MAIN ROADS

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. 2

November, 1929

Foreword.

By Councillor G. A. L. Wilson,

President, Shires Association of New South Wales.

SHIRE COUNCILS throughout the State will welcome the issue by the Main Roads Board of a journal from which they will be better able to keep in touch with the problems of road construction, maintenance, and administration.

For Councils to be well informed, they must be conversant with all phases of these problems, and when, as is sometimes the case, we hear of the Board being criticised adversely, many of us are apt to wonder what the facts really are.

The publication of "Main Roads" fills the gap, and will, no doubt, enable us to become more familiar with the Board's ideas and general policy, and will help to bring about a better and still better understanding between the Board and the Councils.

For the rural population particularly, good roads are vitally important, not only from a productive standpoint, but to improve social conditions, and thus help to bring about prosperous and contented rural communities.

The Councils and the Board have a great national work to perform, and it is the aim of both to work in a co-operative spirit in all their undertakings, and by so doing, achieve in the best possible manner the work with which they have conjointly been entrusted.

"Main Roads" will help us with a monthly account of the activities of the Board. Therefore, I say we welcome it.

Councillor G. A. L. WILSON.

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The Responsibilities of the Board.

IF a road is a main road, the man in the street naturally associates the Main Roads Board with its condition and everything connected with it. The position is not, however, so clear-cut as that. A road, when it is proclaimed a main road, does not pass from the Council's charge. The Council still owns it, just as it does other roads which are not main roads. What then are the Board's responsibilities so far as main roads are concerned?

These may be divided into two parts:

(a) Those of a financing authority.

(b) Those of a co-ordinating authority.

Wrapped up with the former are, under special circumstances, those of a constructing or maintaining authority, when the powers of the local Council in connection with any work (but only to that extent) are temporarily suspended by the Executive Council and transferred to the Board.

The most prominent aspect of the Board's responsibilities is that relating to finance. The Board is provided under statute with certain funds which it has to administer in accordance with definite principles laid down by Parliament in the Main Roads Act. The State is divided into three parts for this purpose: the County of Cumberland, the remainder of the Eastern and Central Divisions of the State, and the Western Division. Two distinct funds have been created to deal with the first two—the County of Cumberland Main Roads Fund and the Country Main Roads Fund. The third is also assisted to a minor degree from the Country Main Roads Fund, but to a greater extent from the Federal Aid Roads Fund, the benefits of which extend to the whole State. The whole cost of works on main roads in the County of Cumberland is, as explained elsewhere in this Journal, borne by the County of Cumberland Main Roads Fund, and it is part of the Board's duty, after consulting the Councils, to select the precise works on the main roads which shall be undertaken with its aid.

In the country, the main roads are divided into three classes: State highways, trunk roads, and ordinary main roads. On the first, the whole cost of the works sufficient to establish a 20 feet width of carriageway is borne by the Board; on the second, two-thirds of a similar width of road; and on the third, three-fifths of such width. The remaining costs of work on trunk roads and ordinary main roads are borne by the Councils concerned, unless financed from the Federal Aid Fund. In this latter case, the Council's contribution is limited, for reconstruction works, to one-third and two-fifths respectively of the State's quota, i.e., one-seventh and six-thirty-fifths of the total cost (the contribution of the State being at the rate of 15s. for each £1 by the Commonwealth), while there is no contribution from the Council on account of new construction works. As it is laid down in the Main Roads Act that the ratios of assistance to the two lower classes of main roads shall be on uniform principles unless special circumstances prevail, it will be apparent that the work which is done upon any section of trunk road or ordinary main road is generally determined by the amount of money the particular Council is able to make available. If it can afford only £200 for maintenance on a certain trunk road, then the amount of the Board's assistance will be £400. If it can contribute only £300 to an ordinary main road, then the Board's subsidy will be £450. So far, therefore, as maintenance and construction (other than Federal Aid Road works) on trunk and ordinary main roads are concerned, the works which may be undertaken are limited by the capacities of the respective Councils to contribute. On the State highways in the country, the Board's financial responsibility is similar to that on the main roads in the County of Cumberland, except that in the latter it may contribute to any width of road, whereas in the former, it is limited to 20 feet of carriageway. The responsibility for the selection of the works to be done is the same in either case. On the trunk roads and ordinary main roads in the country, the responsibility rests primarily upon the Councils to select what works should be done, and to submit these for the Board's approval and to secure the corresponding rate of subsidy. Whether in the County of Cumberland or the country, the works which may be financed or subsidised by the Board are those for the improvement of the carriageway or its drainage. The costs of forming and building footpaths and of kerbing and guttering, except in so far as this latter work acts as a support to the carriageway, are matters for the local Councils.

It will be apparent that, due to its financial obligations, the Board will also act as a co-ordinating authority among the Councils so far as the types of work to be undertaken on main roads, the widths of pavement and formation, the standards of loading to which bridges will be designed, etc., are concerned. Sections 39 and 41 of the Main Roads Act, however, place upon the Board still more definite responsibilities as a co-ordinating authority. Section 39 requires, in brief, that

before anything can be done or any structure erected in a main road to which this section has been proclaimed by the Governor to apply, the Board's approval must be obtained. Section 41 requires that before any main road may be deviated to fit in with the requirements of any work, such as a new railway, the plans and arrangements proposed, so far as they affect the main road, must be approved by the Board. Section 39 has been proclaimed to apply to the County of Cumberland and the State highways in the country. The principal bodies affected by this are those controlling water mains, gas mains, electric power mains, tramway and light poles, tramlines, etc., and the Councils. The Postmaster-General's Department, being a Commonwealth instrumentality, is outside the jurisdiction of State legislation. It is pleasing to record that, in the exercise of its functions in this matter, the Board has met with the most cordial assistance from the various bodies concerned. It can be truly said that whatever the difficulties may be in this direction outside main roads, they do not apply to main roads, except possibly in the matter of tram tracks. Working arrangements have been entered into between the various authorities and the Board, by which any reorganisation of public utility services, such as mains, etc., is undertaken prior to the reconstruction of the road, while even in the matter of tram tracks, arrangements have been made by which these are adjusted to the levels and position in the road desired by the Board, whenever the tracks are due for renewal. It is to be noted that the Transport Bill, now under consideration by Parliament, contains a number of clauses which, if passed into law, will go a long way towards co-ordinating road and tramway construction.

It is by virtue of Section 39 of the Main Roads Act that the Board is charged with the responsibility of deciding whether new kerbside petrol pumps shall be permitted to be established on main roads. Applications for permission to erect such pumps must, in accordance with the Local Government Act, be made to the Council. The Council may reject these if it so desires, in which case the matter is finished. Should the Council desire to give permission, the Board's approval must be obtained, and should this be withheld, the Council is required to refuse the application. It is important that the relative responsibilities of the Council and the Board in this matter should be understood. It is not possible to short-circuit the Council by coming direct to the Board, for the Board's powers only operate where the Council desires to grant permission.

In special cases, the Governor may authorise the Board to carry out the construction or maintenance of any section of roadway. When this is done, the Council's powers and responsibilities, so far as they apply in respect of the particular work in question, are transferred to the Board and are in suspense until the road is formally handed back by the Board to the Council. This is necessary to avoid the possibility of the Council being placed in a position of having a body operating upon its road over which it has no control, and which might be creating a liability for the Council.

News of the Month.

METROPOLITAN DIVISION.

THE reconstruction of the Hume Highway between the water race at Carne's Hill and Narellan is well under way. Excavation, filling, trimming and rolling are in progress, and concreting has commenced at the deviation. The work is being carried out by the Board by direct labour.

The Woollahra Council is now actively engaged in reconstructing New South Head Road from the Rose Bay Sea Wall to Newcastle-street. In order to carry on the boulevarde effect existing west of Rose Bay, a strip of Lyne Park and of the Naval Recreation Reserve, together with portions of certain private properties (which have been resumed) are being incorporated in the road, and will be laid out in grass plots at the edge of the carriageway. The laying of the pavement, which will be of cement concrete, commenced on 1st October, 1929.

On State Highway No. 13 (Pennant Hills Road), the 20 feet central strip of concrete pavement which was laid by the Board's staff between Campbell-avenue and Red Hill Observatory, a distance of 2 miles, 1,675 feet, has been opened to traffic. Opportunity was taken, as part of the reconstruction, to improve the alignment at several awkward bends, the necessary land being resumed for this purpose. At important intersections, difficulty in maintaining adequate facilities for traffic was overcome by the use of quick hardening cement concrete.

As part of the scheme undertaken by the Waverley Council for the improvement of Bondi Beach, the reconstruction of Campbell-parade, Bondi, was authorised by the Board. In keeping with the holiday character of the site, a boulevarde design was adopted, and the Council has now completed the construction, with its own staff, of a 30 feet strip of cement concrete pavement, on the eastern side of the tram lines, from

Lamrock-avenue to North Bondi. Included in this work is an important addition to the underground stormwater drainage system of this area. Provision has been made for grass plots between the tram tracks and the new roadway.

Mosman Council has completed a strip of concrete, 30 feet wide between kerbs, from the foot of The Spit Hill to The Spit, on the southern side of the tramlines. This construction makes it unnecessary for vehicles to cross the tram lines and thus effects a much desired improvement in traffic conditions approaching The Spit Bridge. On the Manly side of the bridge, the Manly Council, under arrangement with the Board, is carrying out the reconstruction of Secondary Road No. 2004—Battle-Boulevarde, Ponsonby-Parade and Palmerstone-Place—in bituminous penetration macadam on a telford base. This road, when completed, will be used as a one-way traffic road from The Spit to the top of the hill in approach to the Bridge, the existing main road being then confined to one-way traffic coming from Manly.

