

# MAIN ROADS

Being a month to month account of the activities of  
THE MAIN ROADS BOARD OF NEW SOUTH WALES.

Issued by and with the authority of the Board.

Vol. I, No. I.

SEPTEMBER, 1929.

## Foreword.

BY LT.-COL. THE HON. M. F. BRUXNER, D.S.O., M.L.A.

*Minister for Local Government.*

THE issue by the Main Roads Board of a monthly journal which will give detailed information of the work being done on the main and developmental roads of the State, adds another landmark to the history of road progress in New South Wales. Roads are of vital concern to everyone. "It is the Road," says Hilaire Belloc, "which determines the sites of many cities and the growth and nourishment of all. It is the Road which controls the development of strategies and fixes the site of battles. It is the Road that gives its framework to all economic development. It is the Road which is the channel of all trade, and, what is more important, of all ideas. In its most humble function it is a necessary guide without which progress from place to place would be a

ceaseless experiment; it is a sustenance without which organised society would be impossible; thus, and with those other characters I have mentioned, the Road moves and controls all history."

In this State, with its wide spaces and widely distributed population, the road constitutes in many instances the only link the settler has with the world at large. Without good roads, industry can scarcely proceed and agriculture barely exist. Anything then that will help in solving the road problem of this State merits our warmest approbation. This attempt by the Board to bring the work of improving the main and developmental roads of the State under the closer notice of the community is a valuable step in this direction, and meets with my cordial endorsement.

## The Purpose of the Journal.

FROM year to year, an annual report, reviewing the operations of the Board during the preceding year, is submitted to Parliament. This is necessarily a comprehensive work. Its objective is primarily to account for the expenditure of the funds voted by Parliament for main and developmental roads, to explain the policy that has guided the Board in the application of the principles of the Main Roads Act, and to direct the notice of Parliament to any matters affecting main or developmental roads which, in the opinion of the Board, need attention. Incidentally, some review of the many issues affecting the problem of roads is attempted, with a view to informing Councils and their engineers of the Board's experience, so that the standards of work shall be im-

proved not only on the main roads, but on roads generally throughout the State. The variety of the work, and the many subjects which call for comment, involve that an annual report shall deal generally with basic principles. It is not possible to describe in any detail many of the individual works that are undertaken from time to time, and which are most interesting in themselves, nor to indicate how a particular local problem of, perhaps, high technical interest, but not of State-wide concern, is being dealt with, and the reasons for this. While the value of an annual report is enhanced by the breadth of its outlook, it loses by that very broadness the intimate touch which is so valued by many readers, who are more anxious to know what is being done in their areas, or what is

involved in a particular work, than they are to comprehend the general problems of highway administration. The conviction has been growing upon the Board for some months that something more than a series of annual reports is required in so large a State as New South Wales to keep the community adequately informed as to the activities of the Board and the Councils on main and developmental roads. Information at more frequent intervals and in more acceptable form than an annual report is required.

In addition, the organisation of the country work into six divisions, and the Metropolitan work into one division, all of which divisions, as explained elsewhere in this journal, are more or less self-contained, makes it a matter of necessity that there shall be some means by which each division shall be kept fully informed of the operations of the other divisions, and how main and developmental road works are proceeding throughout the State. The Councils within each division are encouraged to deal directly with the divisional engineers, rather than with the Board, as with the volume to which the work has now grown, it is no longer practicable for the Board to do this, as it did in the early days of its existence. This means that except on special occasions, when deputations come to Sydney or the Board visits the Councils in their own domains, the Board is not in personal contact with the Councils to the same degree as heretofore. It needs to have some means by which it can restore this contact.

The Board, therefore, has decided to issue a monthly statement of its activities in which will be set out the expenditure of the preceding month, and topical articles

on all phases of its work. The majority of the articles will be written by members of the Board's staff who have specialised in the subjects with which they deal, and will, therefore, it is hoped, be of considerable technical interest. An endeavour will, however, be made to write them in a manner which will be acceptable to the non-technical reader, and to give him an intelligent insight into the problems of road construction, maintenance, administration and finance.

There are many sides to the road problem. If it is to be tackled adequately, and if both the State and the Board are to keep abreast of the needs, the fullest information on all its phases is necessary. The Board will, therefore, welcome any suggestions that are put forward in a constructive spirit for dealing with the problem. It may be that it will be unable to adopt some of them; it trusts that it will be able to adopt others; but whether they are adopted or not, none will be idly disregarded.

The Board desires that these monthly statements shall be regarded as supplementary to its annual reports, which will, after the issue of the Fourth Report now in course of compilation, be confined for the future to general matters. It is proposed, therefore, to issue single copies, without charge, to all Members of Parliament, to Councils, the Board's Staff, and the Press, in the same manner as in the case of the annual report. Further copies will be available, upon application to the Acting Secretary, to any of these, and to members of the general public, at a cost of sixpence for a single number, or five shillings per year.

## The Organization of the Main Roads Board.

THE operations of the Main Roads Board are, for purposes of administration, divided into two parts—Country and Metropolitan. Separate funds, called the Country Main Roads Fund, and the County of Cumberland Main Roads Fund, have been established by the Main Roads Act to deal with the main roads in the country and the metropolitan area respectively. The metropolitan area consists of the County of Cumberland, the Shire of Blue Mountains, the Municipalities of Katoomba and Blackheath, and portions of the Shires of Bulli and Colo which are outside the strict boundaries of the County, but which, for purposes of road finance, are considered to be more of metropolitan than country concern, and are so included by the Act.

Works on main roads in the country cannot be assisted from the County of Cumberland Main Roads Fund, nor can works in the metropolitan area be

assisted from the Country Main Roads Fund. Thus a definite safeguard is established by the Act to prevent either metropolitan or country interests predominating in the distribution of Main Roads revenues. Not only does the Act provide for two funds, but it also lays down different methods for the Councils to share in the cost of main road works. In the metropolitan area, Councils contribute to the County of Cumberland Main Roads Fund at a rate fixed each year by the Board, but not exceeding  $\frac{1}{2}$ d. in the £ on the unimproved capital value of lands within their areas (reduced to half this in rural areas devoted to primary production, and in the City of Sydney); while in the country, Councils contribute in definite proportions with the Board (nil on State highways, one-third on trunk roads, and two-fifths on ordinary main roads), and cannot, except of their own volition, be required to contribute in any one year more than  $\frac{1}{2}$ d. in the £

on the unimproved capital value of lands within their areas. The amounts expended by country Councils on main roads are, therefore, except in very special cases, entirely at their own discretion.

These two distinctions of funds and methods of contribution by Councils have resulted in two somewhat different organisations to deal with them. In the metropolitan area, it is not necessary for the Board to ascertain whether any Council will contribute towards any work before initiating it. Provided the Board is satisfied that the work is required and that it can provide the cost from its own funds, it is possible to authorise it being proceeded with. This reduces the correspondence between the Board and the Council to a minimum. In the country, on the other hand, both parties must come to an agreement as to whether they can afford a particular work before it can be authorised. In addition, the construction of a metropolitan main road is a much more complex problem generally than that of a country main road. Except in country towns, there are no water mains or gas mains, or power lines or sewers to be adjusted before work can proceed on a country main road. In the metropolitan area, there are all these things and others besides, such as underground cables, tramlines, &c., the numbers of which and the necessity of arranging for their adjustment, frequently make the construction of the road pavement the easiest part of the job of building the road. Then, again, there are few country main roads which require widening, and where there are such, this is a comparatively simple matter. Many of the metropolitan main roads, however, are already congested with traffic, or show signs that they will become so at a not remote date, and widening is most important.

From the beginning of the Board's operations in 1925, the administration of its activities in the two areas has been kept more or less distinct, and with the growth of the work this has become complete so far as the engineering side of the work is concerned. The country work is under the charge of Mr. D. Craig, M.Inst.C.E., Chief Engineer, with Mr. H. M. Sherrard, M.C.E., Assoc.M.Inst.C.E., Assistant Chief Engineer, Mr. S. Dennis, B.E., Bridge Engineer, and Mr. E. F. Crouch, Inspecting Engineer, as his chief assistants at Head Office. In addition, the country is divided into six divisions, with divisional engineers in charge, as follows:—

Division.	Headquarters.	Divisional Engineer.
Upper Northern ...	Glen Innes ...	Mr. A. L. Horniman.
Lower Northern ...	Tamworth ...	Mr. J. A. L. Shaw, B.E.
Outer Metropolitan	Sydney ...	Mr. D. H. Ingram (acting).
Central Western ...	Parkes ...	Mr. H. M. Baker.
Southern ...	Queanbeyan ...	Mr. T. A. Donaldson.
Riverina ...	Wagga Wagga	Mr. V. G. J. Harding, B.E.

Each of these divisions is self-contained. It has its own clerks, draftsmen, surveyors and engineers. Negotiations in connection with any works are carried out between the divisional engineer and the Councils of his area in accordance with the principles laid down by the Board, and the allocations of funds to

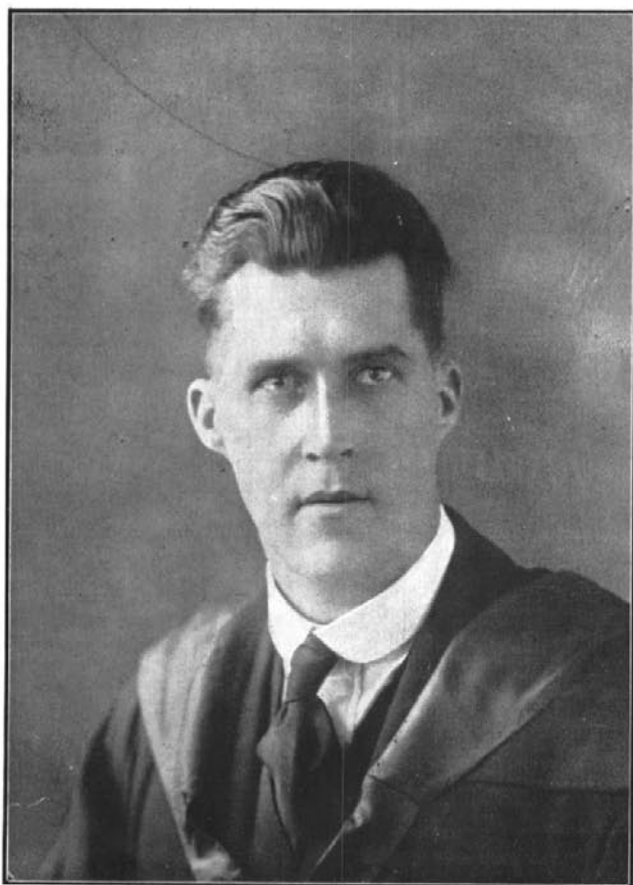


Mr. D. Craig, M.Inst.C.E., M.Inst.E., Aust., Chief Engineer.

Mr. Craig is a Member of the Institution of Civil Engineers, London, and a Member of the Institution of Engineers, Australia. He received the earlier part of his training and experience in Scotland under a private firm of Civil Engineers and afterwards with a Public Works Contractor. For ten years he was engaged as Assistant Engineer and Inspecting Engineer with the Railway Construction Branch of Victoria and afterwards for four years as Chief Engineer to a firm of Public Works Contractors operating in New South Wales and other States. He was appointed to the Board's Staff in February, 1928, as Engineer-in-Charge of all Country Construction work, and three months later as Chief Engineer to the Board. He has had extensive experience on all classes of Road and Bridge Constructional work.

the division. The inspection of the works carried out by the Councils on either main or developmental roads is also made by the divisional engineers and their staffs. Any works carried out directly by the Board, either by contract or day labour, are under the control of the divisional engineer.

The advantages of this system, over that which prevailed up to 30th June, 1928—before which time all work was directed from Head Office—are obvious. The Councils and the Board's responsible officers are brought into closer touch, many things can be settled by inspection on the ground which would otherwise take a good deal of correspondence to clear up, and the Board gains the advantage of having the members of



Mr. A. E. Toyer, B.E., Engineer-in-Charge, Metropolitan Division.

Mr. Toyer is a graduate in Engineering of the University of Sydney and an Associate Member of the Institution of Engineers, Australia. He received the earlier part of his training and experience in the Public Works Department of this State. He was one of the earliest officers appointed to the Board's Staff, which he joined in 1925. Since then he has held the positions of Assistant Engineer, Designing Engineer, and Metropolitan Construction Engineer; and when the Metropolitan Division was constituted on 1st January, 1928, he was placed in charge. He has had a wide experience of all phases of Metropolitan road work.

its staff in positions where they readily get to know thoroughly the locality in which they are working. The divisional boundaries and their headquarters are shown on the map which is portrayed on the cover of this journal. They have been selected so that if, at some future date, it should become necessary to divide up the State further, this can be done without having to shift the present headquarters.

