian which determine the issue. In the case of traffic congested roads, especially in cities, it will be apparent that an especially high degree of judgment and care is called for from drivers. It is in such circumstances that the construction of "motorways," or arterial roads having restricted access, can result in a great reduction in road accidents, as has been well demonstrated in the United States.

It is the task of the Department of Main Roads and of Councils to see that the Main Roads of the State are built, improved and maintained in such a way as best to aid in securing road safety, the extent to which such work can be carried out being necessarily dependent on the funds available for the purpose. On the other hand, the best of main road facilities will not prevent accidents unless every driver and pedestrian realises his responsibility to other main road users, and acts accordingly.

All of us are road users, and all of us are concerned with road safety. Road authorities, to the extent of funds available, can provide favourable conditions for traffic safety, and assist the road user to do the right thing at the right time and place, but the safe use of the roads can only be secured by the exercise of care and judgment by all road users.

AIDS TO SAFETY ON MAIN ROADS.

Modern Standards of Design.—The proper design of the road is the road-builders first step in facilitating road safety. One of the first actions taken by the Main Roads Board in 1925 was to establish standard cross-sections for country main roads, and standards for the super-elevation and widening of horizontal curves, and for grading over crests. The Board also sought the elimination of V-gutters across main roads, so common at that time. The standards were published in the Board's first annual report.

Since 1925, the vehicles using the road have been transformed in respect of speed, weight, power, and braking equipment, and road design standards have had to be adjusted to meet these new requirements. Considerable research has taken place, especially in the United States, into the relation of the modern vehicle and the road, and this enabled the Department of Main Roads in 1937 to promulgate comprehensive road design standards to meet the changed conditions. These standards are based on the conception of providing safe travelling conditions for travel at a chosen vehicular speed, the selected speed being determined largely by the status of the road and the topography of the country passed through. The standards cover alignment, grading, visibility, shoulder and pavement widths, crossfall including superelevation and curves and road junctions and intersections. Roads constructed to these standards, and provided with a bitumen surface have a high degree of "in-built" safety.



A length of the Prince's Highway north of Bateman's Bay constructed to modern design standards.

Local Improvements.—All roads cannot be quickly rebuilt to provide ideal conditions for travel. The change in nature of road use has been so rapid that the transformation of road systems cannot keep pace. However, much can be done by local improvements to bring the older roads closer to the ideal and thus to render them safer for the traffic of today.

Work of this kind has been proceeding steadily during the past 25 years. Probably thousands of curves have been super-elevated and probably thousands of V-gutters have been eliminated. Sharp curves have been widened and "day-lighted" to give increased visibility. Road surfaces have been improved, often bitumen surfaced, and road safety furnishings have been installed. These and similar minor works have been constantly in progress throughout the Main Roads system for the past 25 years, and while unspectacular individually, in total they have had a big effect in improving road safety on main roads in New South Wales.

Intersection Layout.—Intersections especially in towns, are a frequent site of accidents. The design of rural road junctions and intersections was included in the Department of Main Roads 1937 Design Standards. Principles were there established regarding safety requirements. In particular it was emphasised that

there should be good visibility at road junctions, and that traffic entering a major road must slow down. The installation of road junctions so laid out at or near a right angle as to make it impracticable for traffic to enter without slowing down, has at times been opposed. The Department of Main Roads practice in this respect, however, is fully supported by experience and practice in the United States, and the Department is satisfied that where it is necessary for one vehicle to cross the path of another, the paths should cross at right angles or close thereto, and the vehicle entering the major road should proceed with especial caution.

Where improved urban intersection design is possible, the Department follows generally the policies of the American Association of State Highway Officials. In a number of cases, models have been prepared of proposed urban intersection layout to facilitate prior discussion with traffic officials and to ensure the best possible design.

Warning Signs.—Proposals for road signs on Main Roads were described in the first Annual Report of the Main Roads Board. The erection of these signs has been a continuous feature of Main Road work throughout the past 25 years. Following conferences with representatives of Road Authorities of other States, a high degree of uniformity of signs was first secured on Main Roads in all States, and this led to the establishment by the Standards Association of Australia Road Signs Code, intended for application on all roads in the Australian Commonwealth. The Code was published in 1935, and re-issued, after amendment, in 1946.

Related to road warning signs, is the elimination of advertising signs and hoardings from main roads. Twenty-five years ago roadsides on main roads and roadside trees, often provided a stand for advertisers. Apart from the resulting loss of amenity from advertising signs, their presence tended to be distracting to drivers and was liable, at times, to result in confusion with warning signs. The elimination of advertising matter on roadsides has thus assisted road safety. Signs outside the boundaries of Main Roads are also subject to control by the Department of Main Roads if prejudicial to the safety of the travelling public.

Railway Level-crossing Improvement.—There are some 600 railway level-crossings on main roads in New South Wales. While 31 level-crossings have been eliminated from main roads since 1925, it is apparent that elimination cannot be applied to all level-crossings on main roads on account of high cost. By ascertaining the rail and road traffic and other circumstances at existing level-crossings, those most in need of elimination for safety reasons have been selected, and further elimination will be carried out as funds permit.