Messrs. Lane and Peters, the contractors for the reconstruction of Pittwater-road, between Dee Why and Collaroy, have laid the concrete slab from the end of the previous construction at Pacific-parade to Lismore-road. The re-decking of the bridge over Dee Why Lagoon is being carried out at the same time and it has been necessary to divert traffic from the main road.

The laying of the gravel pavement on the deviation of Prince's Highway between Waterfall and the Dummies—a distance of 5½ miles—has been completed.

OUTER METROPOLITAN DIVISION.

A contract has been let to Mr. W. Bailey for a bridge at Sale's Crossing, on the road from Eccleston to Gresford (Developmental Road No. 1128). The contract price is £2,253 1s. 2d.

Arrangements have been completed with the Wallarobba Shire Council for the construction of a timber bridge over Anley's Creek on the Dungog-Paterson road (No. 101), about 2 miles from Dungog. The new bridge will form part of a short deviation to eliminate the unsatisfactory approaches to the present structure.

A contract has been let to Mr. F. H. Stewart for approximately 2 miles of reconstruction on the Abermain-Weston road (No. 218). Approximately 1¾ miles will be of cement concrete, and the remaining ¼ mile of tar penetration.

A tender has been accepted for the formation of a further section of about 2½ miles on the Stockton-Nelson's Bay, road (No. 108). The contractors, Messrs. Cox and McNiven, have recently completed an adjoining length of about 2½ miles at the Nelson's Bay end of the road. The new contract covers the length of the road not yet constructed, and will provide a formed road throughout from Stockton to Nelson's Bay.

The substructure of the bridge over Mooney Mooney Creek on the Sydney-Newcastle road, between Peat's Ferry and Gosford, has been completed, and the false work placed in position in readiness for the erection of the steel superstructure.

The construction of a reinforced concrete bridge on the Maitland-Cessnock road (No. 218) at Chinaman's Flat, near Weston, is approaching completion. The work is being carried out by Contractor C. V. Lawson, and it is anticipated that the bridge will be opened to traffic during November.

The Board has informed the Adamstown Council that it will contribute three-fifths of the cost of reconstructing in cement concrete the length of the Newcastle-Wallsend road (No. 107) within the Municipality of Adamstown. This road serves a considerable area of the western suburbs of Newcastle, and on account of its low-lying location, its maintenance has been unduly costly.

UPPER NORTHERN DIVISION.

The reconstruction in bitumen penetration macadam of 130 chains of the Lismore to Ballina road (Trunk Road No. 64), in the Municipality of Lismore, is nearing completion. This work will give a good riding surface and improved curves on the Goonelabah Cutting.

A commencement has been made with the reconstruction in bitumen penetration of Skinner-street (No. 151) and Through-street (No. 117) within the Municipality of South Grafton. Through-street carries the traffic from South Grafton railway station to the ferry over the Clarence River.

The tender of Mr. F. Gilbert has been accepted for the construction of 2,894 lineal feet of waterbound macadam construction between the 62 m.p. and 63 m.p. on the South Grafton to Armidale road (No. 121) in the Shire of Nymboida. The work is known locally as the Poley Creek Culvert deviation, and will improve a section of the road which is difficult to negotiate during wet weather.

Tenders have been let for 11,140 lineal feet of gravel construction on the road from Delungra to Graman (Developmental Road No. 1082) in the Shire of Bannockburn. The work is well in hand and on its completion the majority of settlers on the road will have been provided for.

Messrs. Kennedy Bros. are well forward with the construction of a three-span timber bridge over Roseberry Creek on the Kyogle-Woodenbong road (No. 140) in the Shire of Kyogle.

LOWER NORTHERN DIVISION.

Extensive reconditioning of the North Coast Highway in the Shire of Bellingen is in progress. The work is being carried out by the Board and affords a much-needed relief from the previously existing rough metal and rutted gravel.

Contractor Dowson has completed a reinforced concrete framed cantilever bridge with approach spans over Uralla Creek on the Uralla-Inverell road (No. 115) in the Shire of Gostwyck. The bridge is 75 feet long and replaces a timber structure which had to be closed some months ago.

A 6,000 feet length of creek sand pavement on black-soil country has been completed on the Manilla-Boggabri road (Developmental Road No. 1003), within the Shire of Mandowa, completing a section of about 10 miles of such construction by the Board. The work will be of great benefit during the coming wheat harvest.

The McLean Construction Company has completed a three-span reinforced concrete bridge over Reedy Creek on the Mudgee-Cassilis road (No. 214) in the Shire of Merriwa. The bridge eliminates an open crossing.

The Manning Shire Council has reconditioned Main Road No. 192 between Wingham and Taree, and this length is now in good order.

CENTRAL WESTERN DIVISION.

The Shire of Jemalong has completed the construction of two sections of gravel pavement, between 12 and 13¼ miles, and between 13¼ and 16½ miles, on the Forbes-Grenfell road (No. 236). The Shire has also completed 3 miles of gravel construction on the Gareema-Pinnacle road (Developmental Road No. 1103), commencing at Gareema Railway Siding.

Typical condition before reconstruction of road crossing Bullenbong Plain, between Lockhart and Wagga (Trunk Road No. 59).

On the North-western Highway, the Shire of Cobbora has completed the construction of a further section of premixed bituminous macadam pavement on telford base on the deviation between 10 and 12 miles, near Geurie, eliminating two railway level crossings, and considerably improving the location of the highway.

In the Shire of Marthaguy on the North-western Highway, a deviation 1¼ miles long is being constructed at Buckley's Swamp. The road traverses a black soil swamp. The new work will include a gravel pavement, and will eliminate a bend, as well as improving a section which has formerly been impassable in wet weather. Messrs. Deacon and Sons are the contractors.

The Shire of Wingadee has completed forming, top-dressing and construction of culverts, between 35½ and 38 miles on the Coonamble-Carinda road (Developmental Road No. 1083). The Council is proceeding with forming and top-dressing on the recently proclaimed Coonamble-Pilliga road (Developmental Road No. 1120). This work will extend the formed road from the Coonamble Municipal Boundary to the 21-mile peg. Within the Municipality of Coonamble, the road will shortly be formed and top-dressed, and a concrete culvert constructed at 2¼ miles.

RIVERINA DIVISION.

Tenders have been invited for the construction of a two-mile length of gravel pavement and necessary culverts on the Lockhart-Urana Road (Trunk Road No. 59) on Brookong Plain in the Shire of Lockhart.

A length of 7,564 feet of gravel pavement has been completed by Contractor David Glascott on the road between Lockhart and Urangeline Soldiers' Settlement (Developmental Road No. 1031).

Nineteen hundred and eighty lineal feet of the Mid-Western Highway in Main Street, West Wyalong, is to be reconstructed when weather conditions become more favourable. The construction of three reinforced concrete box culverts and three concrete causeways on this length is well in hand.

Road adjacent to section shown in adjoining illustration after reconstruction with gravel pavement. This road cost £3,500 per mile, including culverts.

Repairs to the two-span timber and concrete bridge over Carboona Creek on the Mullanjandra-Tumbarumba road (No. 278) in the Shire of Holbrook, have been completed, and the structure is now open to traffic.

The construction of two reinforced concrete culverts on the Henty-Culcairn-Albury road (No. 210) in the Shire of Culcairn, has been completed. The road at these points was previously almost untrafficable in wet weather.

SOUTHERN DIVISION.

On the Mount Darragh Developmental Road (No. 1041) in the Shire of Imlay, a 3-span concrete bridge is being constructed over Mataganah Creek, near Wyndham. Mr. W. D. McDonald is the contractor, and the work will be completed early in 1930.

A length of three miles of premixed bituminous macadam pavement has been completed and opened to traffic between 126½ and 129½ miles on the Prince's Highway near Tomerong. A bituminous pavement now extends some 13 miles south of Nowra. At 132½ miles, a deviation has been surfaced with gravel, and opened to traffic. These works were carried out by the Board by direct labour.

The Shires of Mulwaree and Yarrowlumla have commenced reconditioning of the road between Goulburn and Queanbeyan, via Tarago and Bungendore. This road is, pending the completion of the Federal Highway, the main road of approach from Sydney to the Federal Capital, south of Goulburn. Seventy men are engaged, and considerable improvement has already been effected, particularly between Tarago and Goulburn.

On the Prince's Highway at Wandandian, Contractor de la Torre has completed the construction of a four-span concrete bridge over Wandandian Creek. A deviation three-quarters of a mile long, of which the bridge is part, is being gravel-surfaced and will be opened to traffic during November. The new location avoids the steep grades and unsatisfactory alignment of the old route, while the new bridge replaces three worn-out timber bridges.

Messrs. Australian Roads Ltd. are the contractors for the construction in bituminous penetration macadam of 3½ miles of the Hume Highway, between Yass and Bowning, in the Shire of Goodradigbee. It is anticipated that the work will be completed during January, 1930. Reconditioning is in progress on this road at the Fish River, between Cullerin and Gunning; between Gunning and Yass; and at Flinters Gap, between Bowning and Bookham.

Between Cooma and Nimmitabel on the Monaro Highway in the Shire of Monaro, a length of three miles is being reconstructed in bitumen-surfaced water-bound macadam. Messrs. Peake and James are the contractors. On the same Highway, between Bega and Tathra, in the Shire of Imlay, the previous construction of 5½ miles is being extended between 5½ and 7½ miles under contract by Mr. G. A. Armstrong.

Expenditure from 1st July to 30th September, 1929.