The metropolitan division is older in point of history than any of the country divisions. It is under the charge of Mr. A. E. Toyer, B.E. It commenced its operations as a division on 1st January, 1928, and the success which it very quickly achieved in co-ordinating the whole of the activities in the metropolitan area gave the Board, in a large measure, confidence to establish the country divisions some six to nine months later. It is made up in a similar manner to the

country division, though on account of the greater complexity and volume of the work, is considerably greater in size than any of them, and is organised somewhat more elaborately. Here again Councils are encouraged to deal directly with the divisional engineer rather than with the Board.

While the Metropolitan and Country administrations operate quite separately, and their respective heads are responsible only to the Board, care is taken, both by the Board and these officers, to ensure that, as far as possible, both work on uniform lines and on uniform specifications. A free interchange of plant and officers also takes place between the two, as may be necessary from time to time.

It remains to explain that, so far as the engineers engaged on country work and established at Head Office are concerned (not including the officers of the outer metropolitan division, who, although having their quarters in the same building as Head Office, are not part of the Head Office organisation), their duties are to co-ordinate the activities of the divisions. This is done both by correspondence and inspection, and from time to time by consultation at Head Office. In addition, as it is not practicable to maintain within each division a sufficiently skilled staff to deal with all types of bridges that may occur, the design of all important bridge structures is carried out at Head Office by the bridge engineer and his staff for both Country and Metropolitan areas, based on the data supplied by the divisional engineers.

## Danger Signs at Railway Crossings.

A CONFERENCE of representatives of Australian railway and highway authorities has adopted a uniform series of warning and danger signs for use at railway crossings throughout the Commonwealth.

The sign to be displayed at unattended crossings not equipped with gates or booms consists of a cross, carrying the words "RAILWAY CROSSING" in black upon a white ground on diagonal arms at a height of 10 feet above ground level. On the same post, the familiar red triangle danger sign is displayed at a height of 5 feet above ground level.

At attended open level crossings, the crossing-keeper will display a banner by day and a red light by night. The banner is a red disc, carrying the word "STOP" in white, and is mounted on a staff 6 feet high.

Where the approach view of a crossing is restricted, a warning sign will be displayed at the roadside, at about 100 yards from the crossing. This sign consists of a white disc, carrying diagonal black bars, and, mounted immediately beneath the disc, the red triangle danger sign. The height of the sign above ground level is 7 feet.

The two first-mentioned signs will be provided and maintained at existing crossings by the railway authority. The third sign will be provided by the railway authority, and erected and maintained by the road authority. Where new roads are constructed to cross existing railways, the expense of sign posting will be wholly defrayed by the road authority.

## Expenditure from 1st July to 31st August, 1929.

	Expenditure from 1st to 31st July, 1929.	Expenditure for month of August.	Total Expenditure to 31st August, 1929.
	£ s. d.	£ s. d.	£ s. d.
<b>COUNTY OF CUMBERLAND MAIN ROADS FUND—</b>			
Construction of Roads and Bridges ... ..	31,263 11 0	49,582 9 3	80,846 0 3
Cost of Land Resumptions ... ..	5,531 10 11	5,436 18 8	10,968 9 7
Maintenance of Roads and Bridges ... ..	15,436 12 7	16,160 19 5	31,597 12 0
Repayment of Loans ... ..	38,780 9 6	15,005 13 9	53,786 3 3
Cost of Survey, Design, Supervision and Administration ... ..	8,875 9 5	8,377 8 4	17,252 17 9
Purchase of Stock and Assets ... ..	7,137 14 7	8,213 14 10	15,351 9 5
Miscellaneous ... ..	375 17 4	567 17 5	943 14 9
<b>Total ... ..</b>	<b>107,401 5 4</b>	<b>103,345 1 8</b>	<b>210,746 7 0</b>
<b>COUNTRY MAIN ROADS FUND—</b>			
Construction of Roads and Bridges, including Resumptions ... ..	78,644 3 1	60,257 16 3	138,901 19 4
Maintenance of Roads and Bridges ... ..	78,088 19 7	80,301 5 3	158,390 4 10
Cost of Survey, Design, Supervision and Administration ... ..	6,508 14 1	7,001 17 3	13,510 11 4
Purchase of Stock and Assets ... ..	8,682 11 9	10,386 14 4	19,069 6 1
Miscellaneous ... ..	2,947 7 4	1,779 3 10	4,726 11 2
<b>Total ... ..</b>	<b>174,871 15 10</b>	<b>159,726 16 11</b>	<b>334,598 12 9</b>
<b>FEDERAL AID ROADS FUND—</b>			
Construction of Roads and Bridges, including Resumptions ... ..	75,684 17 2	65,208 1 9	140,892 18 11
Purchase of Stock and Assets ... ..	1,675 8 6	527 19 10	2,203 8 4
Miscellaneous ... ..	170 1 8	465 0 8	635 2 4
<b>Total ... ..</b>	<b>77,530 7 4</b>	<b>66,201 2 3</b>	<b>143,731 9 7</b>
<b>DEVELOPMENTAL ROADS FUND—</b>			
Construction of Roads and Bridges ... ..	23,674 15 0	23,968 13 11	47,643 8 11
Miscellaneous ... ..	10 0 6	.....	10 0 6
<b>Total ... ..</b>	<b>23,684 15 6</b>	<b>23,968 13 11</b>	<b>47,653 9 5</b>
<b>Grand Total ... ..</b>	<b>383,488 4 0</b>	<b>353,241 14 9</b>	<b>736,729 18 9</b>
<b>SUMMARY, ALL FUNDS.</b>			
Construction of Roads and Bridges (including Resumptions) ... ..	214,798 17 2	204,453 19 10	419,252 17 0
Maintenance of Roads and Bridges ... ..	93,525 12 2	96,462 4 8	189,987 16 10
Repayment of Loans ... ..	38,780 9 6	15,005 13 9	53,786 3 3
Cost of Survey, Design, Supervision and Administration ... ..	15,384 3 6	15,379 5 7	30,763 9 1
Purchase of Stock and Assets ... ..	17,495 14 10	19,128 9 0	36,624 3 10
Miscellaneous ... ..	3,503 6 10	2,812 1 11	6,315 8 9
<b>Grand Total ... ..</b>	<b>383,488 4 0</b>	<b>353,241 14 9</b>	<b>736,729 18 9</b>

## News of the Month.

## METROPOLITAN DIVISION.

THE necessary resumptions have been gazetted to provide for the extension of Lane Cove Road, North Sydney, to Junction-street, linking up with the Sydney Harbour Bridge approach on the northern side. The lands will be cleared and available for the road construction work so that this may be completed to coincide with the opening of the bridge.

The contract for the reconstruction of the Prince's Highway at King-street, St. Peters, is complete, and a

highway 80 feet wide now exists between St. Peters Station and the bridge. The work has resulted in a complete transformation of what was, two years ago, one of the worst arterial roads in Sydney.

Travellers from the northern suburbs to the city who come in by road via Fig Tree bridge and the "Five Bridges" road are now able to make uninterrupted progress along the whole of the route in Hunter's Hill and Lane Cove. The reconstruction in cement concrete of the pavement in Salter-street and Manning-road (Hunter's Hill), and of Burns Bay road between

View-street and Beatrice-street (Lane Cove) has been completed, and the whole has been thrown open to traffic.

The reconstruction of the remaining sections of this route along Gladsville-road and Joubert-street in Hunter's Hill, and the remaining sections between Fig Tree bridge and Longueville-road, in Lane Cove, will be undertaken as part of the 1929-30 construction programme.

Work has been commenced on the widening and reconstruction of the bridge and road at Grainger's Hollow, on Parramatta-road, Ryde. The tram tracks will be centralised at this point. This work will, when completed, remove one of the most awkward and dangerous bends on the road.

Following the recent proclamation as a main road of the new circumferential route from Strathfield to Hurstville, reconditioning, and other work has been carried out by the Board's staff, and by Hurstville Council. The work carried out by the Board has consisted mainly of resheeting with premixed bituminous macadam the existing foundation of Punchbowl-road, from its junction with State Highway No. 2 (Liverpool-road) at Enfield, to the bridge over Cook's River; improvements over the railway bridges—the surface of which was previously in a very rough condition, and the widening of Canary-road, Canterbury. The Hurstville Council resheeted the continuation of this road (Dumbleton-road) within its municipality, using premixed bituminous macadam. This work has made available a most useful route for traffic from the Western Suburbs to the Hurstville district, which, with its continuation via Woniara-road, gives access to the Prince's Highway and the George's River bridge.

The work of constructing the approaches to the new bridge over the railway at Morgan's gate, on the Liverpool-Appin-Bulli road near Campbelltown, is nearing completion. The earthworks, comprising over 34,000 cubic yards of filling, have been carried out under contract by Mr. J. C. Bowerman, and the placing of a temporary gravel pavement, for use during the consolidation of the filling, will shortly be undertaken by the Board.

At Parramatta-road, Petersham, Annandale, and Leichhardt, the sections not reconstructed last year have been completed very expeditiously by the contractors, Messrs. W. B. Carr Construction Limited; the use of quick hardening cement in the concrete foundation contributing in no small measure to this result. Although this is a very heavily trafficked road, not a single complaint has reached the Board of any unnecessary inconvenience.

### OUTER METROPOLITAN DIVISION.

The construction of a subway to eliminate the level crossing on the Great Western Highway near Bowenfels in the municipality of Lithgow, the cost of which is being shared between the Railway Commissioners and the Board, is in hand.

Construction work on the Charlestown-Speer's Point road (Developmental Road No. 1,140) is complete, and the road has been opened to traffic. This will considerably improve access to Toronto and Lake Macquarie, and be of great convenience to tourists.

The tar re-surfacing of the Sydney-Newcastle road, between Swansea and the end of the concrete road, has been completed. A first-class surface now exists over practically the whole length of the road from Newcastle to Swansea. Only a few years back, this road was almost untrafficable, and particularly dusty under traffic. A regular bus service between Newcastle and Swansea is maintained.

Arrangements have been completed with the Merebether Municipal Council by which, in the construction of Union-street, which forms part of the Great Northern Highway, provision shall be made for any future extension of the tramline from the present terminus to Rifle-street. The central 18 feet of the road will be left with a temporary pavement, which the council has undertaken to provide and keep in order, and two permanent strips of pavement 12 feet wide will be laid by the Board on either side to carry the through traffic. In order to accommodate these side strips to possible tramway extension, they are being constructed in cement concrete with an asphaltic wearing course.

The road between Cessnock and West Maitland carries heavy local traffic, which has rendered the cost of maintenance in the Kearsley Shire area, in its present class of construction, prohibitive. A first step towards the laying of an improved pavement has been made by the construction of a length of 2 miles between Neath and Abermain, by the Kearsley Shire Council, and a contract has now been let for the reconstruction in cement concrete and tar penetration of a further length of about 2 miles between Abermain and Weston.

Traffic between Bathurst and Ilford at present crosses the Turon River at Sofala by a ford, and in times of flood is held up. A reinforced concrete bridge is being built over the river to obviate this. The contractors, Messrs. McIntyre and Cable, have the work well in hand, and it is anticipated that the bridge will be open to traffic about the beginning of April, 1930.

Reconditioning of Trunk Road No. 55, from Wallerawang towards Mudgee, is proceeding in Blaxland Shire.

### UPPER NORTHERN DIVISION.

The contractors, the Foundation Co. Ltd., have commenced the construction of a high level steel truss bridge over the Gwydir River at Gravesend, on the Oxley Highway (State Highway No. 12). The present crossing is seldom trafficable, travellers between Wyallda and Moree generally proceeding by a bush track via Pallamallawa. The site of the new structure is about 10 chains upstream from the present railway bridge.

The erection of a reinforced concrete bridge over the Brunswick River, near Mullumbimby, on the North Coast Highway (State Highway No. 10), has been commenced. The condition of the existing timber structure has caused concern amongst travellers for some time past.

Messrs. Model Homes Ltd. are well forward with the construction of 4 miles of bitumen penetration on the North Coast Highway (State Highway No. 10), near Glen Innes, in the Municipality of Glen Innes and the Shire of Severn.

The Municipality of Murwillumbah has decided to pave all the main roads within the municipality in cement concrete. The North Coast Highway (State Highway No. 10), within the town, has already been opened to traffic.

Messrs. A. M. Black and Co., contractors to the Shire of Tweed, are laying 2 miles of concrete pavement on the North Coast Highway (State Highway No. 10), between Murwillumbah and Tweed Heads.

### LOWER NORTHERN DIVISION.

The three-span reinforced concrete bridge over Carlyle's Gully, on the Great Northern Highway (State Highway No. 9), in the Shire of Cockburn, has been taken over from the contractor. This bridge replaces a timber structure burnt down some years ago, and eliminates a sandy crossing.