Of perhaps more immediate importance, is the improvement of safety conditions at level-crossings on main roads by means of local adjustments. With this object, an inter-Departmental committee was set up by the Department of Railways and the Department of Main Roads. During the last four years the committee has inspected about two hundred and fifty of



Warning devices installed at a level crossing on Hume Highway near Narellan.

the more important level-crossings on Main Roads. As a result, improvements have been or are being made to about two hundred of the crossings. The improvements include alterations or additions to warning signs, provision of gates at open crossings, flashing lights, devices to warn gate-keepers of a train's approach, and removal of trees and structures that interfere with visibility between drivers of road vehicles and approaching trains. While improvements at some level crossings are only of a minor nature, nevertheless they all contribute in some measure to greater safety.

Centre-line Marking.—The marking of a centre-line on main roads by the Department of Main Roads has proved to be of the greatest value in road safety. Not only does it aid in safe passing of vehicles, but also, by use of the double line, it prohibits overtaking at points of low visibility.

The method of line-marking in use today is uniform in all States, as a result of conference and agreement between State Road Authorities. About 2,000 miles of main road are now line-marked in New South Wales.

Observance of line-marking is required under the New South Wales Traffic Regulations.

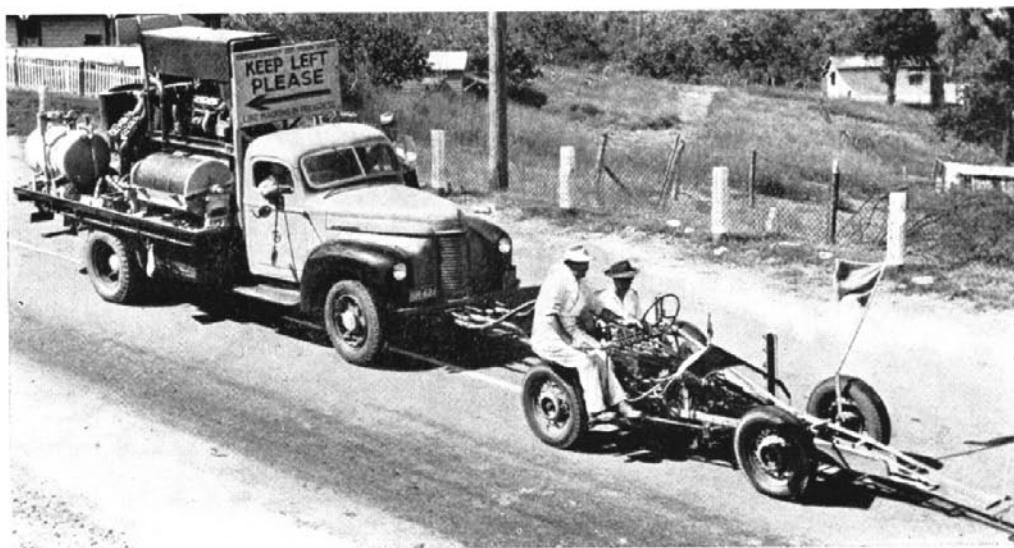
Protection Fencing, Guide Posts and Reflectors.—Safety measures on main roads include the erection of protection fencing on high embankments, especially where curves are sharp, and the erection of white guide posts along the outer edge of the shoulders of the road. These are of especial value in night driving. Reflectors are used on posts in some cases, especially in areas subject to fog, and practically every main road bridge is provided with a reflector strip at each end, attached to the end post.

Another safety device is the painting of railway overbridge parapets, and railway subway walls, with horizontal white bands, to render them more visible at night.

Physical Separation of Opposing Traffic Streams.—Head-on collisions of vehicles cannot occur if there is a positive barrier separating opposing traffic streams. Such a barrier can take the form of a central strip of grass dividing a road into two separate carriageways.

This form of construction is applicable only on heavily trafficked roads, as the total width of carriageway will necessarily be not less than sufficient to provide for four lanes of traffic, because each individual carriageway must be wide enough for not less than two lanes, in order to provide for overtaking.

Centre-line Marker at work.





Protection fencing on an embankment, Great Western Highway, Blue Mountains.

The divided carriageway type of main road has been used to a limited degree on main roads in Sydney and Newcastle, and it is planned to extend its use wherever feasible.

Motorways of the Future.—In 1945, the Main Roads Act of New South Wales was amended to provide for the proclamation of motorways, *i.e.*, roads on which frontage access may be restricted.

By the construction of motorways, it is possible to eliminate parking, turning and crossing movements, and to make a complete separation between vehicles and pedestrians. The motorway is thus not only a

road with exceptionally large vehicular carrying capacity, but also is a road with a high degree of in-built safety.

Motorways are planned for future development in the Sydney metropolis, in Newcastle and in Greater Wollongong.