	Expenditure to 31st August, 1929.	Expenditure for month of September.	Total Expenditure to 30th September, 1929.
	£ s. d.	£ s. d.	£ s. d.
COUNTY OF CUMBERLAND MAIN ROADS FUND—			
Construction of Roads and Bridges	80,846 0 3	58,121 1 4	138,967 1 7
Cost of Land Resumptions	10,968 9 7	28,832 0 8	39,800 10 3
Maintenance of Roads and Bridges	31,597 12 0	31,643 8 7	63,241 0 7
Repayment of Loans	53,786 3 3	13,542 4 3	67,328 7 6
Cost of Survey, Design, Supervision and Administration	17,252 17 9	7,209 12 7	24,462 10 4
Purchase of Stock and Assets	15,351 9 5	*Cr.* 12,203 1 8	3,148 7 9
Miscellaneous	943 14 9	*Cr.* 38 8 6	905 6 3
Totals	210,746 7 0	127,106 17 3	337,853 4 3
COUNTRY MAIN ROADS FUND—			
Construction of Roads and Bridges, including Resumptions	138,901 19 4	87,406 7 5	226,308 6 9
Maintenance of Roads and Bridges	158,300 4 10	89,564 7 11	247,954 12 9
Cost of Survey, Design, Supervision and Administration	13,510 11 4	7,321 8 11	20,832 0 3
Purchase of Stock and Assets	19,069 6 1	*Cr.* 27,007 9 11	*Cr.* 7,938 3 10
Miscellaneous	4,726 11 2	*Cr.* 723 9 3	4,003 1 11
Totals	334,598 12 9	156,561 5 1	491,159 17 10
FEDERAL AID ROADS FUND—			
Construction of Roads and Bridges, including Resumptions	140,892 18 11	96,689 10 10	237,582 9 9
Purchase of Stock and Assets	2,203 8 4	3,104 5 10	5,307 14 2
Miscellaneous	635 2 4	2,196 3 10	2,831 6 2
Totals	143,731 9 7	101,990 0 6	245,721 10 1
DEVELOPMENTAL ROADS FUND—			
Construction of Roads and Bridges	47,643 8 11	27,534 12 6	75,178 1 5
Miscellaneous	10 0 6	*Cr.* 170 3 9	*Cr.* 160 3 3
Totals	47,653 9 5	27,364 8 9	75,017 18 2
Grand Totals	**736,729 18 9**	**413,022 11 7**	**1,149,752 10 4**
SUMMARY, ALL FUNDS			
Construction of Roads and Bridges (including Resumptions)	419,252 17 0	298,583 12 9	717,836 9 9
Maintenance of Roads and Bridges	189,987 16 10	121,207 16 6	311,195 13 4
Repayment of Loans	53,786 3 3	13,542 4 3	67,328 7 6
Cost of Survey, Design, Supervision and Administration	30,763 9 1	14,531 1 6	45,294 10 7
Purchase of Stock and Assets	36,624 3 10	*Cr.* 36,106 5 9	517 18 1
Miscellaneous	6,315 8 9	1,264 2 4	7,579 11 1
Grand Totals	**736,729 18 9**	**413,022 11 7**	**1,149,752 10 4**

The County of Cumberland Main Roads Fund—Its Functions and Position.

Portion of an address delivered to the Annual Conference of the Local Government Association of New South Wales, on 26th September, 1929.

By H. H. Newell, M.Inst.C.E., M.I.E., Aust.,
Deputy President.

EVEN now when the Main Roads Act has operated for almost five years, some landowners in the Metropolitan area have an uneasy feeling when the Municipal or Shire rate notice reminds them that ½d. in the £ on the unimproved value of their land is paid for the maintenance and improvement of main roads, that their money is used for expenditure on main roads in the vicinity of Bourke or some equally remote locality. It is well to reiterate that this is not the case. The Main Roads Act provides that a maximum of ½d. in the £ on the unimproved capital value of ratable land shall be paid by each Council in the County of Cumberland, except that the rate is reduced by one-half in the case of the City of Sydney, or in respect of lands used principally for primary production purposes, e.g., orchards, poultry farms, market gardens. The money provided is pooled for expenditure within the County of Cumberland, but the Board has no power to spend any portion of the contribution outside those limits. The boundaries are, briefly, the Hawkesbury River on the north, Mount Victoria on the west, and Bulli Pass on the south.

On the other hand, when a metropolitan resident who owns a motor vehicle pays his registration fee and tax, one-half is retained for maintenance or construction work in the County of Cumberland, and the other half is paid to the Country Main Roads Fund for the upkeep of country main roads. This provision was made because of the use which metropolitan vehicles make of country roads, and although the precise extent of this use cannot be gauged and the arbitrary division of 50 per cent. supported by calculation, it appears to be working out satisfactorily. It is to be remembered that the country main roads system involves the maintenance and, as far as possible, the improvement of 13,000 miles of road as compared with 600 miles in the County of Cumberland, and that without the improvement of the country main roads, the usefulness of their vehicles to metropolitan motor owners would be very restricted.

The land rate and motor tax form the foundation of the County of Cumberland Main Roads Fund, and in round figures, produce £320,000 and £380,000 respectively each year, or a total of £700,000.

The first charge on this revenue is the cost of administration, which amounts to roughly £25,000 per annum (including administration of loan expenditure, special unemployment relief grants, etc.). Next comes the cost of keeping the main road system in reasonable repair, which absorbs a further £225,000 or at the rate of £375 per mile for the 600 miles maintained.

The third item of primary expense is the repayment of past loans, and this requires special comment. The Main Roads Act came into operation on 1st January, 1925, but whilst the passing of legislation was receiving consideration, a number of suburban Councils raised loans to construct main roads on the understanding that the Main Roads Board, when created, would become responsible for the repayment of the loans. Had this provision not been made, a definite and most undesirable pause would have occurred in the improvement of the more important of the metropolitan main roads, since Councils would not have been willing to incur the large liabilities involved in these works, when by postponing reconstruction, the liabilities would have become those of the Board.

In addition, the fund was debited as at 1st January, 1925, with amounts due by Councils to the Treasury on account of advances made for work on main roads at that date, and also with one-half the loan expenditure by the Government from 1920/21 to 1923/24 on these roads.

The total liability undertaken under these headings has been £835,000.

From 1st January, 1925, to 30th June, 1928, the Board obtained loans from the Colonial Treasurer on the basis of repaying one-half the amounts borrowed, but following the passage of the Main Roads (Amendment) Act, 1929, the whole amount of loans advanced by the Board after 30th June, 1928, will be repaid by the Board, except in special circumstances. The liability undertaken by the Board in this manner to 30th June last is £800,000.

As a further means of expediting construction, the Board has guaranteed loans which have been raised by Councils under the Local Government Act for main and secondary road construction, and a debt of £550,000 has been incurred in this manner.

It will be seen from this that the Board has undertaken, up to 30th June, 1929, either voluntarily or by Act of Parliament, loan liabilities totalling £2,185,000 or at the rate of almost £500,000 per annum. It is obvious that a fund with an annual income of £700,000, even though showing a gradual increase, cannot for long expend £250,000 in maintenance and administration charges, and at the same time borrow £500,000 per annum. This heavy early borrowing has been done

deliberately, the Board deeming it wiser to take immediate steps to rebuild the outstandingly bad sections of road and mortgage the revenues of the next fifteen to twenty years, rather than to improve the comparatively few sections which could have been dealt with solely by the use of revenue funds. In this way the Great Western Highway, the Great Northern Highway, the Prince's Highway and the Hume Highway have all been placed in good order, the worst of the subsidiary main road sections have been rebuilt, and the whole of the Metropolitan main road system is in usable condition.

The Board cannot, however, continue to borrow at this rate. The first phase of its operations in the County of Cumberland may be said to be nearing completion. Henceforward, its borrowing must be restricted chiefly to those works on which the annual maintenance charges compel borrowing, and construction works, apart from these borrowings, must be financed from revenue. No further borrowing through Councils, so far as main roads are concerned, will be made after 30th June, 1930. The Board's net loan liability on the 30th June last was £1,866,000, and with a minimum of further borrowings, the annual charge for repayment of loans will for some years amount to at least £220,000. If any increase in the annual revenue be regarded as approximately offset by increased maintenance costs due to greater traffic, the position of the fund may be summarised as follows:

Amount of Annual Revenue ..		£700,000
Cost of Maintenance ..	£225,000	
Repayment of Loans..	220,000	
Cost of Administration	25,000	
		470,000
Balance available		£230,000

The balance of £230,000 will be required to meet the cost of construction and reconstruction of existing main roads, resumption of land, alterations to tram tracks, water mains, etc., and the payment of State subsidy to Federal Aid works, apart from the maintenance and necessary construction of any further roads proclaimed as main or declared as secondary roads.

From these figures, it will be apparent that no early extensive increase in the mileage of proclaimed main roads in the County of Cumberland is practicable. New roads can be added to the list only slowly and must be selected on the broadest possible lines. Any schemes to spend such sums as £1,000,000 or £2,000,000 on comparatively short sections of road widening and reconstruction are clearly beyond the Board's reach. Similarly, the margin between essential expenditure and likely revenue is so small that any reduction in the rate of the levy on Metropolitan Councils would be prejudicial to the soundness of the Fund.