The three-span reinforced concrete bridge over Jacob and Joseph Creeks, on Main Road No. 129, in the Municipality of Quirindi, has been opened to traffic. This bridge carries a footway, and is lighted by four globe lights on dignified concrete standards.

The descent from the Tablelands to the Macleay River (Main Road No. 116) has been greatly improved. Travellers between Armidale and Kempsey will note the gravel surfacing and drainage work recently completed by the Shire of Dumaresq on the Big Hill. "V" gutters have been eliminated and the surface improved, so that tourists may now enjoy in comfort the magnificent views from this road.

A survey has been completed for a high level bridge over the north arm of the Bellingen River at Raleigh, on the North Coast Highway (State Highway No. 10), in the Shire of Bellingen. The present crossing is by petrol-driven ferry. Traffic is increasing, and the construction of a bridge will be acclaimed by travellers.

Twenty chains of "retread" surfacing (tar and crushed slag, mixed in place), has been constructed on the Great Northern Highway (State Highway No. 9). This length is immediately adjacent to a length of tar penetration with bitumen seal, and a length of bitumen surfacing with tar primer. The section carries heavy traffic, and a record is being kept of maintenance costs on the three types of pavement. The "retread" has a non-slippery surface, and rides smoothly at high speeds. It appears to offer definite advantages for country work on sections carrying moderately heavy traffic.

### CENTRAL WESTERN DIVISION.

Mr. S. W. Down was acting Divisional Engineer, Central Western Division, from 5th August to 1st September, during the absence on sick leave of Mr. H. M. Baker.

The tender of Messrs. Silk and Press has been approved for the construction of a reinforced concrete bridge over Sandy Creek near Yeoval, on Main Road No. 233, in the Shire of Amaro. The new bridge replaces a very old timber structure.

Twenty miles of clearing, grubbing, and earth formation has been commenced on the Barrier and North western Highways, westwards from Nyngan. The Shire of Bogan is operating two 60-horse power caterpillar tractors and two 12-foot blade graders loaned by the Board. The work will be continued in successive years, and, with the construction of necessary culverts, will ultimately remove the terrors of black soil to travellers beyond Nyngan.

A steel truss bridge is being built over the Lachlan River at Forbes. This structure replaces Fitzgerald's bridge on the Forbes-Condobolin road (Trunk Road No. 61).

One of the Board's standard danger signs has been erected at 174½ miles, near Molong, on the North-western Highway, to warn traffic of a bad curve. Eight similar signs are being erected in the Shire of Amaro, between 194 miles and 195 miles, on the same highway, at the Serpentine, near the Bell River.

Contractor Keir has commenced the construction of 9¾ miles of earth formation, including corrugated iron culverts, on the Walgett-Coonamble road (Trunk Road No. 56), commencing near Walgett. This is a further stage in the offensive against the black soil blockade in this district.

The Shire of Gilgandra has completed 6,800 feet of gravel pavement, including concrete causeways and pipe culverts, near 26 miles on the Gilgandra-Dubbo road, (Trunk Road No. 56). This section was previously unformed, and almost untrafficable in wet weather.

### SOUTHERN DIVISION.

Australian Roads Ltd. have started the reconstruction in bitumen penetration of 3 miles of the Hume Highway near Yass.

A contract has been let to Concrete and General Constructions Ltd. for the erection of a concrete bridge over Uringalla Creek, near Marulan, on the Hume Highway midway between Berrima and Goulburn. The work is in progress. This bridge replaces a worn-out timber structure which had become a source of danger to traffic.

Work is in progress on the deviation of Trunk Road No. 55 at Stringybark Hill, near Queanbeyan. This deviation eliminates the heaviest length of continuous grade between Queanbeyan and Cooma.

The construction of Monaro-street, Queanbeyan, under the supervision of the municipal council, has

been practically completed, and the street has been opened to traffic. The work comprises two 20-foot strips of cement concrete, with the remainder of the roadway in bitumen surfaced waterbound macadam.

### RIVERINA DIVISION.

Extensive reconditioning and surface treatment with bitumen or tar has been carried out on the Hume Highway in Gundagai Shire during the last two years. A further length of over 20 miles of bitumen or tar surfacing has recently been completed. Exhaustion of local gravel supplies has precluded the further resheeting of this road, and surface treatment has been adopted on this account.

Progress is being made by the Hardy Contracting Co. Ltd. in the construction of a  $2\frac{1}{4}$ -mile length of Trunk Road No. 59, crossing Bullenbong Plain, between Lockhart and Wagga. Bullenbong Plain is recognised as the most treacherous section on this road.

2,400 feet of bitumen penetration macadam has been completed by Contractor G. M. Watson, in Green-street, Lockhart (Trunk Road No. 59), completing the paving of the main street in either bitumen or tar-surfaced macadam.

A five-span reinforced concrete bridge on Main Road No. 243, over Rocky Ponds Creek, in the Shire of Demondrille, was recently completed and opened to traffic.

Piers and abutments are being erected for a five-span bridge over Barmedman Creek, on Trunk Road No. 57, in the Shire of Bland. The work includes concrete piers and abutments, timber superstructure, and approaches.

On the Monaro Highway, between Tumut and Yarrangobilly Caves, dangerous curves have been widened and super-elevated. Between Adelong and Tumut, and between Talbingo and Yarrangobilly, long lengths of table drains on steep gradients have been stone pitched.

## Developmental Roads Policy.

ONE of the most valuable and vital parts of any roads policy, so far as the man on the land is concerned, is that which provides for assistance in the construction of developmental roads. Assistance in this direction was first granted by the Commonwealth and State Governments in conjunction in 1923, when an amount of £276,000—one-half to be found by each Government—was provided for grants to Councils, free of any repayment obligation. Similar assistance was given for the financial years 1924-25 and 1925-26, the total amount provided thus being £828,000, of which £430,685 was allocated for expenditure on main roads which were developmental in character, and £397,315 was set down for expenditure on developmental roads.

This assistance was given without special State legislation, but in the Main Roads Act of 1924, a section was devoted to the establishment of a Developmental Roads Fund and the definite proclamation of selected roads as developmental. The Act followed to a degree the provisions of a prior Victorian Statute, and described the roads eligible for proclamation as those which—

- (a) serve to develop or further develop any district or part of a district; or
- (b) serve to develop any area of Crown or private land by providing access to a railway station or a shipping wharf or to a road leading to a railway station or a shipping wharf.

The main provisions in regard to the financing of works carried out on these proclaimed developmental roads were that the money provided should be spent on construction only, and Councils receiving assistance should pay interest at 3.3 per cent. for twenty years on

any loan money voted, and should also be responsible for the adequate maintenance of roads constructed.

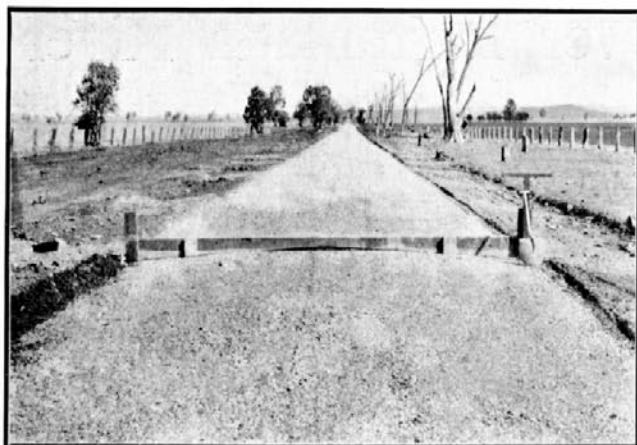
The Main Roads Act commenced on 1st January, 1925, and in addition to the State subsidy of the 1925-26 Commonwealth grant amounting to £138,000, two further sums of £138,000 each were provided from loan and revenue during 1926-27, as well as amounts



Steam Shovel at Work on Mt. Darragh Road—Developmental Road No. 1041—in the Shires of Imlay and Bibbenluke.

of £88,493 and £107,435 included for proclaimed developmental roads (as distinct from any main roads of a developmental character) in the Federal Aid Roads programmes of 1926-27 and 1927-28, towards which the Commonwealth contributed four-sevenths of the cost, and the State three-sevenths.

As from 1st July, 1928, the condition by which Councils paid interest on loan money for twenty years was



Developmental Road No. 1007, Shire of Macquarie. Water-bound Macadam Road between Arthurville and Geurie, showing base course completed and ready for surface course.

removed, and all grants for developmental roads are now free of obligation except as to future maintenance. An appropriation of £250,000 was passed by Parliament for the year 1928-29 for expenditure on developmental roads, and in addition an amount of £43,330 was included for this purpose in the approved Federal Aid Roads programme for 1928-29.

Apart from these general provisions, the Government has from time to time made available sums for the relief of unemployment, and construction work on developmental roads has been put in hand in three instances from this source, viz., for the Ellalong and Paxton to Cessnock roads in Cessnock Shire, an amount of £2,492; for the Mount Darragh deviation in Inlay and Bibbenluke Shires, an amount of £132,000; and for the Koreelah Creek-Urbenville road in Tenterfield Shire, an amount of £25,000.



Developmental Road No. 1007, Shire of Cobbora. Gravel Road between Arthurville and Geurie.

The full amount so far made available for the construction of developmental roads is £1,332,065, i.e., the total of the items shown in the subjoined table.

	£
Amount provided equally by Commonwealth and State from 1923-24 to 1925-26—portion of £828,000 ..	397,315
Amount provided by Commonwealth and State as portion of Federal Aid Roads programmes 1926-27 to 1928-29 .. .. .	239,258
Amount provided from State Funds—General .. .. .	£526,000
Unemployment relief ..	159,492
	<hr/>
Total .. .. .	£1,332,065

In the allocation of the money that has been entrusted to its administration since 1st July, 1925, the Board has, from the many applications that have been made to it by Councils, selected for recommendation of proclamation, 141 roads having a total length of 2,340 miles. These recommendations have been approved by the Governor and the roads proclaimed.



Completed Work on Developmental Road No. 1103, Garema to Pinnacles, in the Shire of Jemalong. This gravel road cost £1,630 per mile.

It is now estimated that an amount of at least £1,000,000 will be required in order to complete the construction of roads already proclaimed as developmental, in addition to the funds already provided. Applications continue to be made to the Board by Councils for new developmental roads, numbers of which have claims equal to those already proclaimed.

There is no legal obligation on the Government or the Board to provide assistance to any particular developmental road, by virtue of its proclamation as such, but there is a clear implication that after proclamation, assistance shall not be long deferred.

It is, therefore, a matter for determination whether it is advisable for the Board to continue to make recommendations to the Governor to add to the length of proclaimed developmental roads, and for new roads to be proclaimed, or whether it would be preferable to complete the construction of those already proclaimed before new roads are added to the list. This is dependent largely on the total amount of the funds which can be provided for developmental roads, and will be referred for the consideration of Parliament in the Board's fourth annual report now in course of preparation.

# The Proposed Bridge Over Parramatta River Between Concord and Ryde.

BY A. E. TOYER, B.E.

*Engineer-in-Charge, Metropolitan Division.*

## PRELIMINARY NEGOTIATIONS.

A PROPOSAL for the construction of a bridge in lieu of a ferry over the Parramatta River between Meadowbank and Rhodes, connecting the Municipalities of Ryde and Concord, was first submitted to the Minister for Public Works in 1913. Owing to funds being unavailable for the purpose, no action was taken until, in 1920, a deputation from a joint committee of the northern suburbs from Strathfield to Hornsby waited upon the then Minister for Works and Railways, the Hon. R. T. Ball, M.L.A., and urged that the matter be proceeded with. As a result, the Minister arranged for an investigation to be made towards the selection of a site for the bridge in this locality. Borings and soundings were taken. The site selected was between Uhr's Point, Concord, and a point near the Ryde wharf. This is illustrated on sheet 1 of the plans accompanying this report.

In July, 1924, the Minister for Public Works announced in Parliament that he was prepared to introduce an Enabling Bill to give to the Ryde and Concord Councils the power to build the bridge on the same lines as the authority given to the Manly and Sutherland Councils, in respect of the Spit and George's River Bridges. A further deputation on the matter waited upon the Hon. E. A. Buttenshaw, M.L.A., as Minister for Public Works and Railways, in December, 1927, at which the Councils of Ryde and Concord, i.e., the two Councils primarily interested, urged that the bridge should be built at the site selected by the Public Works Department, while the Councils of Dundas, Ermington and Rydalmere, Eastwood and Hornsby desired that the bridge should be constructed at the site of the ferry. They agreed, however, that they were prepared to adopt either site, whichever should prove the more desirable from all points of view. The Minister promised that "an investigation would be made as to the best place for the bridge to be constructed; together with the cost of construction and the liability that will have to be incurred in connection with the resumptions, with a view to the introduction of an Enabling Bill to permit of the bridge being constructed." Subsequently the Concord Council indicated that it was inclined to favour the site adjacent to the ferry. Following on the arrangements made by the Government by which the Main Roads Board took over the responsibility of all works on main roads (the ferry is part of Main Road No. 200), the completion of this investigation was transferred to the Board, in July, 1928.