The Study of Road Accidents.—The study of accident reports can often lead to the detection on a road of some unobserved hazard requiring correction. Accordingly copies of reports on accidents on main roads by Police are obtained in all cases where road conditions may possibly have been a contributing factor.



A divided carriageway. A section of the Hume Highway near Yagoona.

The field conditions are then closely examined, and safety action is taken if necessary.

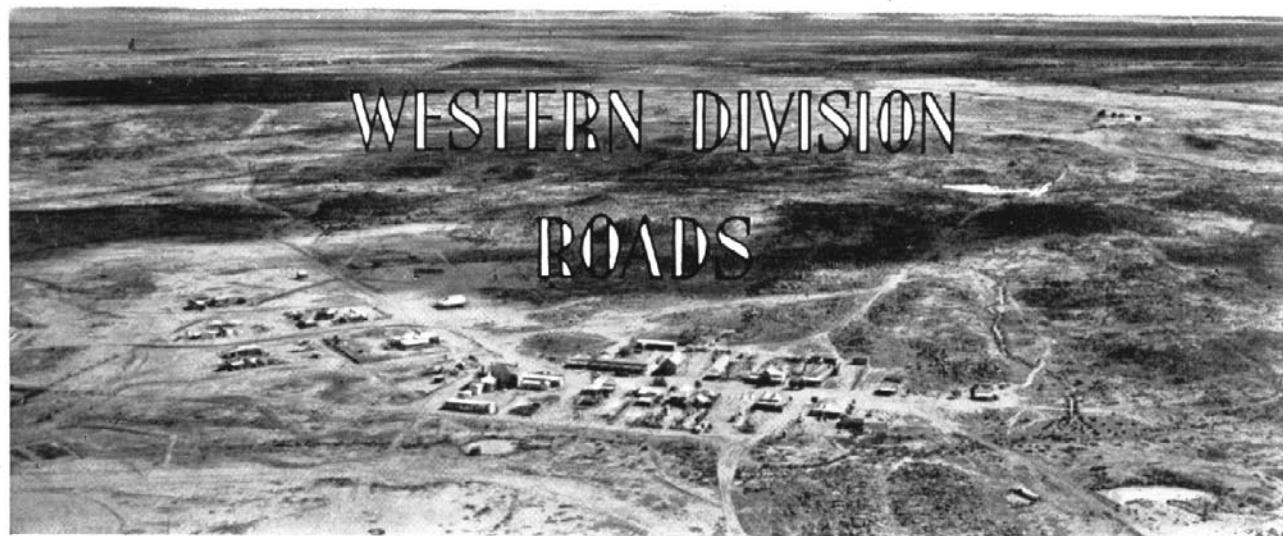
Accidents are also recorded on maps by the Police Department. These maps are examined by the Department of Main Roads and photographed periodically and also aid in the detection of hazardous locations where road improvement may be required.

CONCLUSION.

Twenty-five years' work by Councils and the Department of Main Roads on the main roads of New South Wales has seen the building of many new and safer roads, the improvement of the older roads, and the

widespread installation of devices to aid in the safe use of main roads. During the same period there has been a great change in the nature of vehicles and in the volume of traffic on the main roads of the State.

Regardless of such efforts to improve road safety as the road-builder has carried out in the past, and plans to do in the future, the co-operation of the individual road-user, both driver and pedestrian, is increasingly necessary if safety is to be achieved. The Department of Main Roads will continue, as in the past, and in association with Councils, to play its part in the common task, and to see that main roads are engineered for safety to the greatest possible extent that resources permit.



The Western Division of New South Wales covers 125,000 square miles and comprises 40 per cent. of the area of the State. Its land is almost entirely devoted to sheep raising, except that near Wentworth, in the south, at the junction of the Darling and Murray Rivers, are a series of irrigated areas, growing citrus fruits, vines and other crops. Near the western border of the Western Division is the mining city of Broken Hill.

The population of the Western Division is 51,000 persons, the principal towns and their populations being as follows:—Broken Hill 27,000, Wentworth 2,500, Cobar 2,000, Bourke 2,000, Brewarrina 840, and Wilcannia 800. The rural population of the Western Division is fairly uniformly distributed throughout apart from the closely settled irrigation areas near Wentworth. The sparseness of the population of the

Western Division results directly from its limited rainfall, the average annual fall varying from 15 inches along much of the eastern border to as little as 8 inches at and north of Broken Hill near its western border.

It will be apparent that with so large an area and so scattered a population, the Western Division is a country of big distances, and that road mileage must necessarily be great in relation to population. There are nine persons per mile of main road in the Western Division, compared with 166 persons per mile of main road in the remainder of New South Wales.

On account of the large mileage of road in relation to population in the Western Division, road improvement necessarily comprises in the first place the provision of earth formations, gravelled where possible over lengths otherwise untrafficable for extended periods in wet weather, and with firm stream crossings in cases



An effect of wind erosion. Culvert blocked by drifting sand.