It has been suggested that the Board should each year make an estimate of the work to be carried out by it, and, after reducing these estimates to the limit that economy can suggest, then only levy such rate as may be necessary for the purpose of carrying out the work estimated. It has been the Board's practice since the establishment of the Metropolitan Division as a self-contained entity on 1st January, 1928, to prepare an annual budget of its expected revenues and required loans, and to allocate these to the various works to be undertaken during the ensuing year. Prior to the date mentioned, it was not practicable to do this, owing to funds having accumulated for some time before expenditure on any large scale could be commenced. It has been the Board's endeavour to allocate the moneys to the most urgent works, and also to add to the main road or secondary road list as any moneys not required for already proclaimed roads would permit. The Board has, therefore, attacked the problem rather from the point of view of maintaining the ½d. rate of contribution to its funds, and endeavouring to take on greater liabilities in the shape of new roads as the yield from this rate and of motor taxation would permit. It has in this way added 78 miles to the main road mileage and 43 miles of secondary roads. In other words, if the length of secondary road be divided by two to reduce it to an equivalent length of main road, the main roads mileage has been increased by 100 miles, i.e., by approximately one-fifth of the mileage as it stood at the Board's inception. This brings about some of the relief which Councils desire, and, it is thought, best fits the needs of the ever increasing traffic. The main road problem can never be a stationary one—there will always be the need for constant expansion and consequently for a steadily increasing revenue. At the present moment, the prospective demands on the County of Cumberland Main Roads Fund for the provision of the necessary connections to the Sydney Harbour Bridge, on both the north and south sides of the Harbour, is very great—so great in fact that it appears that the expenditure in construction for possibly the next five years on the north side of the Harbour will be determined almost entirely by this bridge.

New Main, Secondary, and Developmental Roads.

The following new Main Roads have been proclaimed—

Main Road No. 12.—Gwydir Highway. The proclamation of this road was amended to connect with Collarenebri instead of Mogil as previously proclaimed.

Main Road No. 123.—As the section of Main Road No. 123 from Grawan Bridge to Collarenebri has been proclaimed as portion of Main Road No. 12 (Gwydir Highway), the road from Grawan Bridge to Pokataroo has now been proclaimed as Main Road No. 123.

Main Road No. 319.—From the Mid-Western Highway (Main Road No. 6) south of Maude, via Moulemein, to Koondrook Bridge at Barham.

The following Main Road has been de-proclaimed—

Main Road No. 180.—The old Windsor Road from its junction with the Great Western Highway (Main Road No. 5) near Parramatta to the northern boundary of Holroyd Municipality.

The following new Developmental Road has been proclaimed—

Development Road No. 1,083.—The Coonamble-Carinda Road in the Municipality of Coonamble.

The following road has been declared a Secondary Road—

Secondary Road No. 2,013.—From Balmain Road (Secondary Road No. 2,007) via Marion-street and Ramsay-street to Great North road (Secondary Road No. 2,006), within the Municipalities of Leichhardt and Ashfield.

The Widening and Reconstruction of King Street, St. Peters.

By A. E. Toyer, B.E., A.M.I.E., Aust.,

Engineer-in-Charge, Metropolitan Division.

THE earliest route from Sydney to the South Coast was via the Campbelltown-Appin Road, which was surveyed in the forties. Later the route via Unwin's Hill, Tempe, and Forest-road, Hurstville, crossing the George's River at Lugarno was used.

The crossing of the George's River at Tom Ugly's Point, which determined the route of the present Prince's Highway, first came under notice when used by Holt for swimming cattle over the river in connection with his holdings of the Sutherland Estate. Later, a hand punt was installed, being replaced by a steam punt in 1882.

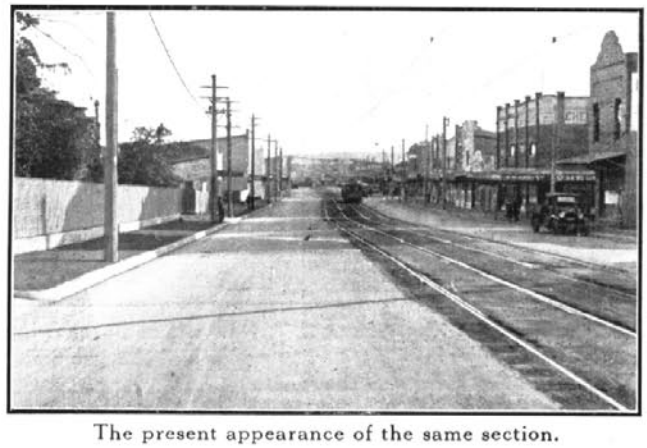
The present route of the Prince's Highway is, therefore, the most recent route from Sydney to the South Coast. The portions of it nearer the city were apparently determined by the vagaries of suburban subdivision rather than as part of a plan for an arterial road leading from the metropolis. King-street, St. Peters,

A view of King-street, near Union-street, before widening and reconstruction.

was the worst section of this. It was, when the Board came into existence, a narrow, dirty, potholey road of varying widths, traversed by a double line of trams which splashed the mud from the road on to the walls and fences on either side, and reduced the area to little better than a slum. Only force of circumstances could have induced any one to live vountarily under such conditions, notwithstanding that the road was part of one of the most important highways of the Commonwealth—the Prince's Highway. Parts of it were only 43 feet wide overall, with a carriageway of 28 feet; other parts were 66 feet. Spasmodic efforts had been made by the Council of the Municipality of St. Peters to widen it, but with the limited funds at the Council's disposal, this had produced no substantial result, other than a number of irregular changes in alignment. It is, indeed, difficult to visualise, as one travels along the road to-day, the conditions that existed less than four years ago.

The problem of providing some improvement or relief from these conditions had exercised the minds of public bodies for some years prior to 1925. One of these was a proposal by the Town Planning Association of New South Wales, made in 1915, for the construction of a parallel avenue 150 feet wide along the west side of Shea's Creek from Botany-road, Alexandria, to West Botany street, Rockdale. This scheme, together with modifications, was considered by the Governments of the day between the year 1921 and the passing of the Main Roads Act in 1924.

Simultaneously, considerable agitation was made for the widening of King-street. The St. Peters Council could not be expected to bear the burden of such a



The present appearance of the same section.

work in order to give the necessary relief to traffic. Works of this class were properly a charge on the community as a whole, instead of on an individual council. Considerations of this nature led to the passage of the Main Roads Act, by which the resources of the Metropolitan Area were pooled in the County of Cumberland Main Roads Fund, and the task of effecting the necessary improvement to metropolitan main roads from this fund was given to a new body, termed the Main Roads Board of New South Wales.

When this Board was appointed in 1925, one of its first tasks was, therefore, to grapple with the problem of providing an entrance to the city from the south, worthy of the State capital, and of creating a modern highway from a road which was practically a lane way. At a conference between the St. Peters Council

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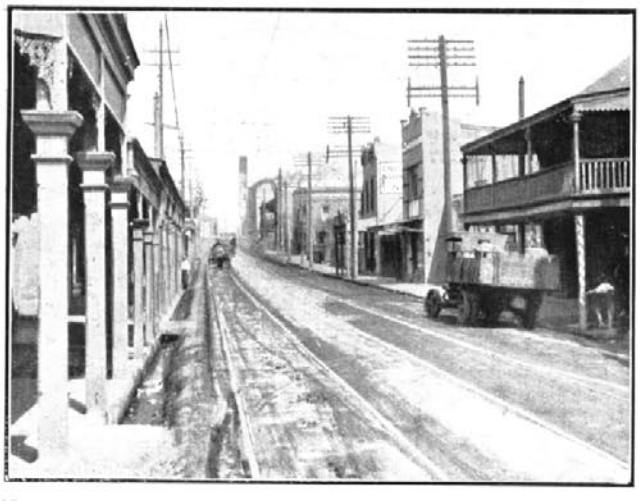
and the Board, held on 13th March, 1925, it was arranged that the Council should engage a competent consulting engineer to prepare a scheme for the reconstruction and widening of the road. The Council thereupon engaged the services of Mr. S. L. Luker, B.Sc., Assoc. M. Inst. C.E., for this purpose, and instructions were given for the preparation of alternative plans for widening the road to 66 feet, 80 feet and 104 feet to 110 feet. When these plans were completed, the advice of the Valuer-General was sought as to the costs involved by each scheme, and it was eventually decided that the 80 feet width should be adopted. Such a width would provide two 10 feet footways and a carriageway of 60 feet, *i.e.*, sufficient for six streams of vehicles of 10 feet each. The Council then engaged Messrs. Gowans and Johns, a firm of practising surveyors, to carry out the detailed resumption survey in accordance with the adopted plans.

It was realised that a considerable time must elapse before the whole of the resumptions could be completed and improvements moved from the resumed



King-street, near Victoria-street, before widening, showing the old carriage-way, 28 feet wide, and the proximity of the tram tracks to the kerb.

strips. In order to expedite the work, the road was, therefore, divided into two sections for construction purposes:

(1) From Cook's River Dam to the Sydenham-Botany Railway, and

(2) From the Sydenham-Botany Railway to Barwon Park road.

As the first section presented fewer difficulties in effecting resumptions, it was decided to concentrate on clearing that section first, and while construction work was proceeding there, to attempt to finalise resumptions on section (2).