## INFORMATION OBTAINED.

The sites and approaches thereto shown on sheet 1 of the accompanying plans have been investigated, and statistics taken of the traffic using the ferry, with

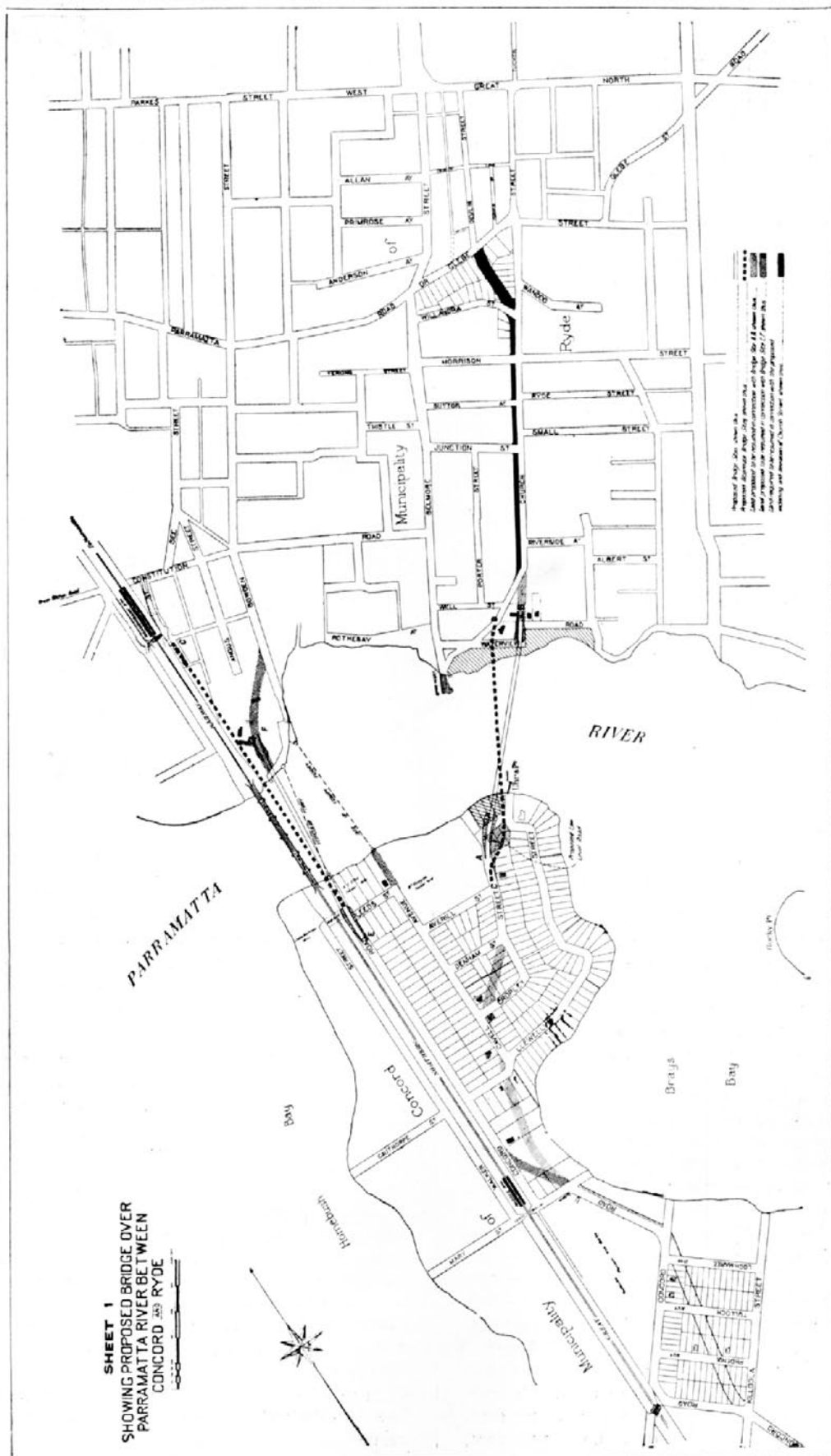
a view to ascertaining the sources from which the traffic arises and to which it proceeds on the north side of the river. The results of these are illustrated on sheet 4. All schemes provide for a minimum clearance under the bridge of 50 feet and a clear waterway of 150 feet, as required by the Sydney Harbour Trust. The railway bridge immediately upstream of the ferry crossing has a clearance of 38 ft. 6 in. only, but the plans of the Harbour Trust contemplate that this will be ultimately increased to 50 feet.

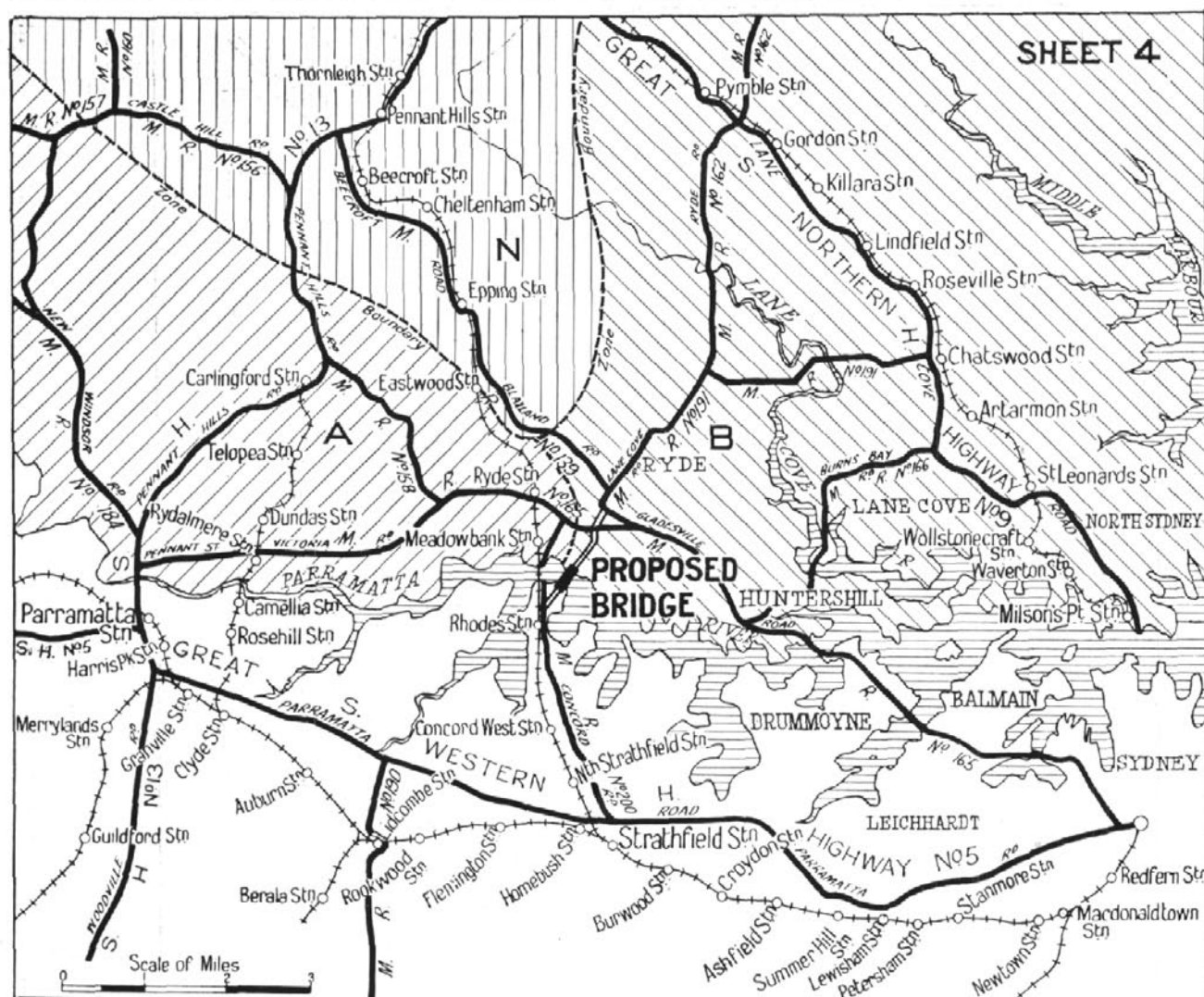
## TRAFFIC DATA.

Broadly, there are two schemes—one crossing between Uhr's Point to a point near Ryde wharf, and the other at the existing ferry site. As investigation proceeded, it became apparent that either scheme was practicable, and that there were alternative routes of approach from the north in the case of the ferry site. The selection of which route is the more appropriate to regard as the bridge approach, should, it is considered, be determined by the source of origin or the destination of the traffic from or to the north for which the bridge would cater when erected. The Board therefore arranged for a census of the traffic using the ferry to be taken from 7.30 a.m. to 6.30 p.m. each day during the week 20th–26th March, 1929, inclusive. The areas north of the river were divided into four zones, three of which are as shown on sheet 4, and the fourth described as "Ryde," and the traffic from the north was requested to say whence it had come, and in the case of that going to the north, whither it was going. The results were as follow:—

Date.	Zone A.	Zone N.	Zone B.	Ryde.	Total.
1929.					
20 March .....	51	247	138	192	628
21 " .....	59	244	146	192	641
22 " .....	39	248	118	182	587
23 " .....	50	297	136	193	676
24 " .....	73	322	173	231	799
25 " .....	65	238	112	159	574
26 " .....	78	277	127	155	637
Total .....	415	1,873	950	1,304	4,542

From this, it is apparent that the major portion of the traffic is to the immediate north and north-east rather than to the west. On this basis, any route which would directly connect Main Road No. 200 with the junction of Main Roads Nos. 191 and 139 would have advantage over any other route, particularly when the level crossing over Main Road No. 165 at Ryde Station is eliminated, which should not much longer be delayed.





SCHEME 1.

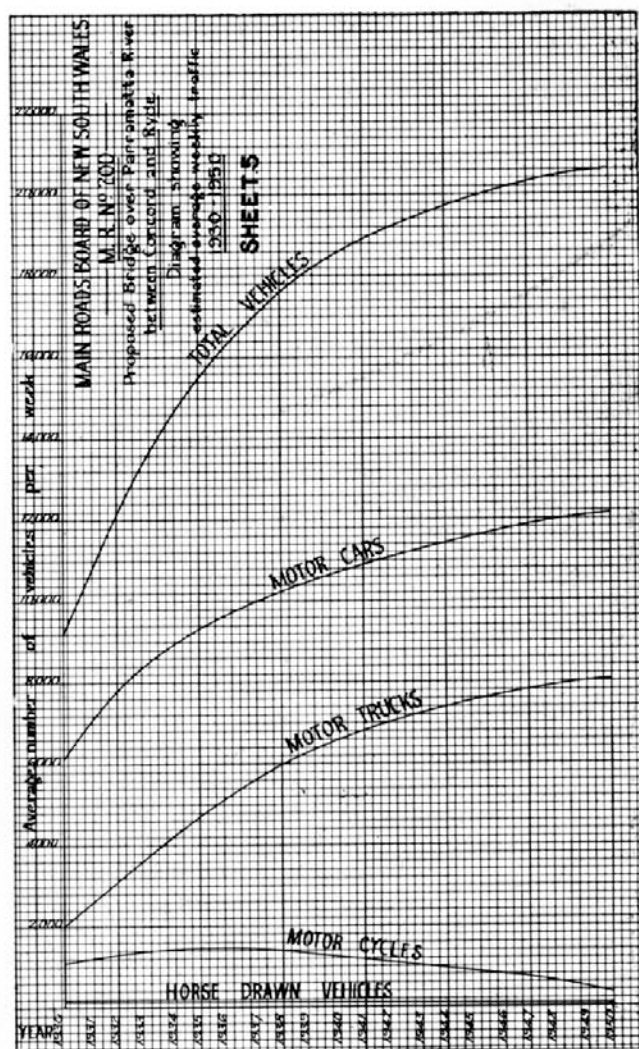
**Uhr's Point—Ryde Wharf Crossing.**

The site recommended for the bridge if the Uhr's Point-Ryde crossing is to be adopted is indicated by the line A-B on sheet 1. This crosses the river at a slight angle, instead of square, but this angle is such that the piers may be placed square to the bridge and will be in the direction of the current of the river, owing to the bend in its course at this point. It leads directly on to Cropley-street on the south and Church-street on the north, with the minimum of angle in the approaches. The points of commencement on both sides are a little used reserve, and a small park, respectively; the portions of these which will not be occupied by the bridge could be used for the storage of materials, &c., during construction, without inconvenience to the public. The ground rises rapidly from the water's edge on either side—more particularly on the northern side—and affords an admirable take-off for the bridge, although as will be seen from the longitudinal section, it is necessary for a ramp to be used at either end to reach the deck level prescribed by the clearance over the river. The total length of the bridge required would be 1,340 feet,

consisting of six 160-foot trusses and two 70-foot plate girders, and six 40-foot R.S.J. spans. The estimated cost of such a work, allowing for a 30-foot carriageway and one 6-foot footway, including approaches, i.e., for all work between the points A and B shown on the plan is £125,429.