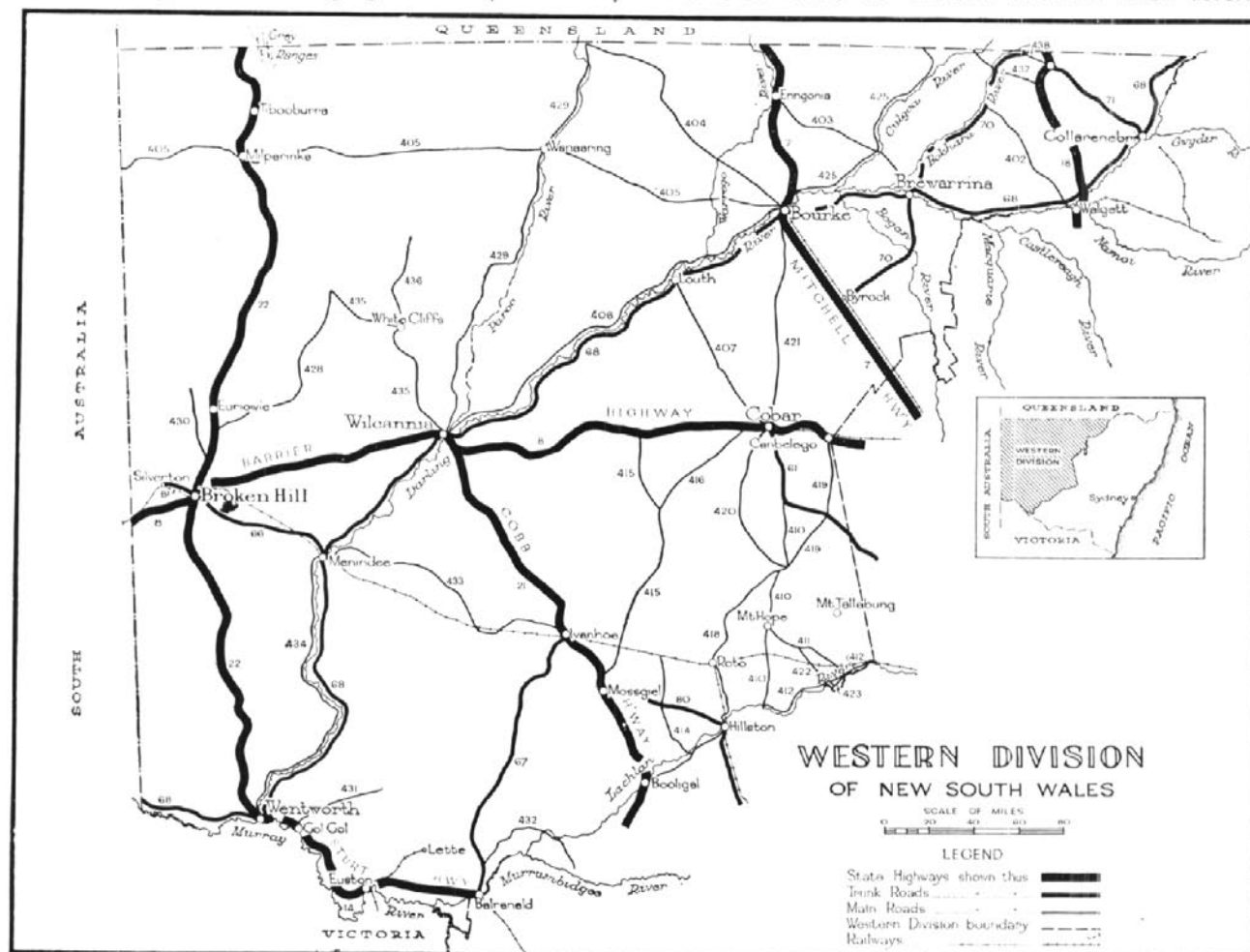
where bridges or culverts are not provided. By this means, a smooth running surface can be maintained in dry weather, and delays to traffic in wet weather are minimised, resulting in greater comfort and convenience in travel, and in reduced cost of haulage.

Road construction in the Western Division presents problems of a special nature due to the climate of the area, particularly the problem of soil erosion. On the one hand, high winds sweeping across open country



Gully formed by water erosion.

cause severe surface erosion, especially in the not infrequent times of drought when there is no grass cover. Earth road formations in some cases are gradually blown away over a period of years; indeed isolated lengths of formation have sometimes been blown away during a few days or even hours. The smaller water-courses and the road drains often become partially blocked with drifting soil under these conditions. On the other hand, the Western Division often receives



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Flood in the Western Division. A view at One Tree Station near Milparinka, August, 1949.

(Photo by courtesy of the "Z.C.—N.B.H.C. Conveyor.")

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much of its limited rain in the form of intense storms. With watercourses partially blocked, and the soil dry and sometimes without grass cover, the run-off may be large and rapid. The flowing water rapidly cuts new channels by erosion where old channels are blocked. Sometimes the general drainage system of a small locality may be completely changed as a result of one storm or a series of smaller storms, and considerable damage may be caused to road formations and associated works.