No one other than those associated with such a work as this could anticipate the detail necessary to bring it to a successful conclusion. The settling of the claims for resumption, and the clearing of the sites alone was a formidable task, covering 178 individual claims and involving an approximate outlay of £130,432. The majority of these claims were dealt with by the Valuer-General's Department and the Town Clerk (Mr. F. H. Terry) on behalf of the Board and the Council, and no description of this work would be complete without a tribute being paid to the skill and patience which the Department mentioned and the Town Clerk have devoted to this phase of the problem. A special Act of Parliament was required to close part of the Church of England Cemetery so that it might be added to the road. The graves affected were transferred to another portion of this, or to other cemeteries. It was necessary also to reorganise the whole of the public utility services existing in the road, i.e., tram tracks, gas, water, electric light and telegraph services. To prevent subsequent disturbance of the road pavement after construction, arrangements were made with the Metropolitan Water, Sewerage and Drainage Board, the Australian Gas Light Company and the Electricity Department of the Sydney Municipal Council for duplicate services such as water, gas and electricity, to be laid in each footway. The size of the task of moving, re-arranging and installing the new services may be gathered from the outlay incurred by the Board in this respect, viz.:

Tramway	£20,037
Water services..	1,768
Gas services	4,539
Electricity services	3,251
P.M.G. services	6,802
Total	£36,397

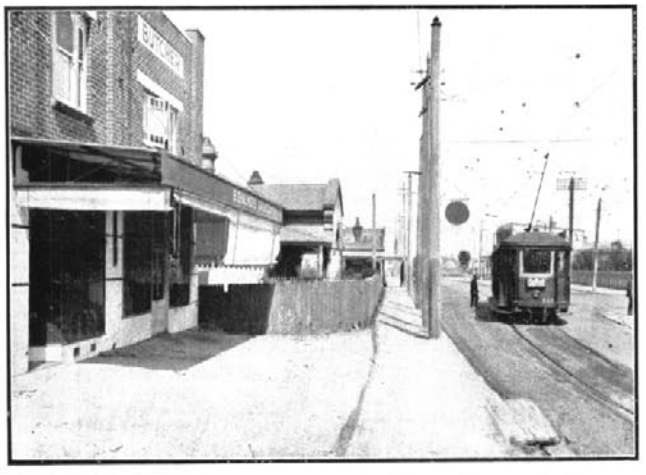
In addition, other costs amounting to approximately £16,500 were borne by the water and gas authorities.

The rearrangement of these services took a considerable time to effect. Until these were nearing completion in each section, the actual construction of the roadway of that section could not be commenced.

While resumptions and alterations to public utility services were proceeding, the detailed plans and specifications were prepared by the Council and approved by the Board. They provided, as previously stated, for a 60 feet carriageway and two footways of 10 feet each, with a cement concrete road pavement. In the period which elapsed before tenders could be called, experience of the wear on the bare cement concrete pavement in Botany road under steel-tyred traffic led the Board to decide that a pavement consisting of a cement concrete foundation, 7 inches thick, with a wearing course of 2 inches of asphaltic concrete would be preferable, as this would provide a renewable coat. The plans were accordingly adjusted. When the rearrangement of public utility services had advanced sufficiently, the Council was authorised to call tenders for the construction of the section from Cook's River to the Sydenham-Botany railway, including the widening of the existing railway bridge over that railway. As a result, the lowest tender received, that of Messrs. W. B. Carr Construction Ltd., amounting to £54,951,

was accepted on 15th March, 1927. Actual road construction commenced on 10th May, 1927, when the then Mayor of St. Peters, Alderman Rowswell, turned the first sod, in the presence of local aldermen and residents. This section of the work was completed and opened to traffic on the 5th April, 1928.

In the meantime, arrangements were proceeding for resumptions and the shifting of public utility services on the section from the Sydenham-Botany railway to Barwon Park road, and tenders for this length were advertised, closing with the Council on the 10th September, 1928, Messrs. W. B. Carr Construction Ltd. again being successful in securing the contract for an amount of £55,221. This work has now been completed and the whole length from St. Peters Bridge to Cook's River opened to traffic.



A view of King-street, near the Tram Depot, before reconstruction.

The approximate final cost of the undertaking is £254,364, distributed as follows:—

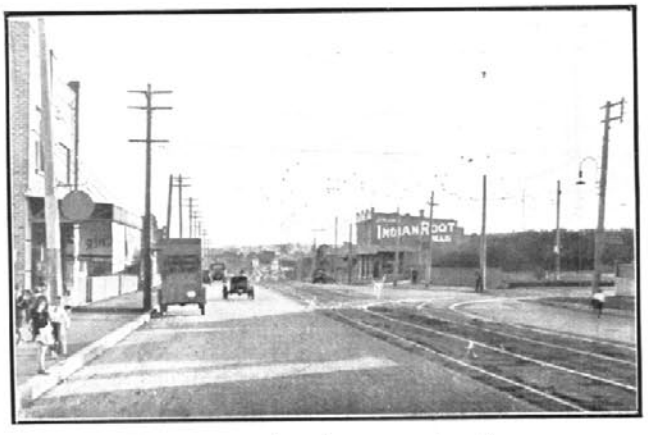
	Section 1.	Section 2.	Totals.
	£	£	£
Resumptions	36,408	66,708	103,116
Public Utilities	15,329	21,068	36,397
Drainage	10,192	11,598	21,790
Road Construction	45,740	47,321	93,061
Total ... ... £	107,669	146,695	254,364

The cost of the drainage, this being a work of benefit to large areas outside the confines of the main road, is being shared equally between the Board and the Council. The Council is also bearing three-quarters of the cost of kerbing and guttering where none existed prior to the road work being done, together with the whole cost of the footpath pavement, other than that which is in replacement of footpaving existing at the commencement of the work.

There remain, so far as the resumptions are concerned, thirty-three claims on the second section yet to be finalised; while there are properties remaining in the Council's possession, having a book value of £13,009, yet to be disposed of.

The lengths of each section are 4,472 feet and 5,781 feet, respectively, making a total of 1 mile 4,973 feet. The costs per foot run of road of the four divisions of the work have therefore been as follows:—

	Section 1.	Section 2.	Average.
	£	£	£
Resumptions	8·14	11·54	10·06
Public Utilities	3·43	3·64	3·55
Drainage	2·28	2·00	2·12
Road Construction	10·23	8·19	9·08
Total ... £	24·08	25·37	24·81



The same section after reconstruction.

The total area of road pavement is 49,125 square yards, and the cost per square yard, exclusive of earthwork, 24s. 9d. The technical supervision of the work performed by the contractor was carried out by the officers of the Board on behalf of the Council.

That this work has been brought practically to completion with so little inconvenience to all parties concerned is due in a large measure to the unfailing energy and tact of the Town Clerk of St. Peters, Mr. F. H. Terry. Although it has thrown a very considerable burden on Mr. Terry's shoulders, he has been at all times ready to carry the responsibility, and ever willing to give his assistance where required.

Tribute should also be paid to the contractors, Messrs. W. B. Carr Construction Ltd., for the manner in which the job was carried out, under—at many times—very trying conditions.

During the progress of the widening and construction, the properties adjoining the road have undergone a transformation. Modern shops have replaced old buildings, mud and dust have given way to cleanliness, a highway exists where formerly there was only a lane. The road is now the pride of the municipality and forms a worthy approach to the capital city.

Razorback Deviation.

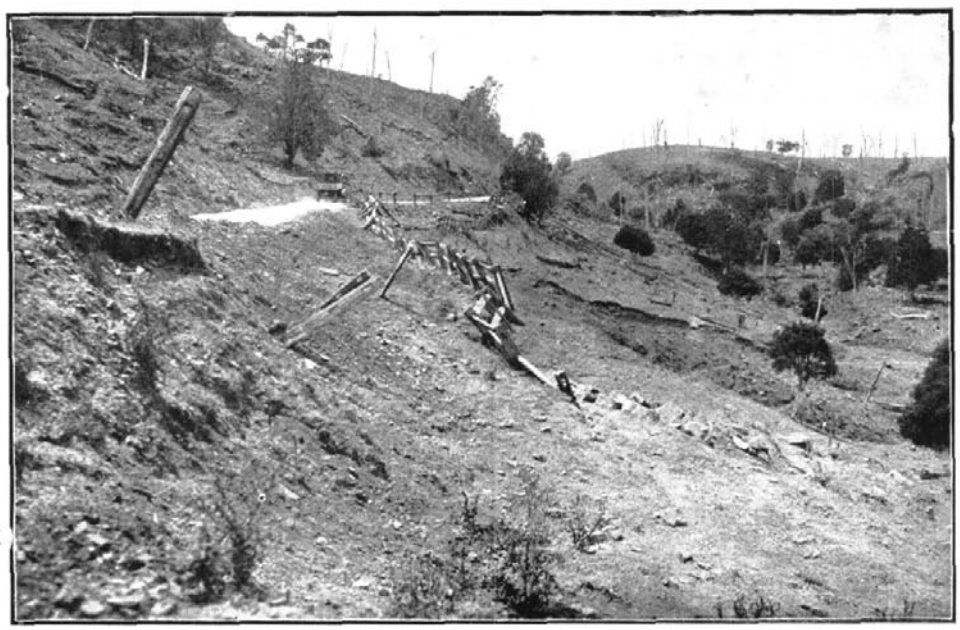
HAD is not been for the stormy weather experienced during the second and third weeks of October, the Razorback Deviation would have been opened to traffic on 19th October. There remains, at the date of going to press, a little over half a mile of pavement yet to be penetrated and sealed with bitumen, and as soon as this is done, the road will be thrown open to traffic. Its opening will be the culmination of the work undertaken by the Board to better fit the Hume Highway at this point for the very prominent part it has to play in the road transport movement of the State.

As one of the two main connections between New South Wales and Victoria, the Great Southern Road has always been one of our most important highways. It passes through some of the most prosperous and progressive inland towns of the State, towns that must ever remain rich in historic interest.

world at large, a road of State, Interstate, National and International concern. Already it looms large in the early records of colonial settlement, and it must ever remain historical, destined as it is to play an important part in the history of Australia as a nation.

Nothing, therefore, should be left undone that may be needed to make it efficient for its purpose, to better fit it to meet the ever increasing requirements of traffic, and to render it comfortable and safe for the passage of that traffic under all conditions.