An alternative site shown by the line C-D, as selected and examined by the Public Works Department, provides a somewhat shorter crossing, but involves curved approaches, and would entail more extensive diversions and improvement of existing side roads on each shore to preserve access to the Uhr's Point and Ryde wharves than would be the case if the line A-B were adopted. The site recommended has been selected with a view to securing as straight approaches as possible. The borings shown on sheet 2 of the plans are on the Public Works Department's line C-D. They indicate that rock foundation is probably available across the whole width of the river, at a depth which does not exceed 75 feet below M.L.W.L. Check borings on the actual site of the crossing and in the vicinity of the piers would be necessary, if this crossing is adopted, before the design of the bridge is prepared.

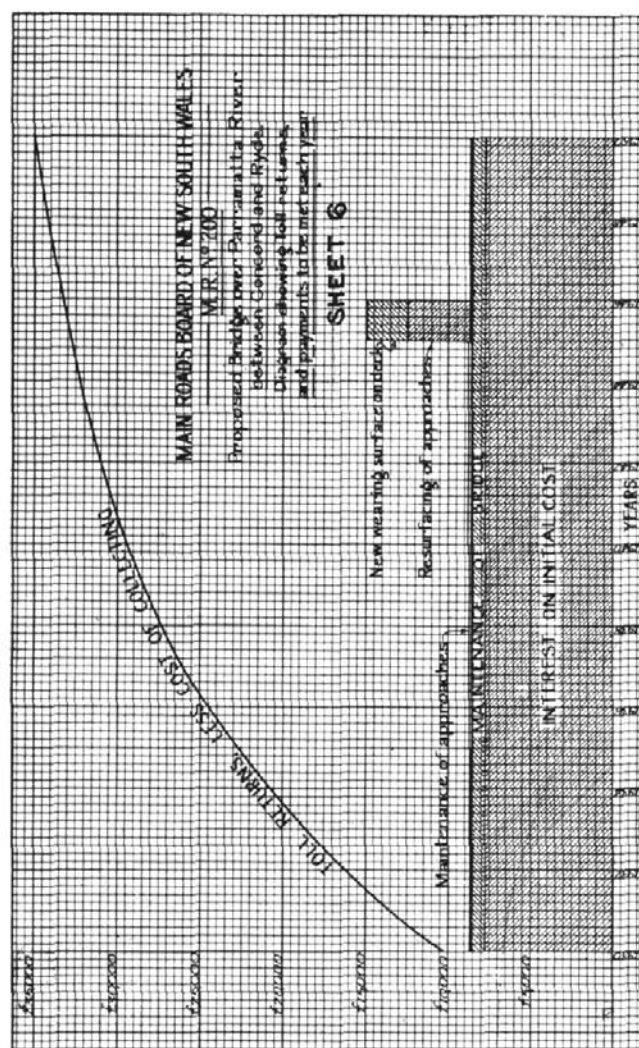
The southern approach from the angle in Concord-road at the north-eastern corner of Tulloch's Ironworks would be by a new road skirting Bray's Bay to the junction of Llewellyn-street and Cavell-avenue, thence *via* Cavell-avenue to Croyley-street; from this point by a straight cut through subdivided, but un-built on, allotments to the junction of Croyley and Denham streets, and finally *via* Croyley-street to the bridge. Access to Llewellyn-street and Uhr's Point wharf would be provided by a low level road from the foot of the bridge approach. On the northern side of the river, the route would proceed *via* a short section of Waterview-street straight through between two houses to Church-street, along which it would proceed to Parramatta-road. The connection for the traffic proceeding to or from the portion of Main Road No. 165 to the east of Church-street would be adequate, but additional work would be necessary to secure proper connection to the north and west owing to the bend in Parramatta-road at this point and to the disposition of Main Roads Nos. 139 and 191. This would be obtained by a short deviation from Church-street south of Parramatta-road to a point opposite Devlin-street; thence *via* Devlin-street to Parkes-street (Main Road No. 139), and finally by another short deviation to the junction of Main Roads Nos. 139 and 191. The width of any existing roads traversed on the south side of the river is 66 feet, but on the northern side the widths of Waterview-street, Church-street and Devlin-street are 60 feet, 45 feet and 33 feet to 45 feet, respectively. Parramatta-road is also only 57 feet wide at this part. It would be necessary to provide ultimately widths of not less than 66 feet throughout, and whenever additional lands have to be acquired for this purpose, it would be desirable to take steps to provide for a width of 80 feet. This greater width would not be required immediately, but where any land has to be acquired in connection with any deviations, the 80 feet width should, it is considered, be provided at the outset. The lands shown shaded on sheet 1 represent, therefore, the lands which would be immediately required in connection with the bridge crossing. Those north of the Parramatta-road (Main Road No. 165) and between Killoola-street and Loch Maree parade are necessary for either scheme, and as their acquisition would be necessary whether the bridge is built or not, this need not be considered as part of the bridge scheme. The lands providing for the ultimate widening of narrow sections of road and for the deviation between Church-street and Parramatta-road, estimated to cost £13,768, would be acquired by the Board as soon as funds could be made available, but as they are not immediately required for bridge purposes should not form a charge against the bridge proposal. The grades on this route generally do not exceed 1 in 18 with the exception of a length of 900 feet in Church-street of 1 in 12, which it may be possible to improve. The estimated gross cost of acquiring the lands shown shaded on sheet 1 is £9,366, and the net cost after disposing of residues not required for road purposes £5,781. The cost of constructing the roads from the north-eastern corner of Tulloch's Ironworks to the junction with the existing pavement in Church-street to a width



of 20 feet of cement concrete pavement is £10,833. The cost of the work which may be considered an essential part of the bridge proposal is estimated at £143,000, made up as follows:—

Bridge and work between points A and B..	£125,429
Net cost of resumptions .. ..	5,781
Remaining road work (including £700 for road diversions) .. ..	11,533
	£142,743
Say, £143,000	

If either of these lines A-B or C-D is adopted, it will be possible to undertake the construction of the bridge and approaches without interference with the existing ferry and the roads connecting thereto. It will, therefore, involve no public inconvenience. This route also makes the type of connection which the traffic census indicated as the most desirable. As Morrison-road, which connects with Church-street on the east side, taps the whole of the area in this direction between Main Road No. 165 and the Parramatta River, and Constitution-road, with its connection to Church-street *via* Belmore-street and Junction-street, taps the corresponding area on the west side, the route proposed



provides admirably for the development of these areas. It appears advisable, however, that, at a later date, Constitution-road should be extended straight through to Church-street to improve its connection. This would involve resumptions estimated to cost £1,600 and a pavement between Belmore-street and Church-street costing £1,300.

## SCHEME 2.

### The Ferry Crossing.

The site recommended for the bridge, if a crossing adjoining the ferry crossing is to be selected, is indicated by the line E-F on sheet 1. Two alternatives were examined—marked E-F and E-G. Both of these are between the ferry crossing and the railway bridge, and differ primarily in the manner in which they connect with the northern road system. The former (E-F) aims to re-establish the connection which the ferry supplies, leading the traffic on to Bowden-street; from which, at the crossing with Constitution-road, traffic has the alternative of proceeding *via* the latter to the west or north-west, or of

continuing along Bowden-street until it joins Parramatta-road, when it can go in any direction north-west or south-east. To provide that it may get on to Main Roads Nos. 139 or 191 readily, the route *via* Devlin-street, &c., as previously described, must be improved. The alternative of Belmore-road between Parramatta-road and Parkes-street, which is admirably located for this purpose so far as direction and width (66 feet) are concerned, is quite impracticable on account of the grades (1 in 10 generally, and 1 in 6 in one place). The site E-G would be suitable if connection on the north side of the river with the west was more important than to the east, as it would lead easily by a short deviation to Railway-road; thence into Constitution-road, where there is an overhead bridge over the railway at Meadowbank; and thence *via* Station-road to Main Road No. 165, although the alignment of this route in the vicinity of Meadowbank Station leaves much to be desired. The traffic census previously referred to indicates, however, that the route *via* Bowden-street would be preferable to this. The bridge crossing would be square in the case of site E-G and nearly so in the case of site E-F. On account of the ramped approach to the ferry on the south side and the elevation of the bridge, the latter would have to be extended beyond the southern bank for a considerable distance. On the northern side the river banks are much higher. The total length of bridge required at the site E-F would be 1,330 feet; consisting of five 160-foot trusses, three 70-foot plate girders, and eight 40-foot R.S.J. spans. The estimated cost of such a work, allowing for the same widths of road and footway as before and including approaches, *i.e.*, for all work between the points E and F shown on sheet 1 of the plans, is £118,914. No borings have been taken at this site, but the particulars available in connection with the railway bridge alongside have been adopted. Check borings on the actual site of the crossing and in the vicinity of the piers would be necessary, if this crossing is adopted, before the design of the bridge is prepared.

The major difficulty in connection with the construction of a bridge at this site is the interference which would result to the ferry during its construction. Owing to the distance to which the bridge and its approach embankments extend on the southern side the southern ferry ramp would have to be moved downstream. The most appropriate position for this during construction is that shown on sheet 1 of the plans, and would involve the reconditioning of Cavell-avenue, the resumption of an area of land from C. R. Mackenzie and Sons, the construction of a new road over the resumed strip and the construction of two new ferry docks—involving in all an expenditure estimated at £4,000. Furthermore, access to the timber yards belonging to Messrs. A. and E. Ellis would be seriously affected, and would have to be provided by internal re-arrangement of the yards and offices with entrance on to Leeds-street. Similarly the direct access from Concord-road to John Darling's mills on the west side of the railway would be blocked, as the approach embankment would necessitate the closing of the existing subway under the railway. The only access to Darling's mill and other business premises

on the western side of the railway would be *via* the level crossing at Rhodes Station and Walker-street. The adoption of the ferry site would, therefore, involve serious business disturbance in Concord.

The appearance of the road bridge at a considerably higher level than the railway bridge alongside would give a somewhat incongruous appearance until the railway bridge was raised; and the presence of the railway along the western side of the road approaches in Concord would reduce the commercial value of the road, only one side of which on the southern side of the river could be used for shops.

The width of Concord-road and Bowden-street is 66 feet and the grades generally do not exceed 1 in 18, with the exception of a length of 400 feet of 1 in 14.8, and another length of 400 feet of 1 in 12.9 in Bowden-street.

This scheme would reduce the immediate resumptions to be made to a minimum. These are shown by shading on sheet 1, and are estimated to cost a net amount of £5,239 (gross cost £5,389). The total cost of the work which would be immediately required and may be considered an essential part of the bridge project, from the north-east corner of Tulloch's Ironworks to Bowden-street is estimated to be £141,000, made up as follows:—

Bridge and work between points E and F ..	£118,914
Net cost of resumptions .. .. .	5,239
Removal of ferry service downstream ..	4,000
Alterations to Messrs. Ellis' yards ..	2,500
Remaining roadwork (allowing for retention of existing pavement on main road on south side of river, for two years) .. .. .	9,967

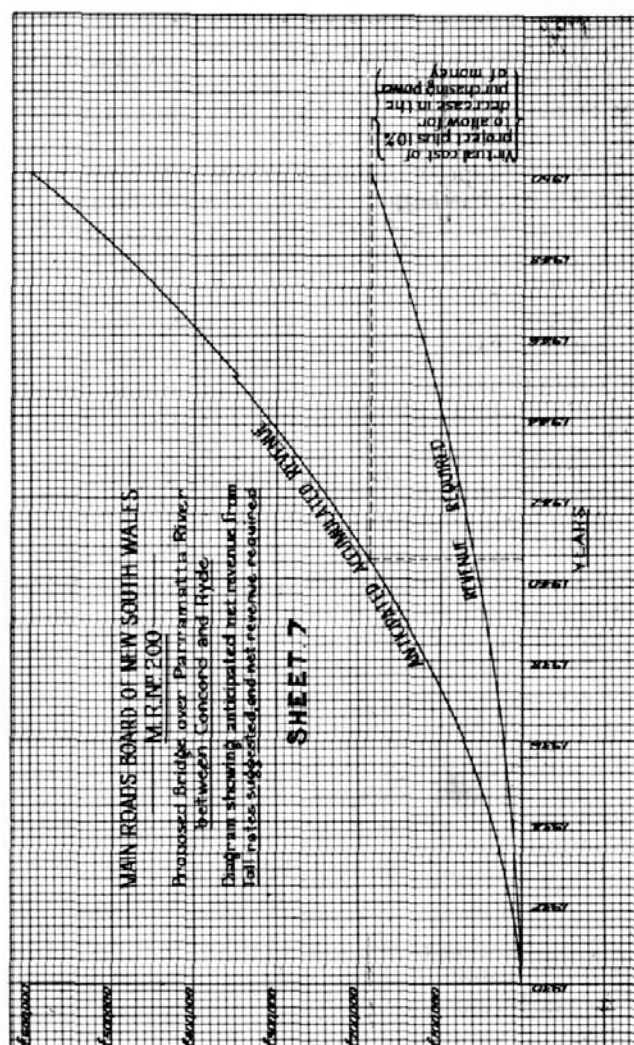
£140,620

Say, £141,000

In addition, the existing pavement on the south side of the river from the end of the deviation north of Tulloch's Ironworks to the bridge would have to be replaced with a new pavement within two years of the bridge being opened. Its cost, estimated at £6,000 for a cement concrete pavement, should be included as one of the essential works required by the bridge, although carried out after the bridge is completed.