In flat country such as much of the Western Division, it might be thought that deciding the most advantageous route for a road would present few difficulties. Nothing could be further from the truth, however, because the flatness of the terrain and the great distances involved make ordinary reconnaissance methods excessively costly. As a result, locations of existing roads have generally not been fixed as the outcome of a complete engineering study, and their frequent damage by rain-storms is to a large degree a consequence of this.

The solution has been found to be in aerial photography, as described in "Main Roads" for December, 1949. By this means a complete picture is obtained of the drainage system on a wide strip, and the road location can be readily fixed in the most advantageous position and in such a way that it is least likely to be damaged or blocked by flooding.

Road Administration.—Apart from the six Municipalities which embody the towns of Broken Hill, Bourke, Cobar, Brewarrina, Wentworth and Wilcannia, the administration of the Western Division is a direct responsibility of the State. Roads outside the six Municipalities are under the care and control of the Department of Main Roads. Within the Municipalities the Department assists the Councils financially in respect of works on main roads, as in Shires and Municipalities elsewhere in the State.

The administration of the public roads system of the Division was assumed by the Department of Main Roads in 1935, having been previously administered by the Department of Public Works. Over a large part of the area the resident District Office staff of the Department of Public Works continues to carry out the necessary supervision on behalf of the Department of Main Roads, from offices situated at Broken Hill, Bourke and Hay. The supervision of the work within the Cobar district has been undertaken directly by the Department of Main Roads since 1935, and within the Wentworth district since early in the present year.

There are 7,966 miles of roads in the Division, comprising 1,329 miles of State Highways, 1,358 miles of Trunk Roads, 2,944 miles of ordinary Main Roads and 2,335 miles of unclassified roads.

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Road building in Western Division using Elevating Grader drawn by 100 h.p. Tractor.

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Long straight roads are common in the Western Division. Light Motor Grader at work, Bourke-Wanaaring Road.

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Road Progress.—On assuming control of roads in the Western Division in 1935, the Department of Main Roads set about linking up the isolated improvements already carried out, concentrating on the Barrier Highway (Cobar—Wilcannia—Broken Hill) and the roads connecting Broken Hill and Wentworth, Brewarrina and Walgett, and Bourke and Cobar. Principal work completed in the pre-war period comprised the formation of the full length of the Barrier Highway to Broken Hill, about half the length of the Wentworth to Broken Hill road, and the greater part of the road between Brewarrina and Walgett. The road from Wentworth east towards Dareton in the irrigated area was improved, and bituminous surfacing was provided or extended on main roads within the principal towns. The reconstruction of the road from Broken Hill to Silverton and Penrose Park, later to be bitumen surfaced throughout, was begun. In addition, the introduction of motor grader units for road maintenance led to much improved running conditions. In addition, many miles of light formation, drainage and other work was done with these units.

At the end of 1940 there were nine heavy motor graders in the Western Division in addition to an elevating grader unit which was used on those sections requiring the higher type of formation. The mobility and efficiency of these machines made possible rapid extensions of the Division's road formations. Unfortunately large scale improvements had to be deferred on account of the war. In the intervening years, due to drought, the effects of soil erosion and sand-drift were particularly severe, so that after the war it was necessary not only to fulfil the normal programme of construction envisaged before the war, but to repair work long neglected because of wartime shortages of labour and plant.

Since the end of the war improvement work has been rapidly put in hand, and maintenance plant has been re-established. At the present time there are in

the Western Division twelve motor graders and three elevating graders, as well as numerous smaller units.

Two of the biggest improvement works in the Division since the war have been carried out in the northern portion:—the formation or re-formation of the Bourke-Barrington road (Mitchell Highway), a length of 85 miles, and the Bourke-Hungerford Road (Main Road No. 404), a length of 126 miles. In addition, black-soil sections on both these roads have been gravelled for distances of 55 and 15 miles respectively. A continuous formation of 78 miles has been provided on the Bourke-Wanaaring Road (Main Road No. 405), and work on the remaining 40 miles is proceeding.

Further extensive formation work has been carried out in the vicinity of Walgett, notably from Walgett to the Queensland border near Hebel (76 miles), together with a branch to Goodooga (30 miles); along 24 miles of the Walgett-Cumborah-Goodooga Road; and along 32 miles of unformed sections on the Brewarrina-Walgett-Collarenebri-Mungindi Road.

In the western and southern part of the Western Division, other extensive works have been recently completed or are in progress. The formation of the Broken Hill-Wentworth Road (State Highway No. 22) has been completed. On the Wentworth-South Australian border road (Trunk Road No. 68) 33 miles have been formed. On the Broken Hill-Queensland border road (State Highway No. 22), 250 miles, work of creating a road from what was little more than a bush track, has been in progress for several years. This work has presented especial difficulties due to climate and shortage of labour. The construction of a road formation from Wentworth to Menindee (167 miles) is also in progress.