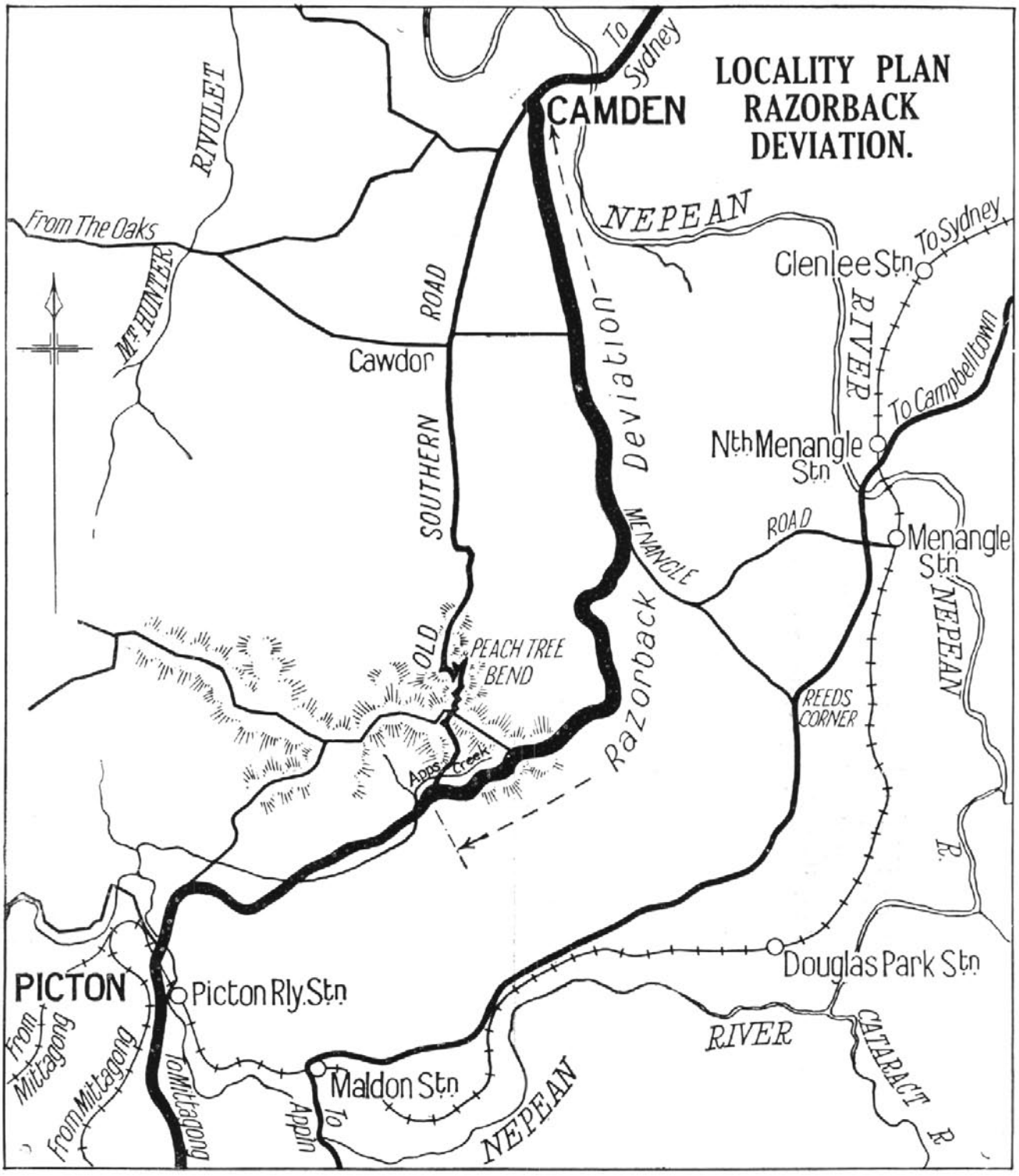
Just as the Hawkesbury River and Ranges on the Great Northern Highway, the Lapstone Hill on the Great Western Highway, and the Bulli Pass on the Prince's Highway, constituted major obstacles to traffic, so Razorback Range on what was then known as the Great Southern Road, and now as the Hume Highway, constituted the chief bar to effective and safe use of this road. The old road, after passing from Camden



Part of the old road between the top of Razorback Range and Apps Creek. Between 1916 and 1925 this road moved bodily down hill a distance of 26 feet.

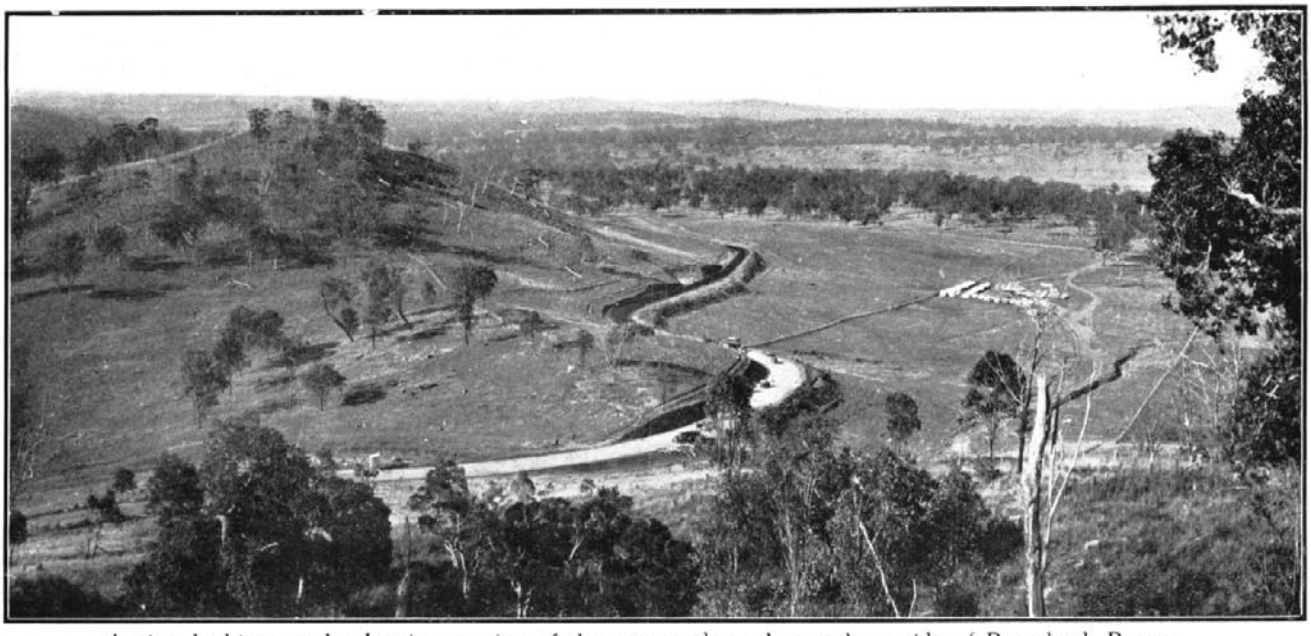
The transfer of the seat of Government of the Commonwealth to Canberra in May, 1927, has added to its importance, having regard to the fact that the section between Sydney and Yarra (six miles west of Goulburn) thereby became the main avenue of road connection between the capital cities of the Commonwealth and the State of New South Wales. This alone must tend to make the highway pre-eminent among Australia's roads, but when it is remembered that it forms also the main road connection between the Federal Capital and the most important of the established seaports on our Pacific coast, it becomes a road of world-wide interest—a link in the lines of communication between the Commonwealth and the

across 4 miles of easy country, of which 2,400 feet are under flood level, climbs the range on the northern side in a principal ascent 3,800 feet long, rising on an average grade of 1 in 14.4, and for two lengths of 700 feet and 1,400 feet—the former immediately below the well-known Peach Tree Bend, and the latter at the crest of the range—on grades of 1 in 10.8 and 11.4 respectively. The Bend mentioned consists of two curves of 66 feet and 55 feet radius, occurring on grades of 1 in 12.7 and 1 in 16.9 respectively. On the southern side, the descent is made over a length of 5,540 feet to Apps Creek, on an average grade of 1 in 15.4, a short length being on a grade of 1 in 9.5. The country passed through had in the past proved



treacherous. As an indication of its unstable nature, it may be stated that between 1916 and 1925 (when the Board came into existence), the road in the vicinity shown in the photograph had moved bodily towards a parallel gully, a distance of 26 feet.

The new route follows the Camden-Menangle Road for 4¾ miles before branching to the south-west, at which point it commences to climb the range by a new road which reaches its highest point at 1,009 feet above sea level—35 feet below that of the highest point on the old road. It then descends, rejoining the old road some 3¾ miles north of Picton. It covers a length of about 9½ miles, being 1¼ miles longer than the old route. On the northern side, the grade does not exceed 1 in 20 except for three lengths of 1,100 feet, 700 feet and 1,600 feet where the grades are 1 in 17.5.



A view looking north, showing portion of the new road on the northern side of Razorback Range.

1 in 18.2 and 1 in 18.5, respectively; while the sharpest curve has a radius of 200 feet. On the southern side, the average grade is 1 in 17.3, some 800 feet near the summit being on a grade of 1 in 16.1, and the sharpest curve has a radius of 150 feet. The road is wholly above flood level and the country passed through is generally sound.

Motor-car crossing Camden Bridge during Tuesday morning, 15th October.