#### COMPARISON OF SCHEMES AND RECOMMENDATION OF SCHEME 1.

It will be seen that the initial cost of scheme 1 is £143,000 as compared with that for scheme 2 of £147,000 (£141,000 plus £6,000). If, however, allowance be made for maintenance and renewals, the virtual costs, or the costs of establishment in perpetuity (which is the proper basis for comparison) of the two alternatives are £169,000 and £171,000. When the possibilities of error in the assumptions which the figures have been calculated are considered, the cost of the two schemes must be regarded as practically identical. The basis of choice between the two alternatives must therefore be: which will give the best



service? This is indeed the fundamental consideration irrespective of the relative costs of the various schemes. On the grounds of—

- (i) The desirable routing indicated by the traffic census;
- (ii) the relation of this bridge to other projected bridges across the Parramatta River, notably at Silverwater;
- (iii) the ability to carry out the improvement with the minimum of inconvenience to traffic and business;
- (iv) the increase in the benefited area in Ryde and Concord between the main road in approach to the bridge and the railway, of which the values will be increased by the two bridges being some distance apart instead of close together;
- (v) the better aesthetic appearance while the railway bridge remains at its present level;

the Uhr's Point-Church-street route is considered to be superior to the other and is strongly recommended.

### FINANCING OF PROJECT.

It remains now to consider whether, since the bridge and approaches are to be financed under a toll system, the amount of traffic is such as to make the work a sound financial proposition.

For the purpose of investigation, a toll period of twenty years has been assumed and a schedule of toll charges, simplified and somewhat reduced, as operating on the newly-opened bridge over the George's River, has been adopted as follows:—

			s.	d.	Average rate adopted for calculation, is.
Motor Lorries—					
Up to 1½ tons capacity	...	...	0	6	
1½—3 tons capacity	...	...	1	0	
Over 3 tons capacity	...	...	1	6	
Motor Omnibuses	...	...	1	6	}
Charabancs	...	...	1	6	
Motor Cars	...	...	0	6	
Motor Cycles	...	...	0	3	
Horse-drawn vehicles—	...	...	0	3	
1 horse	...	...	0	3	
Each additional horse	...	...	0	3	

The volume of traffic which would use the bridge has been estimated from the number of vehicles using the present ferry crossing, as obtained from the Ferry Master's records, allowing for a 30 per cent. increase on these figures on the opening of the bridge, and thereafter a further annual increase in accordance

with the probable increase in motor traffic registrations in New South Wales. Curves showing the probable traffic using the bridge over a period of twenty years are shown on sheet 5 of the plans.

Sheet 6 of the plans is a graph showing the expected revenue from tolls after allowing for the cost of collection (which has been estimated at £50 per week). This graph also shows the annual expenditure that will be necessary on account of interest on the initial cost, annual maintenance charges, and various replacement items.

Sheet 7 of the plans is a graph showing how the annual surplus of toll revenue, after meeting all other charges, builds up and provides a free structure for posterity. A curve has also been plotted on this graph showing the toll revenue which it will be necessary to collect each year in order that the surplus may build up to the virtual cost of the scheme in a period of twenty years. From this graph it will be seen that the application of a toll schedule similar to that operating at George's River Bridge will be more than sufficient to provide the virtual cost of the scheme within a period of twenty years, and that the toll could be waived, in all probability, at the end of eleven years.

The investigation has shown therefore that the financing of the bridge by a toll system is a sound financial proposition.

## The Principles of Road Location.

BY H. M. SHERRARD, M.C.E., ASSOC.M.INST.C.E.

*Assistant Chief Engineer.*

**T**HE location of a road is primarily governed by the nature of the country traversed, and by the importance, or prospective importance, of the route.

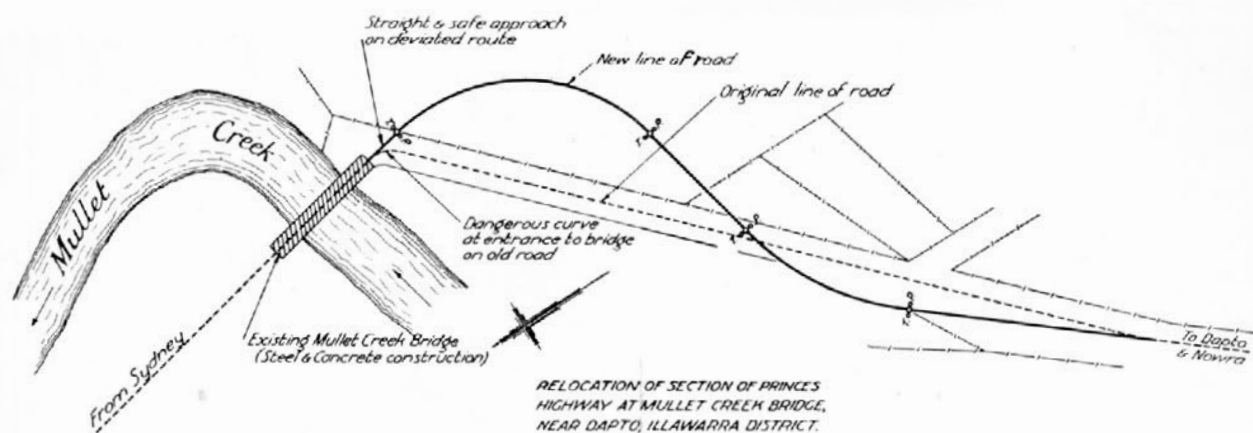
The bullock-team may follow up a valley, crossing and re-crossing the creek by fords, and then plunging up a steep spur and along a rocky ridge, but such a route, with its poor visibility, steep grades, and absence of bridges, is unsuitable for present-day traffic conditions.

The traveller to-day demands a smooth pavement to give comfort, and to give long life to his costly motor vehicle, and a dry "all weather" road. He also demands an absence of sharp or screened curves, with their hidden perils, and their need for slackening speed. The danger of sharp and "blind" turns is greatly accentuated after a road pavement has been reconstructed, as with better travelling conditions, traffic travels at higher speeds than before, and the curve that was formerly unnoticed becomes a potential danger point. From the point of view of safety in use, an alignment as straight as is practicable in any situation must, therefore, be the first consideration of location. Such a location will, other things being equal, also make for economy in operation of the vehicles using it. Where a new road is being located, it is usually not difficult to arrange reasonably wide curves unless there are special features which closely confine the location. In the case of existing roads requiring such improvements, one of three methods

must be adopted: a considerable length of the road must be relocated, or each particular curve so dealt with, or the existing curves retained and simply superelevated. These conditions apply where the road and the railway follow the same route as between Blaxland and



Mount Brown Deviation, Princes Highway. The old road is seen higher up on the right-hand side of the picture.



AN EXAMPLE OF IMPROVED ALIGNMENT

Katoomba. Here the railway, on account of its need for flatter ruling gradients and wider curves has had preference over the road, which has been located on those parts of the ridge traversed not required by the railway.

This has resulted in the road being carried first on one side of the railway and then on the other, crossing sometimes over the railway and sometimes under—when the latter, generally by dangerous blind turns which, at this stage, are difficult and costly to improve. Where it is possible to overcome these difficulties by carrying the road through wholly on one side of the railway, this is being done, as at Valley Heights, but elsewhere the alterations are being confined to the improvement of the existing bends.

In many cases sharp turns are of such nature as to render the matter of relocation out of question on the score of expense, and the best that can be done is to superelevate the roadways, improve the surfaces, and provide easily visible warning signals. The curve at the Picton subway will be known to many as an example of this nature.

Of second importance comes the elimination of steep grades. The existence of a short length of 6 per cent. (1 in 16) or 7 per cent. (1 in 14) grade, occasions no particular hazard to traffic if succeeded by an opposing grade or by a flat grade. A length of very steep grade preceded or succeeded by other fairly steep grades in the same direction is a marked danger to descending traffic, however, and a long length of steep grade will materially increase costs of ascending traffic, on account of increased petrol consumption and reduced speed in low gear.

Apart from traffic conditions, however, the location of roads in such a way as to avoid steep grades is often justified in order to avoid the excessive maintenance costs which occur on such grades in certain classes of country due to scour after rainfall.

A third matter of importance in locating a new road is to avoid unnecessary height. In many cases, it will be more economical from the point of view of operating costs to travel around the obstacle than over it. This will sometimes add length to the road.

In comparing a number of alternative routes, consideration must then be given to their length, ruling grade and height reached, and a reasonable balance arrived at.

The Engineer dealing with location, and design of roads needs to keep before him three prime aspects, viz., alignment, drainage, and grading, and the ignoring of any one of the three will mean unsuccessful location.

Modern traffic demands a reasonable straight road, i.e., good alignment; it demands an "all weather" road, i.e., good drainage; it demands a "top-gear" road, i.e., long lengths of grade not steeper than 1 in 20, though shorter lengths allowably steeper. It is for the Location Engineer to meet these requirements.

## New Main and Developmental Roads Proclaimed.

The following new Main Roads have been proclaimed:—

**Main Road No. 187.**—The proclamation of this road was amended to connect with Main Road No. 63 (Warialda to Goodiwindi) at a point approximately 15 miles south of Yetman, instead of direct to Yetman, as previously proclaimed.

**Main Road No. 306.**—From the Lismore-Nimbin Road (Main Road No. 142) within the Municipality of Lismore, via Dunoon, Dorrroughby and Rosebank, to the North Coast Highway (Main Road No. 10) at Mullumbimby.

**Main Road No. 317.**—From Bunnerong Road (Main Road No. 171) near Smith Street, via Hogue Street and Fitzgerald Avenue, to Maroubra Beach.

**Main Road No. 318.**—From the Great Western Highway (Main Road No. 5) via Marlborough Road and Richmond Road, to Rookwood Cemetery.

The following Main Road has been de-proclaimed:—

**Main Road No. 306.**—From State Highway No. 10, west of Byron Bay, to a point outside Mullumbimby.

The following new Developmental Roads have been proclaimed:—

**Developmental Road No. 1009.**—Extension of existing Developmental Road from Cummoock-Eurimbla to link up with the North-western Highway (Main Road No. 7) in the Macquarie Shire.

**Developmental Road No. 1045.**—The road from Main Road No. 276, near Towamba to State Highway No. 1, at Kiah, within Imlay Shire.

**Developmental Road No. 1087.**—Extension of existing Developmental Road from Cowpasture Road westerly to Luddenham.

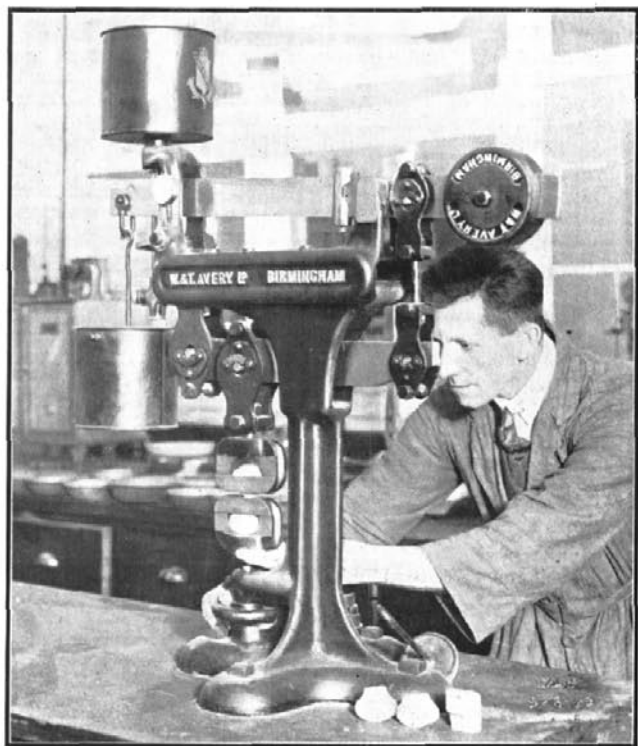
**Developmental Road No. 1095.**—The road from Boggabri Railway Station towards Manilla, within Namoi Shire.