In the Wentworth district work has been initiated which will lead to the provision of a bituminous surface between Wentworth and Euston (72 miles), the most heavily trafficked long length of road in the western Division.

Planning For The Future.

Planning in relation to main roads comprises the logical forecasting of future main road requirements, and has been a feature of the work of the Department of Main Roads during the past twenty-five years. The object of advance planning is primarily to ensure that individual works constructed at any particular period will not only best serve present requirements, but will also form part of a complete road system so designed as to give the best possible service to the people of New South Wales, for as far ahead as may be foreseen.

Planning in relation to main roads has three aspects—first the choice of those roads to be developed as main roads, second the selection of the precise routes to be followed, and finally the determination of the works required on the selected main roads system and of the order in which the works should be carried out.

On first thoughts, it might be considered that little main road planning is called for in New South Wales to-day, that the needs are so obvious that the work to be done selects itself. For example, there is a recognised need for improved metropolitan main road facilities; for additional roads in the country to be brought within the main roads system; for the construction of new bridges in place of those washed away by floods, and to replace those which on account of age can now carry only very restricted loads; there is need to construct bridges at many small streams at present unbridged, and to replace punts by bridges on some larger streams; in the eastern part of the State there is a call for the improvement, straightening and bitumen surfacing of long lengths of State Highways, Trunk Roads and other Main Roads, while in the Western parts of the State, there is an equal demand for earth formations on many miles of main roads still little better than tracks. There is a strong case for some further expansion of the mileage of the Main Roads system to meet the changes in traffic and population during the last ten to twelve years. Finally, there is the need for pioneer Developmental Roads in the country, to open up the way for increased settlement and happier rural life.

While the requirements of a situation can readily be determined in broad terms, and many individual needs can be stated without hesitation, the carrying out of large engineering works involving considerable expenditures can only soundly be conceived by thorough preliminary investigation, especially when those works are to be spread over 22,971 miles of Main Roads and 2,939 miles of Developmental Roads throughout a State of 309,433 square miles, roughly twice the size of California, one of the largest American States.

Before decisions are made, the relevant facts have first to be determined, and they have then to be applied

to the situation, in order to ensure that the funds available will be spent to the best advantage of the community as a whole, paying full regard to probable trends in the development of the State's resources, to the consequent growth of population, and to the inevitable further growth in traffic, a traffic growth which has averaged more than $6\frac{1}{2}$ per cent. each year during the past 25 years. The smallest percentage increase in any one year was in 1932 when registrations increased only 1.7 per cent. over those for 1931. The largest percentage increase was in 1949, when registrations increased by 12 per cent. over those of 1948.

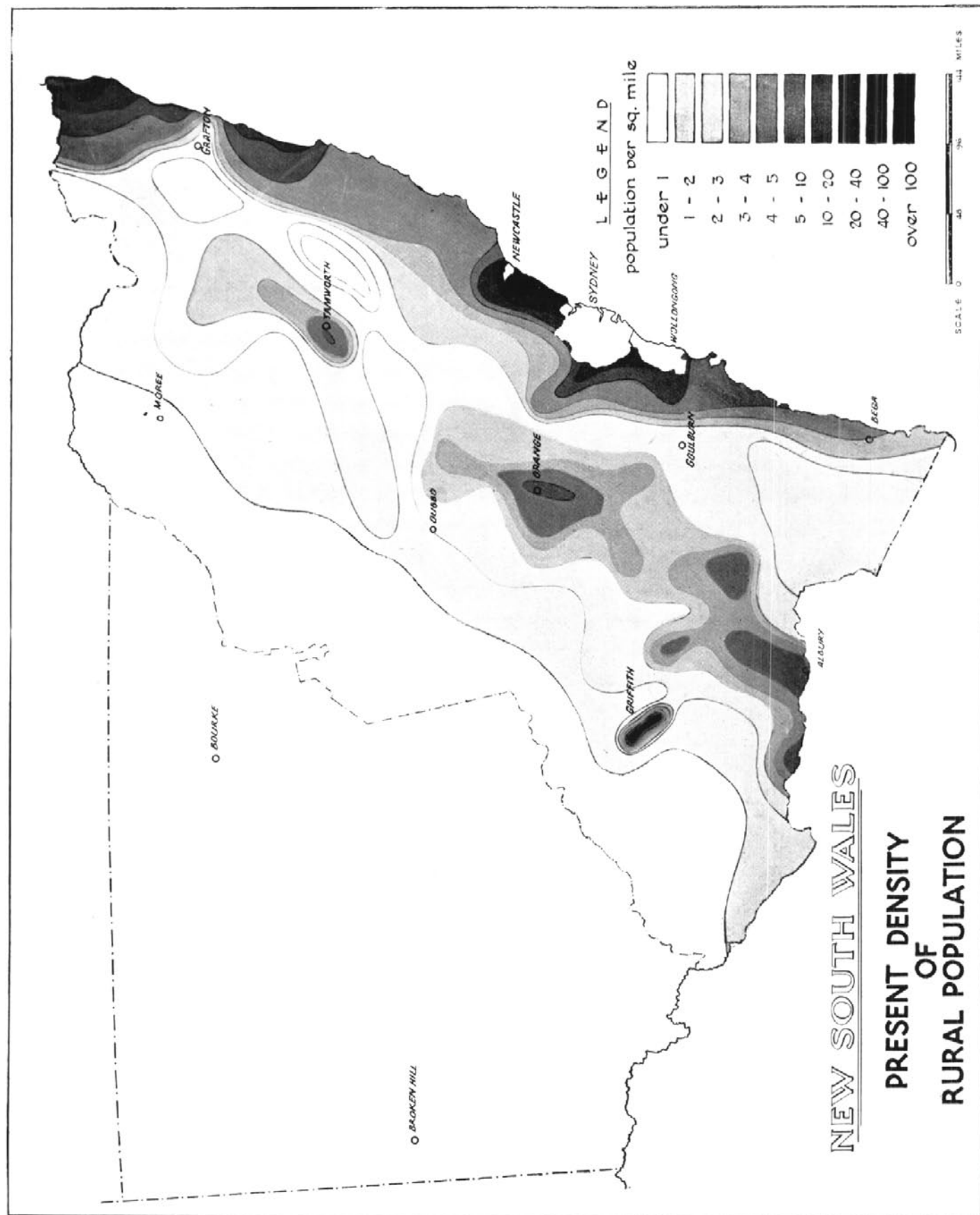
For these reasons, the Department of Main Roads has always aimed at a policy which takes proper account of future needs as well as those of the present. For example, where deemed necessary the width of road reservations has been fixed well in excess of immediate requirements, so as to provide for the widening of the carriageway when necessary at a later stage. Likewise, where the construction of a Developmental Road has appeared likely to lead to such development as may at some later date justify the proclamation of the road as a Main Road, then the bridges, culverts, etc. on the Developmental Road have been so constructed as to be suitable for the larger traffic volumes to be expected in the future.