Owing to the nature of the country, very careful investigation was necessary before the final route was determined upon. The old road was examined to see whether it would be practicable to make the desired improvements without substantial deviation. Three other routes were also prospected. The alteration of the old road to fit it for modern traffic conditions was found not to be feasible, and after taking into consideration the advantages already mentioned of the new route previously described, and the reduced maintenance costs which would result from placing the road in more stable country, the Board decided to recommend to the two Councils of Camden and Wollondilly, through whose areas the road passed, that this should be adopted. A conference was held at Camden with these bodies on 28th April, 1926, at which the Board's proposals were approved. In order to afford relief for unemployment, special funds were made available to the Board by the second Lang Administration in order to enable its construction to be started, and work commenced in August, 1927. Following the passage of the Federal Aid Roads Act, 1927, by which the State Parliament ratified the agreement entered into on 17th June, 1927, by the then Premier (Hon. J. T. Lang, M.L.A.) with the Commonwealth, the work came under the scope of this agreement, and the special moneys originally provided were transferred to other works. The whole cost inclusive of resumptions and fencing, amounting to approximately £138,000 will, therefore, be shared between the Commonwealth and the State, in the ratio of 20s. by the Commonwealth to 15s. by the State.

The dislocation of traffic caused by flooding of the old Southern Road on the south side of Camden was amply demonstrated as recently as October 15th, when

Vehicles held up or being towed through flood waters south of Camden on 15th October.

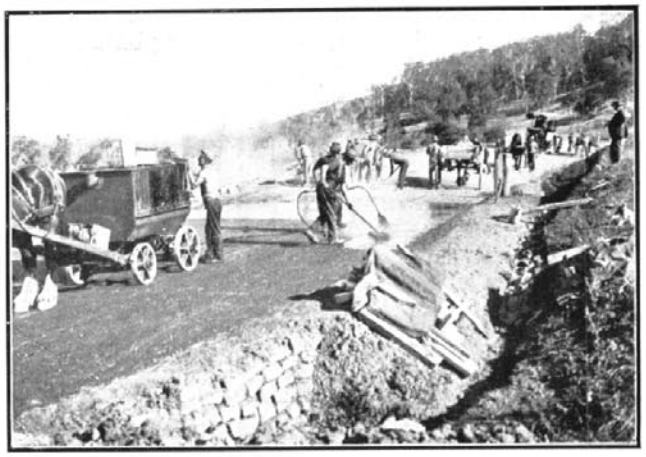
heavy rains had caused the Nepean to rise overnight. Early on the morning of the 15th, Camden Bridge and the road between the bridge and the town was submerged to a depth of about 15 inches. The water

receded slightly before mid-day and continued to fall throughout the day, but traversing the bridge, although inconvenient, was not impracticable or dangerous. Beyond Camden, between the town and the foot of Razorback, where the roadway is more than 5 feet lower than the deck of the bridge, the water was more than 3 feet above the roadway, which was submerged for nearly half a mile. This water connects with the river downstream from the bridge, but it fell only about 1 foot during the day, and, at a late hour in the afternoon, traffic south of Camden was still entirely suspended.

Some idea of the magnitude of the task completed will be gained from the following figures giving the quantities of the major items of the work done:—

Clearing	19½ acres
Earth and rock excavation	142,997 cubic yards
Catch drains	4,087 cubic yards
Concrete pipe culverts (15in. to 30in.) ..	3,233 lineal feet
Concrete arch and box culverts	2
Pavement	114,765 square yards

The pavement is 20 feet wide, increased on curves, with shoulders 4 feet wide. The road foundation is a Telford base course 8 inches thick, constructed of sandstone from the roadway excavations and from quarries established close to the road. For 5 miles at the northern end, beginning at Camden, a light blanket course of broken sandstone 2 inches consolidated thickness was applied to the Telford base, on top of which a bitumen penetration wearing course of 2½ inches consolidated thickness has been constructed. Bowral basalt was employed for this wearing course, penetrated with 1⅛ gallons of bitumen per square yard, and sealed with ⅜ gallon of bitumen per square yard. For the remaining 4½ miles to Apps Creek, where the earthwork was particularly heavy, a less elaborate wearing course was adopted, in view of the possibility of settlement during consolidation of the banks, and opportunity was taken to utilise the sandstone available on the works. The upper portion of pavement here consists of a 3 inch consolidated course of local sandstone, to which was added, where necessary, a small quantity of basalt screenings well rolled in, to form a key for the tar and bitumen surfacing. A priming coat of light tar was then applied at the rate of 1/5th of a gallon per square yard, followed by a seal coat of 85/100 grade bitumen, at the rate of 3/8 of a gallon per square yard.



Applying bitumen seal to sandstone macadam wearing course.

A view looking south, showing the new road on the southern side of the range.

The unit costs of some of the more important items have been:

Earthworks	6/6 per cubic yard
Telford base course (including blanket course)	5/1 per square yard
Bitumen penetration wearing course	4/9 per square yard
Macadam wearing course sealed with tar and bitumen	3/2 per square yard

Earthworks, construction of base course, quarrying and spreading sandstone metal, spreading basalt metal, and applying bitumen seal to the sandstone wearing course, have been undertaken by direct labour; bitumen penetration and sealing of the basalt wearing course have been carried out under contract by Messrs. John Fowler & Co. (Aust.) Ltd., while tar priming of the sandstone wearing course has been applied in similar manner by the Australian Gas Light Co. Ltd. Mr. W. W. Grainger has been the Board's Resident Engineer. The average number of men employed during the progress of the work has been 176, with a maximum of 229.

In lieu of the old second or third gear road, with its difficult and dangerous bends, there is now available a top gear road throughout, which will prove, not only in the ease and safety with which it can be negotiated, but also on account of the fine panoramic views of the surrounding country which it affords, a boon to all who use it.

The Bridge Over the Gwydir River at Gravesend.

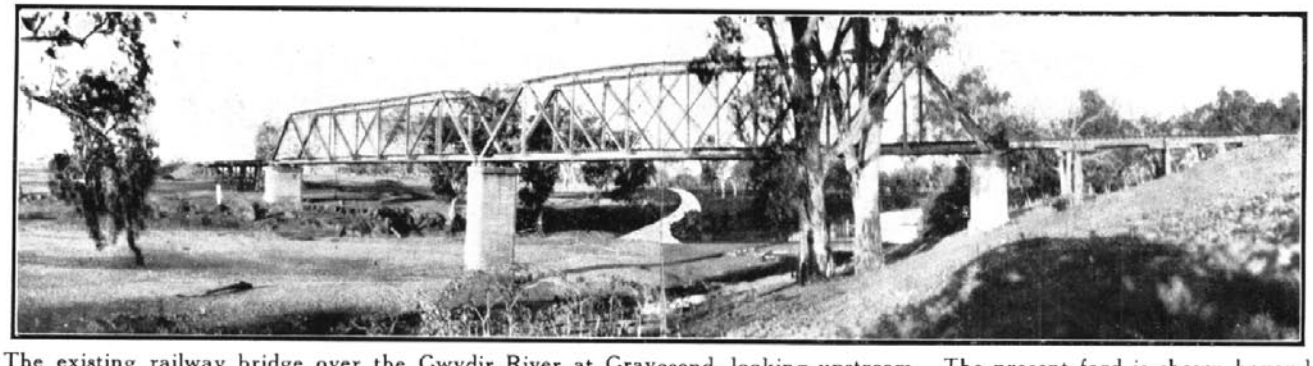
By S. Dennis, B.E.,

Bridge Engineer.

THE Gwydir Highway, extending from South Grafton, by way of Glen Innes, Inverell, Warialda and Moree to the Darling River at Collarenebri, is the main traffic artery between coast and interior in the Upper Northern section of the State. An essential link in this important route is a satisfactory crossing of the Gwydir River at Gravesend.

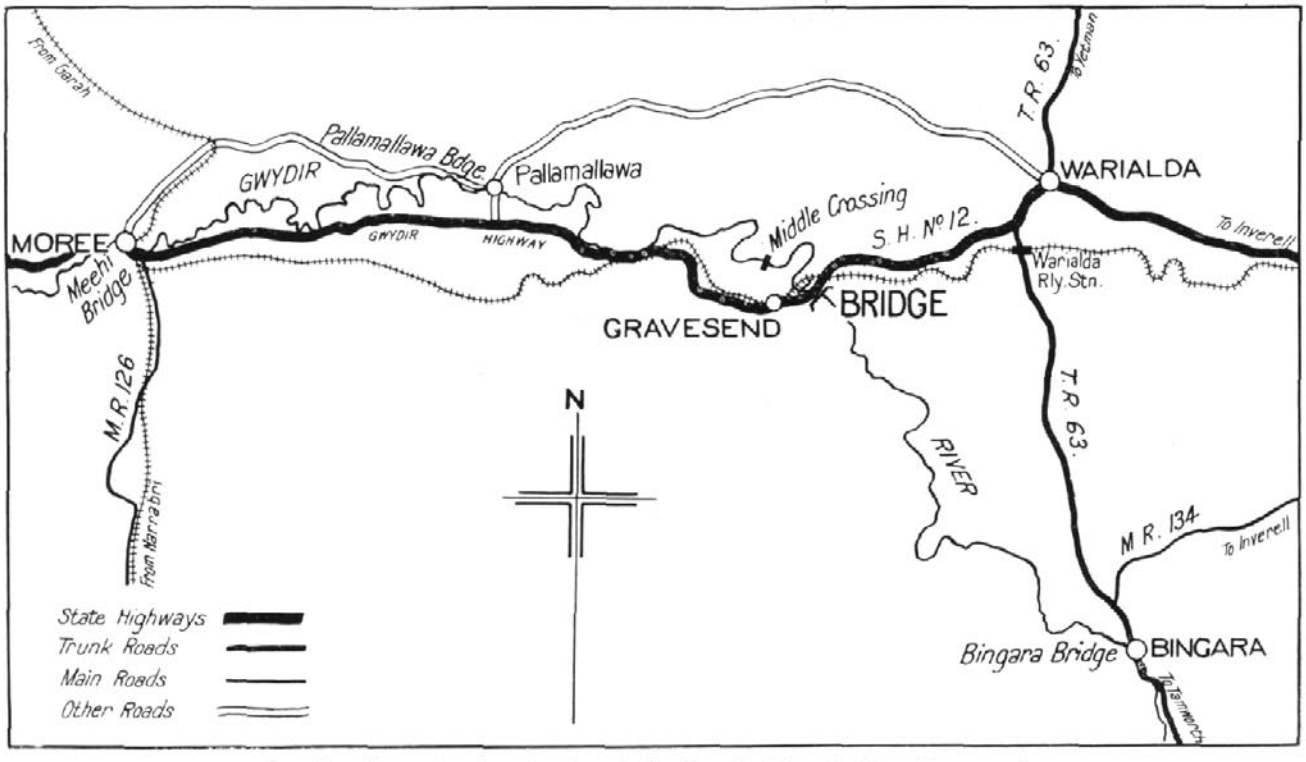
Prior to the completion of the railway between Moree and Inverell, the principal traffic route followed the northern bank of the Gwydir River, and a bridge was built at Pallamallawa in 1908 so that properties on the south bank might have access to this road. The railway hastened the development of the adjacent areas of farming country, and the main road was diverted to a more direct route closely following the railway, crossing the Gwydir at Gravesend by a ford near the railway bridge. The river is subject to frequent and prolonged flooding, and traffic over the ford has often been suspended for weeks at a time. The alternative route via Pallamallawa involves a long detour over indifferent tracks, so that motor cars have actually been driven over the sleepers of the open decked railway bridge, while local legend has it that horsemen have on occasion negotiated the crossing in similar fashion.