# Testing and Experiment.

BY A. C. MACK, B.E.,

*Testing Engineer.*

**T**HIS is a scientific age. The old rule of thumb methods and checks that sufficed in the days of our grandfathers are no longer adequate. New materials and new processes are continually being brought forward, and we need to have some means of ascertaining whether their use is likely to prove successful or otherwise. Old materials, of no substantial difference in appearance among themselves, have been tried. Some have been successful—some have failed. We need to have some method of ensuring that only those that have proved successful will be utilised. It is practicable to analyse and discover those characteristics of any materials which make for their success or failure, and then to apply this analysis to any materials which are proposed for use in the future. This is the function of testing—to discover the prospective usefulness of new materials, or of old materials in new situations, and to check up the manner in which any materials supplied to any work conform to the requirements of the specification governing the work. By taking samples of any completed work and testing them, it is also possible to gauge whether the correct processes are being used in its construction. Testing, therefore, enters very fully into the proper conduct of any engineering work.



Main Roads Board Testing Laboratory. Briquette Machine for measuring the tensile strength of cement mortar.

The Board has established in the basement of its offices at 309 Castlereagh-street, Sydney, a well-equipped laboratory for the testing for road materials, rocks, gravels, soils, bitumens, tars, oil, cement, sand, cement concrete and asphaltic concrete. In conjunction with the Testing Branch of the Department of Public Works and the Testing Laboratory of the Engineering School of the University of Sydney, it is able to conduct any tests or experiments that may be necessary in connection with highway materials. Some measure of the extent and rapid growth of the testing work since the inception of the laboratory may be gauged from the fact that during the six months ending 30th June, 1929, 721 samples were submitted for test, on which a total of 1,936 separate tests were made. During the month of July, 197 samples were received, on which 644 tests were carried out.

Although the laboratory has been established primarily to assist with main road works, its use is not confined to these. Tests are also undertaken on behalf of Councils or the general public at fixed charges which are based on actual cost. The scale of fees is set out on M.R.B. Form No. 169, which may be had on application to the Acting Secretary, or the Testing Officer. Any materials for testing should be addressed to the Chief Engineer, Main Roads Board of New South Wales, 309 Castlereagh-street, Sydney. Particular care should be taken that any information describing the source from which they have been obtained, by whom forwarded, and what tests are required should be set out, and the paper on which this is given enclosed in an envelope. It is sometimes found that these particulars are placed on loose papers among the samples. These become worn during the transport of the sample and are often almost illegible on receipt at the laboratory. Hence the need of placing such papers in stout envelopes.

## Use of Diatomaceous Earth in Concrete.

**T**HROUGH the courtesy of Sir John Sulman, the Board's attention has recently been directed to the use in the State of North Carolina, U.S.A., of diatomaceous earth for the improvement of the strength of concrete pavements. This material consists of the siliceous cases, or "frustules," of minute plants known as diatoms, which inhabit fresh and salt water, and in some instances, damp soil. It is a very light, porous substance, generally white to grey in colour. When pure, it contains silica and water only, but in most deposits, clay and other impurities are present. By virtue of its finely divided nature, its addition to any concrete mixture increases the strength and promotes workability, and so permits the use of drier consistencies in field concrete.

The North Carolina experiments have shown that by the addition of quantities ranging from 2 per cent. to 5 per cent., by weight, of the cement content, the average compressive strength has been increased 3 per cent. in twenty-eight days, and 8 per cent. in one year.

Deposits of diatomaceous earth occur in New South Wales, near Barraba, Cooma, Coonabarabran, Lismore, Orange, Braidwood, Bungoma, Cobbadah, Glen Innes, Newbridge, Paddy's River, Tweed River, and in the Wellington district.

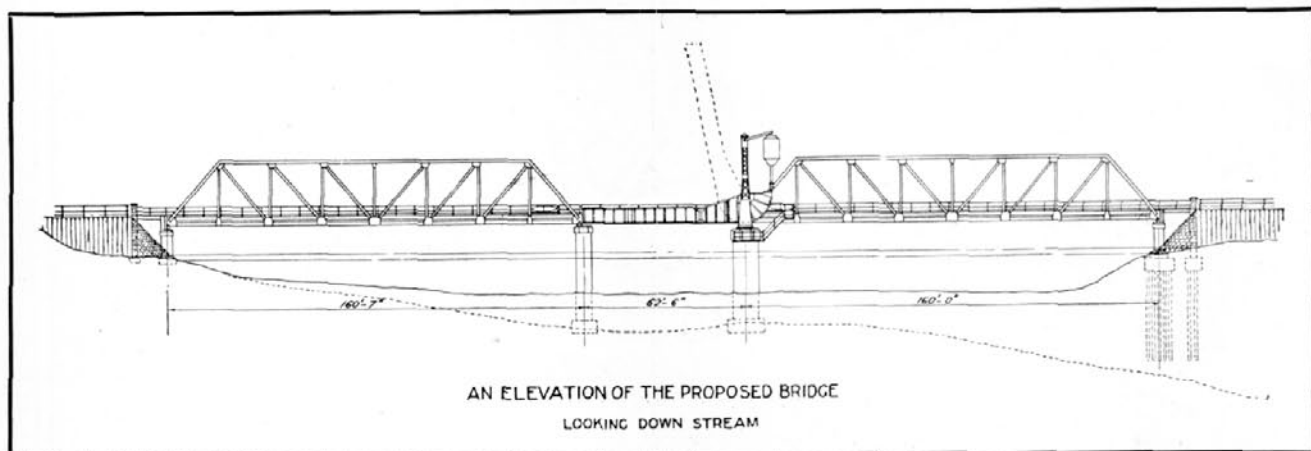
## The Bridge over the Wagonga Inlet at Narooma.

By F. LAWS, B.E.

*Assistant Designing Engineer.*

THE little seaside village of Narooma, which is responsible for many tales of fish, big and otherwise, has for many years been handicapped by poor means of communication with the metropolis. The original means of crossing the Wagonga Inlet was by means of a hand-punt holding two vehicles. This was later converted to a power punt by the installation

of the hinged type of opening span with attached counter-balance was selected. The mechanism on this type, though heavy, is simple and in this particular instance has been arranged so that operation will be performed by hand by one man, due to the introduction of ball and roller bearings. The opening span is located in the middle of the stream, and the crossing is completed



of an oil engine, but was still only capable of carrying two vehicles. When the general improvement of the Prince's Highway was commenced with the operations of the Main Roads Board, this was one of the points which needed attention. A bridge was found to be the most reasonable means of improvement, as it would avoid the possibilities of delay to traffic due to congestion, and possible breakdowns, and stoppages necessitated by rough weather, which the ferry involves.

The width of the river at the bridge site is approximately 370 feet, and the maximum depth of water is 15 feet at low level, the range of tide being 4 ft. 6 in. Rock occurs practically at the surface on the northern bank of the river, the surface of the rock gradually dipping to a depth of 45 feet at the southern bank. The requirements for navigation purposes, as laid down by the Department of Navigation, call for a horizontal clearance of 50 feet, and a vertical clearance of 60 feet above high water. On account of the low southern bank, these conditions made it necessary to include an opening span in the structure. A comparison of costs of vertical lift spans and single leaf bascule spans demonstrated that the latter should be adopted, and

by two 160 feet through steel truss spans, which provide 10 feet clearance between the underside and high water for barges and other light water-borne traffic. The substructure consists of reinforced concrete abutments and piers, the northern abutment being founded on the rock. The piers in the water are carried down to rock which is about 26 feet below low water, with 12 feet of overlying sand. The southern abutment is established on timber piles driven 35 feet in the sand.



Existing Ferry over Wagonga River.



Truss for Wagonga River Bridge in course of assembly at Contractor's Works.

On the fixed spans, the deck is of reinforced concrete, but timber has been used for the deck on the opening span to reduce the dead weight. The bridge necessitates the formation and paving of approximately 1,450 feet of approaches, with subsidiary works. Owing to

the high north and low south bank, the earthworks are fairly heavy. The north approach provides for a curve with a radius of 120 feet, which is the largest that could be provided at reasonable cost. On the south side, the approach is straight in the immediate vicinity of the bridge.

The construction of the bridge has been divided into two parts:—

- (a) The manufacture and supply of the steelwork.
- (b) The construction of the foundations and approaches, the erection of the steelwork, and the completion of the bridge.

A contract for the former has been let to Messrs. Morison and Bearby, of Newcastle, for the sum of £12,267 2s. 6d. Where possible, Australian material, produced by the Broken Hill Proprietary Works at Newcastle, is being used—only the large plates, shafting, and bearings being imported. The fabrication is now in hand.

The construction of the piers, erection of steelwork, and the balance of the work is being carried out by the State Monier Pipe and Reinforced Concrete Works, for the sum of £29,495 16s. 7d.

## The Prince's Highway. Works Done to Date and Proposed Programme.

BY D. CRAIG, M.INST.C.E.

*Chief Engineer.*

THE Prince's Highway (State Highway No. 1) is one of the four main arterial highways radiating from Sydney, and is the Coast Road between Sydney and Melbourne. It passes through some of the most beautiful coastal scenery of the Commonwealth, and on this account alone attracts great numbers of travellers. In addition, on account of the absence of railway facilities south of Nowra, it acts as the main feeder between the South Coast and the capital. It is, therefore, one of the most important highways of the State. The highway commences at the City of Sydney and passes over George's River Bridge (opened to traffic by the Sutherland Shire Council earlier in the year) at Tom Ugly's Point, thence through Sutherland, Bulli Pass, Wollongong, Kiama, Nowra, Bateman's Bay, Moruya, Narooma, Bega and Eden to the Victorian border, a total distance of 351½ miles.

As soon as possible after its inception in 1925, the Board traversed the Prince's Highway and arranged with the Councils of St. Peters, Sutherland, Bulli, North Illawarra, Wollongong, Central Illawarra,

Nowra, South Shoalhaven, Clyde, and Inlay for the reconstruction or construction of portions of the highway that were in urgent need of attention. Work was commenced towards the end of 1925, and has been consistently pursued since that time.



Road along Minnamurra River, Pre-mixed Bituminous Macadam Pavement.





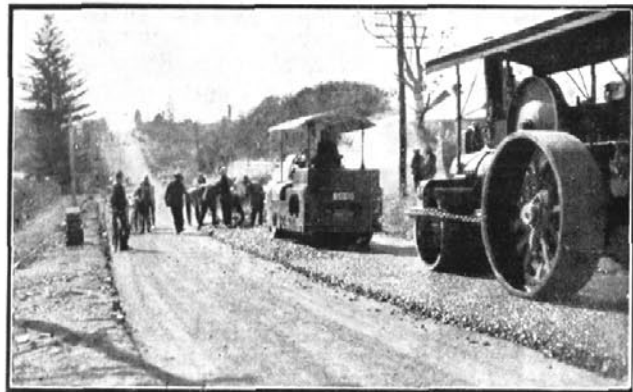
Widened and Super-elevated Curve, with cutting cleared to improve visibility, on Gravel Road near Moruya.

over Frog's Hollow. Beyond this point, intensive maintenance has been carried out and a great deal done towards widening the sharp curves and the improvement of the surface; £20,000 has been allocated from Federal Aid Funds for new construction work for the year 1930-31.

Altogether a total length of 5 miles in the metropolitan area, and 58½ miles in the country has been constructed, while 10 and 11½ miles respectively are in course of construction.

The whole of the road, with the exception of those portions in the Bulli Shire below the foot of the Bulli Pass, and in the Municipalities of Wollongong, Nowra, Berry and Bega, is being maintained directly by the Board.

On the maintenance work from south of Bulli Shire to the Victorian border, the Board has, at present, eight rollers, fourteen graders of various kinds, three road drags and various smaller items of plant employed, and



Laying Pre-mixed Bituminous Macadam at Kiama.

approximately £55,000 has been allocated for this maintenance and improvement work during the present financial year.