Principles and methods of planning for Main and Developmental Roads have been developed with experience, and by the adoption of methods used in countries overseas.

During recent years special studies of main road needs have been made for the Metropolitan area, for Newcastle, for Greater Wollongong, and for the rural parts of New South Wales.

Investigations for Metropolitan Main Road planning were put in hand by a small staff in 1943, subsequently augmented as opportunity offered. Later studies of the Newcastle and Wollongong districts were undertaken. With the creation of the Cumberland County Council in 1945 for the general planning of Sydney and surroundings, the planning work of the Department of Main Roads in the Metropolitan area was harmonised with that of the County Council, and is now largely incorporated in the County Plan.

In the planning of the future Main Roads system for Sydney, every effort was made to base road planning on the anticipated trends of population and development, and to utilise to the greatest possible extent the technique of comprehensive town planning developed in Great Britain and other countries. The planning of future Main Roads in Newcastle and Wollongong followed similar lines.



In the country, detailed attention has recently been given to the planning of the expansion of the rural Main Roads system. A comprehensive investigation of needs in rural areas throughout the State is at present approaching completion. On account of the inability of the Department of Main Roads to give consideration to new Main Road proposals during and immediately after the war, a very large number of applications received from time to time from Councils was awaiting consideration.

As New South Wales is now divided into Regions for purposes of the study of resources and their development, it was decided to plan as far as possible on a regional basis.

A detailed study was first made of the trends in population in each region, and in all the towns in each region. Studies were also made of the trends in production in each region, in land values and in local government rating.

The diagram on page 100 shows rural population density based on the 1947 census figures for New South Wales. The population within the County of Cumberland and within all Municipalities outside the County of Cumberland has been excluded in compiling the map.

The next step taken was the interviewing of each Council in each Region, in order to obtain the Council's views regarding main roads needs in its area, and the reasons underlying the views held. In all cases, proposals were inspected, if not previously inspected. After the Councils in each Region were visited, the Regional Development Committee of the region was interviewed in order to obtain its appraisal of developmental progress or probabilities in the region. As a result of the studies and enquiries described, it then became possible to make a logical assessment of the need for additional main roads in the various parts of the State, and throughout the State, in the foreseeable future, and either to reject the individual proposals put forward for additional main roads, to accept the individual proposals with or without amendment, and to assign an order of priority for proclamation, or to initiate new proposals not the specific subject of applications.

On account of the need being found to be greater than the funds available could support, it has been possible at this stage to recommend only a small portion of the proposals for new main roads, or the increasing of the status of existing main roads, which have been assessed as suitable for proclamation.

The next stage in the planning process as applied to Main Roads, is the selection of the route to be followed by a road linking two points. Here the use of aerial photographs has been found of the greatest

assistance, both in rugged country and in the open lands of the western part of the State. Photographs have been secured along about 3,000 miles of main roads, of which about 1,800 miles have been flown specifically for this purpose. A recent account of the methods followed in route selection aided by aerial photographs, was published in "Main Roads" for December, 1949.

The final stage in planning is the selection of the individual works to be carried out year by year. Here the principal factor to be considered is the nature and volume of traffic as, other things being equal, the higher the traffic on a section of road improved, the larger benefit from the work carried out. It is for this reason, as well as for other reasons, that the Department of Main Roads carries out periodical traffic surveys.

The criterion of traffic volume, while generally applicable in any particular locality, cannot be applied when the State is regarded as a whole, as to do so would deprive sparsely settled areas of a share in main road improvement. Likewise, it might unduly delay the improvement of some long distance main roads, the improvement of which may be required from considerations of wider significance, especially in the case of roads classified as State Highways. For these reasons, therefore, a main road improvement programme has to be based not only on traffic flow, but also on the need both for local main road service, and for State-wide main road service. Even in as small an area as the County of Cumberland, which includes Sydney, a road improvement programme based entirely on traffic considerations would give little satisfaction if it resulted in the relatively lightly trafficked main roads in the rural environs being neglected due to concentration of main road improvements on the more heavily trafficked routes in the built-up area.

In the planning of future works programmes, therefore, the Department of Main Roads' practice is to examine the needs on the main roads in relation to traffic, but also to study those local and State-wide factors which also must influence the order of priority of works if a main roads system is to be built up which will reasonably serve the people throughout the State.

The rate at which a programme of works is carried out must necessarily depend on the funds and other resources available for this purpose. The fact that costs of road maintenance and construction are now over seventy per cent. in excess of pre-war costs and that revenue has not increased proportionately, has necessarily an effect on the rate at which main road improvement work can be implemented at the present time in comparison with the pre-war period.

MINISTERS-IN-CHARGE
OF THE
ADMINISTRATION OF THE MAIN ROADS ACT
1925—1950

The Hon. J. C. L. FITZPATRICK, M.L.A.,
Minister for Local Government—January, 1925, to May, 1925.

The Hon. G. CANN, M.L.A.,
Minister for Local Government—May, 1925, to March, 1926.

The Hon. J. J. FITZGERALD, M.L.A.,
Minister for Local Government—March, 1926, to October, 1926.

The Hon. J. M. BADDELEY, M.L.A.,
Minister for Labour and Industry—October, 1926, to October, 1927.

Lt.-Col. the Hon. M. F. BRUXNER, D.S.O., M.L.A.,
Minister for Local Government—October, 1927, to October, 1930.

The Hon. W. J. MCKELL, M.L.A.,
Minister for Local Government—October, 1930, to June, 1931.

The Hon. J. MCGIRR, M.L.A.,
Minister for Local Government—June, 1931, to August, 1931.

The Hon. J. T. LANG, M.L.A.,
Colonial Treasurer—September, 1931, to March, 1932.

The Hon. J. MCGIRR, M.L.A.,
Minister for Transport—March, 1932, to May, 1932.

Lt.-Col. the Hon. M. F. BRUXNER, D.S.O., M.L.A.,
Minister for Transport—May, 1932, to May, 1941.

The Hon. M. O'SULLIVAN, M.L.A.,
Minister for Transport—May, 1941, to date.

MAIN ROADS BOARD

1925—1932

J. GARLICK,

President—January, 1925, to January, 1932.

H. H. NEWELL, C.B.E., M.I.C.E., M.I.E. Aust.

Member—March, 1925, to January, 1928.

Dep.-President—January, 1928, to August, 1930.

Member—August, 1930, to January, 1932.

President—January, 1932, to March, 1932.

T. H. UPTON, O.B.E., M.Sc., M.C.E., M.I.C.E., M.I.E. Aust.

Member—March, 1925, to March, 1932.

S. R. Henderson, A.I.C.A.

Deputy Member—January, 1928, to August, 1930.

COMMISSIONERS AND ASSISTANT COMMISSIONERS

DEPARTMENT OF MAIN ROADS

1932—1950

H. H. NEWELL, C.B.E., M.I.C.E., M.I.E. Aust.

Commissioner—December, 1932, to March, 1941.

T. H. UPTON, O.B.E., M.Sc., M.C.E., M.I.C.E., M.I.E. Aust.

Assistant Commissioner—December, 1932, to April, 1935.

D. CRAIG, M.I.C.E., M.I.E. Aust.

Assistant Commissioner—November, 1937, to March, 1941.

Commissioner—March, 1941, to August, 1946.

A. E. TOYER, B.E., M.I.E. Aust., M.Inst.T.

Assistant Commissioner—March, 1941, to August, 1946.

Commissioner—August, 1946, to date.

H. M. SHERRARD, M.C.E., M.I.C.E., M.I.E. Aust., M.Inst.T.

Assistant Commissioner—August, 1946, to date.



438 foot Truss Spans of the Peat's Ferry Bridge over the Hawkesbury River
on the Pacific Highway linking Sydney and Newcastle.
Opened to Traffic on 5th May, 1945.