Wherever the alignment and the gradient of the existing road are satisfactory, the maximum advantage is being taken of the existing pavement to form a base for a wearing course in any reconstruction operations. Similarly, wherever intensive maintenance is undertaken, the existing pavement is being widened and reshaped so that it will ultimately form a base for a wearing course.

From Bulli to approximately 20 miles south of Nowra, the type of pavement adopted has consisted of a wearing course of premixed or penetration bituminous macadam with a foundation course of broken stone or Telford base. When reconstruction south of that point is about to be undertaken, the fullest consideration will, following the Board's general policy, be given to the use of any local road-making materials available, and the nature of these materials will determine the type of pavement to be adopted.

In order that the traffic along the highway may be protected and guided to the fullest extent, it has been decided to erect route, alignment, danger and direction signs and mile posts throughout, and this will be given effect as soon as arrangements can be made.



Reconditioned Gravel Road near Moruya.

Since the road has become a State highway (1st July, 1928), the Board has endeavoured to place the surface of the road in such a condition as to permit of comfortable travelling, while at the same time it has undertaken construction works where the alignment or grades required improvement to make the road safe and economical to transport.

Work yet remains to be done to bring the whole length of the highway up to the desired standard, but on the whole, the objective aimed at has been achieved, and the road is now in a better and safer condition for travellers than it has been for many years.

### The Federal Highway.

Tenders have been called for the construction of earthworks and culverts on ten miles of the Federal Highway, between Collector and Canberra. This section extends southwards from contracts, totalling 14 miles, on which work is in progress, or has been completed in the last twelve months, and is the greatest length so far included by the Board in one contract.

# Tenders and Quotations Accepted.

The following Tenders and Quotations were accepted by the Board during the month of August, 1929 :—

## TENDERS.

Work or Article.			Name of Successful Tenderer.	Amount of Accepted Tender.
Municipality or Shire.	Road No.	Description.		
Abercrombie	...	7 Construction of 1,577 feet of deviation on North-western Highway at Rock Creek Bridge.	W. H. Berry and Son...	£ 704 s. 18 d. 0
Gunning	...	3 Construction of 3 miles of earthworks, gravel base course, and bitumen penetration macadam surface course.	John Fowler & Co. (Aus.) Ltd.	11,859 8 7
Tenterfield (Shire)	...	9 Taking delivery of steelwork and construction of Maryland River Bridge.	M. R. Hornibrook, Ltd.	11,576 0 0
Boree	...	224 Construction of 6-span concrete bridge and approaches at Mandagery Creek.	J. Jamieson	8,620 7 0
Imlay	...	1041 Construction of 3-span concrete bridge over Mataganah Creek.	W. D. McDonald	3,536 13 6
Granville	...	5 Removal and re-erection of W.B. cottage	H. H. Roberts	65 0 0
Erina	...	9 Haulage of 10,424 tons of materials	F. H. Reckless	Metal and coal, @ 3s. per ton. Coke and bitumen, @ 3s. 6d. per ton.
Erina	...	9 Hire of up to six 2-ton motor trucks	G. Goodman A. C. Irwin	@ 7s. 9d. per hour. @ 8s. 3d. per hour.

The acceptance by the respective Councils of the following Tenders has been approved by the Board during the month of August, 1929 :—

Work.			Name of Recommended Tenderer.	Amount of Recommended Tender.
Municipality or Shire.	Road No.	Description.		
Wakool	...	1,107 1,500 c. yds. gravelling	J. and F. Wilson	£ 327 s. 7 d. 6
Yanko	...	1,108 Forming and gravelling	W. J. Jackson	262 12 6
Boree	...	1,104 Construction of two culverts	T. E. Davies	80 0 0
Do	...	1,104 Construction of 15 in. pipe culvert	Debenham Pipe Co.	30 0 0
Merriwa	...	1,102 Forming and gravelling	C. A. Leahey	1,243 14 8
Patrick Plains	...	1,124 108 chains, formation and gravelling	F. Pryor	3,645 4 0
Do	...	1,124 Construction and gravelling	D. Shearer	2,561 6 6
Yallaroi	...	63 Excavation, filling, &c.	E. Cleal	1,165 5 0
Tweed	...	142 Construction, section 2, Murwillumbah to Blue Knob	J. Cooley	2,078 0 6
Murrungal	...	1,058 Forming and gravelling, 12,400 lin. ft.	C. McGann	7,950 0 0
Merriwa	...	1,102 Forming and gravelling	W. R. Osborne	2,113 8 0
Patrick Plains	...	213 Bridge over Hunter River at Maison Dieu	J. A. Jackson & Sons	4,743 16 3
Do	...	213 Bridge over Hunter River at Bowman's Crossing	C. A. Leahey	3,993 1 8
Tomki	...	64 16,808 lin. ft. construction between 5 m. 500 ft. and 8 m. 3,900 ft.	W. J. O'Meara	14,286 11 1
Do	...	64 5,797 lin. ft. construction between 3 m. 3,582 ft. and 4 m. 4,100 ft.	do	5,856 13 0
Tumbarumba	...	1,143 Construction of 3 concrete box culverts	T. McLurg	612 0 0
Do	...	1,117 Forming, gravelling, &c.	W. Jackson	2,047 10 9
Hume	...	1,062 do do	L. J. Baker	82 14 3
Wyaldra	...	1,037 do do	F. Thorley	1,004 7 6
Port Stephens	...	108 Clearing, forming and loaming	Cox and McNiven	6,321 0 0
Inverell	...	1,119 Gravelling, culverts, &c.	T. Hewitt	2,849 6 3
Do	...	1,002 Construction between 2 m. 2,000 ft. and 3 m. 3,050 ft.	Addison & McGregor	2,622 12 0
Nymboida	...	121 Construction in waterbound macadam between 62 and 63 m.	F. Gilbert	2,984 3 6
Kyogle	...	1,129 9,310 lin. ft. sandstone construction	J. Droney	2,678 19 0
Do	...	1,050 1,584 lin. ft. construction	B. Murray & Co.	1,256 11 2

## QUOTATIONS.

No. of Quotation.	Description of Article.	Name of Successful Tenderer.	Amount of Accepted Quotation.
540	2 traversing screw jacks ... ..	Consolidated Pneumatic Tool Co. ... ..	£ 40 0 0
565	Reinforced concrete pipes, 90 ft. x 30 in., 30 ft. x 21 in. ... ..	R. Fowler, Vianini, Ltd. ... ..	59 5 0
567	1 dessicator, 25 x 30 x 25 cms. ... ..	Elliott Bros., Ltd. ... ..	12 10 0
570	1,670 l. ft., 5 in. x 3 in. trachyte sets ... ..	Loveridge & Hudson ... ..	79 5 6
571	1 steel vertical filing cabinet ... ..	Chartres, Ltd. ... ..	11 5 0
575	Mastic jointing, 240 pieces type "A," 700 l. ft. type "B" ... ..	Stuart & Son ... ..	16 18 5
577	1,600 l. ft., deformed metallic jointing, 18 gauge ... ..	Malleys, Ltd. ... ..	31 2 3
580	Reinforced concrete pipes, 89 ft. x 15 in., 151 ft. x 30 in., 91 ft. x 21 in., 63 ft. x 24 in., 248 ft. x 30 in. ... ..	State Monier Pipe Works ... ..	247 3 3
581	Mastic jointing, 200 pieces type "A," 180 pieces type "B," 420 pieces type "C." ... ..	Stuart & Son ... ..	62 15 0
585	Chain wire fencing, 600 ft., 8 gauge galvanised, 24 in. x 2 in. mesh. ... ..	Cyclone Fence and Gate Co. ... ..	27 0 0
586	8,000 ft. galvanised chain wire fencing, 24 in. x 2 in. mesh ... ..	Cyclone Fence and Gate Co. ... ..	146 5 0
590	Reinforced concrete pipes, 30 x 15 in. ... ..	R. Taylor, Ltd. ... ..	5 2 0
591	1,200 tons bitumen, 60/70 penetration ... ..	Shell Co. of Australia ... ..	9,000 0 0
594	20,000 sets of 6 Order Forms ... ..	Lamson Paragon, Ltd. ... ..	58 0 0
598	Reinforced concrete pipes, 36 ft. x 21 in., 64 ft. x 24 in. ... ..	R. Taylor, Ltd. ... ..	40 18 9
548	Petrol driven water pump ... ..	Cameron, Sutherland & Seward, Ltd. ... ..	45 10 0
555	2,100 tons blue metal spalls ... ..	New South Wales Associated Blue Metal Quarries, Ltd. ... ..	393 15 0
587	Air vessel ... ..	Glebe Engineering Works ... ..	5 12 6
592	Reinforced concrete pipes, 240 ft. x 15 in. ... ..	R. Taylor, Ltd. ... ..	40 16 0
595	660 ft. metallic jointing ... ..	F. G. Kerr & Co. ... ..	11 9 2
596	¾ in. mastic jointing, 14 pieces 8 ft. x 7 in. ... ..	Ormonoid Roofing and Asphalts, Ltd. ... ..	1 8 7
597	270 tons 6 in. ballast ... ..	Sellen and Sellen ... ..	103 10 0
607	Reinforced concrete pipes, 400 ft. x 18 in., 400 ft. x 15 in., 330 ft. x 12 in. ... ..	R. Taylor, Ltd. ... ..	186 4 4
569	300 tons sand ... ..	River Sands, Ltd. ... ..	105 0 0
576	Boat, double tuck, Clunker built ... ..	White & Co. ... ..	26 10 0
591	Reinforced concrete pipes, 1,103 ft. x 18 in., 165 ft. x 21 in., 193 ft. x 30 in., 66 ft. x 36 in. ... ..	State Monier Pipe Works ... ..	428 6 1
593	Turntable ... ..	Armstrong Holland, Ltd. ... ..	317 0 0
604	Fencing, hardwood posts, 3 x 10 in. dia. x 7 ft. 6 in., 163 x 8 in. x 3 in. x 7 ft. 6 in., 330 x 7 in. x 2½ in. x 8 ft. 10 in. ... ..	A. S. Craig ... ..	46 5 5
605	200 tons 2½ in. metal ... ..	New South Wales Associated Blue Metal Quarries, Ltd. ... ..	50 0 0
613	2,040 l. ft. 6 in. x 4 in. trachyte sets ... ..	Bowral Trachyte Quarries Syndicate ... ..	89 5 0
616	350 tons 8 in. ballast ... ..	Sellen and Sellen ... ..	103 10 10
599	Reinforced concrete pipes, 24 ft. x 15 in., 18 ft. x 30 in. ... ..	State Monier Pipe Works ... ..	14 2 3
602	12 7 cubic foot scoops, 48 wooden handles ... ..	Gibson Battle & Co. ... ..	32 16 5
606	Reinforced concrete pipes, 1,080 ft. x 18 in., 78 ft. x 21 in., 82 ft. 5 in. x 30 in., 100 ft. 4 in. x 36 in. ... ..	State Monier Pipe Works ... ..	357 15 11
608	Reinforced concrete pipes, 132 ft. x 18 in. ... ..	R. Taylor, Ltd. ... ..	25 10 5
611	Blue metal, 200 tons ¾ in., 100 tons 1½ in., 50 tons ⅝ in. ... ..	New South Wales Associated Blue Metal Quarries, Ltd. ... ..	112 10 0
614	12 galvanised steel concrete test cylinders, 6 galvanised concrete slump cones. ... ..	Chown Bros. and Mulholland, Ltd. ... ..	10 19 0
617	500 tons 1½ in. blue metal ... ..	Malleys, Ltd. ... ..	3 15 0
		State Metal Quarries, ... ..	129 3 4

## Nambucca River Bridge, Macksville.

THE Board has approved of the preparation of plans and specifications for a fixed bridge over the Nambucca River at Macksville, on the North Coast Highway (State Highway No. 10), in the Shire of Nambucca.

The selected crossing is in line with Cooper-street, with approaches via Bent, Wallace, and Cooper streets, and the structure will be 700 feet long, made up of two 140 steel truss spans, with steel girder approach spans. The Department of Navigation has approved of the preliminary design, and Messrs. Allen Taylor and Co. have agreed to remove their wharf, which is above the selected site. Funds are available for an early commencement of the work.

## Sackville Ferry.

TENDERS have been called for the supply and delivery of a six-vehicle petrol-driven punt for Sackville Ferry, on Main Road No. 182, in the Shires of Baulkham Hills and Colo. The present small hand-operated two-vehicle punt has served for many years, and the increased capacity and speed of the new vessel will allow traffic to take full advantage of recent improvements to main roads leading to this crossing. The new punt will be in operation before the commencement of the holiday season, and, by way of adding further to the safety and convenience of traffic, the ferry approaches are being equipped with a set of the standard reflecting warning signs recently adopted by the Board for use in connection with ferries generally.