From time to time investigations have been made with a view to arranging for a suitable road bridge. Two sites have been considered in connection with low level bridge proposals—one close to the railway bridge, and another lower down the river at Middle Crossing. The possibility of utilising the railway bridge for road traffic has also been examined. This bridge, although above the highest known flood level when built, has since been submerged to a level higher than the rails. The width available to road traffic, if a suitable deck were constructed, would be narrow. In addition, gates, signals, and ramps at either end leading from the railway embankment to the road would be necessary, the cost of gatekeepers would be a standing charge, and road traffic would be frequently interrupted by the movement of trains, the latter disability becoming more marked in future years.



The existing railway bridge over the Gwydir River at Gravesend, looking upstream. The present ford is shown beyond the railway bridge. The new bridge is being built about a quarter of a mile upstream from the ford.

After an examination of all the circumstances, the Board concluded that an independent high level bridge at the site of the present ford was the proper solution of the problem. Plans were accordingly prepared for a structure consisting of two 140 feet steel truss spans, two 70 feet steel plate girder spans, and four 35 feet rolled steel joist spans. The deck will be of cement concrete, providing a 20 feet carriageway throughout



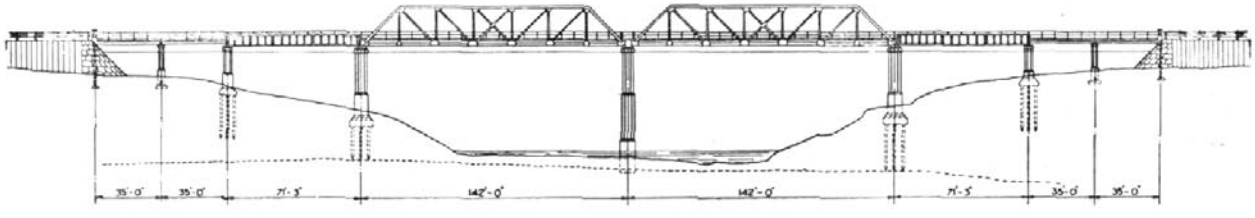
Locality Plan, showing the site of the Gwydir River Bridge, Gravesend.

the bridge. The centre pier will rest on solid rock in the river. The two remaining truss piers and the piers supporting the plate girder spans will rest on concrete piles driven 25 feet, or to rock. The abutments, and the piers supporting the steel joist spans, will rest on spread footings. At either end of the bridge, the approach fill will spill through the columns of the abutment, and will be protected against scour by stone pitched rock fill. The approaches include extensive embankments, and three timber beam bridges of total length 300 feet.

The construction of the work has been divided into three parts:

(a) Supply of the steelwork.
(b) Construction of the piers, erection of the steelwork, and construction of timber beam bridges.
(c) Construction of the approach embankments and gravel pavement.

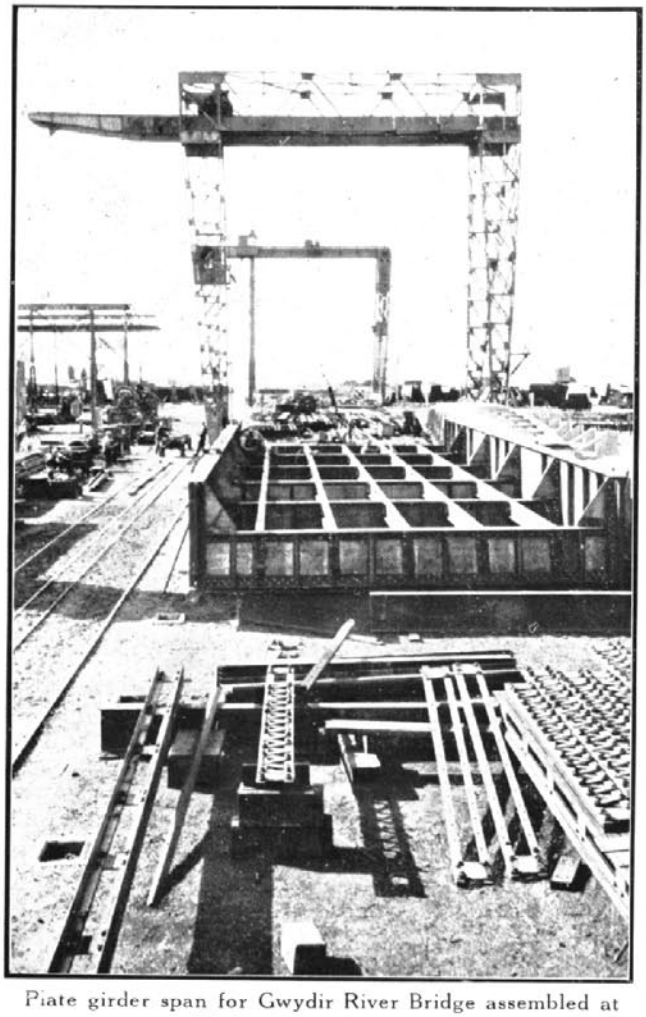
Tenders have been called and accepted for (a) and (b), while tenders for (c) are now being invited with a view to arranging that this part of the work will be completed within the period set for the erection of the bridge. Ten tenders were received for (a), and four for (b). The lowest tender in each case, viz., that of the Government Dockyard, Walsh Island, Newcastle, for (a) in the sum of £9,110 4s., and that of the Foundation Co. Ltd., Sydney, for (b) in the sum of £24,100 was accepted.



AN ELEVATION OF PROPOSED BRIDGE
LOOKING UP STREAM

Good progress is being made by these contractors. So far as the fabrication of the steelwork is concerned, one of the plate girder spans has been assembled, and is illustrated on page 42. The rolled steel joists are all ready for shipment, and many of the truss members have been drilled. The first consignment was despatched to the bridge site during October, and there is every indication that the whole of the work will be completed within the contract period, which expires

on 15th February, 1930. The Dockyard is well equipped for this class of work. For riveting purposes, a pneumatic riveting bear is used. This machine is handier than a hydraulic riveter, and produces equally good rivets, while it performs much better work than the pneumatic "rattler" usually employed. At the site of the bridge, the Foundation Co.



Piate girder span for Gwydir River Bridge assembled at Walsh Island Dockyard.

has completed the foundations for the centre pier, and a considerable number of piles have been driven in the balance of the structure. The contract date set for the completion of this work is 31st August, 1930.

The work is being financed from the Federal Aid Roads Fund as part of the programme for the years 1927-1928 and 1929-1930.

Main Roads Board Standard Specifications.

THE attention of councils is directed to the advantages of obtaining supplies of the Board's standard specifications from the Government Printer. The Printer's stocks are kept up to date, and include all recent amendments.

Obituary.

CAPTAIN F. W. BIDEN.

IT is with a real sense of personal and official loss we have to record the passing of Captain Frederick W. Biden, by whose death on 30th September, 1929, there was taken from us one who was held in the highest esteem and affectionate regard.

Captain Biden joined the Board's staff on 8th April, 1926, as an engineering draftsman.

His kindly nature and genial disposition won for him a warm place in the hearts of all with whom he came in contact. His devotion to duty and his fine spirit of public service were admirable, and these outstanding characteristics must serve to inculcate in others a genuine desire to emulate his example.

With a view to fostering the friendly relations existing between the various branches of the Board's staff, he presented "The Captain Biden Shield" for annual competition in tennis, and followed with close interest the efforts of the competitors.

His death has removed from our midst one whom it was good to have known, truly nature's gentleman, a fine sportsman, one who played the game, whose memory will remain with us fresh, fragrant, and everlasting.

The very real sympathy of the Board and every member of the staff goes out to Mrs. Biden and the members of her family in their bereavement.

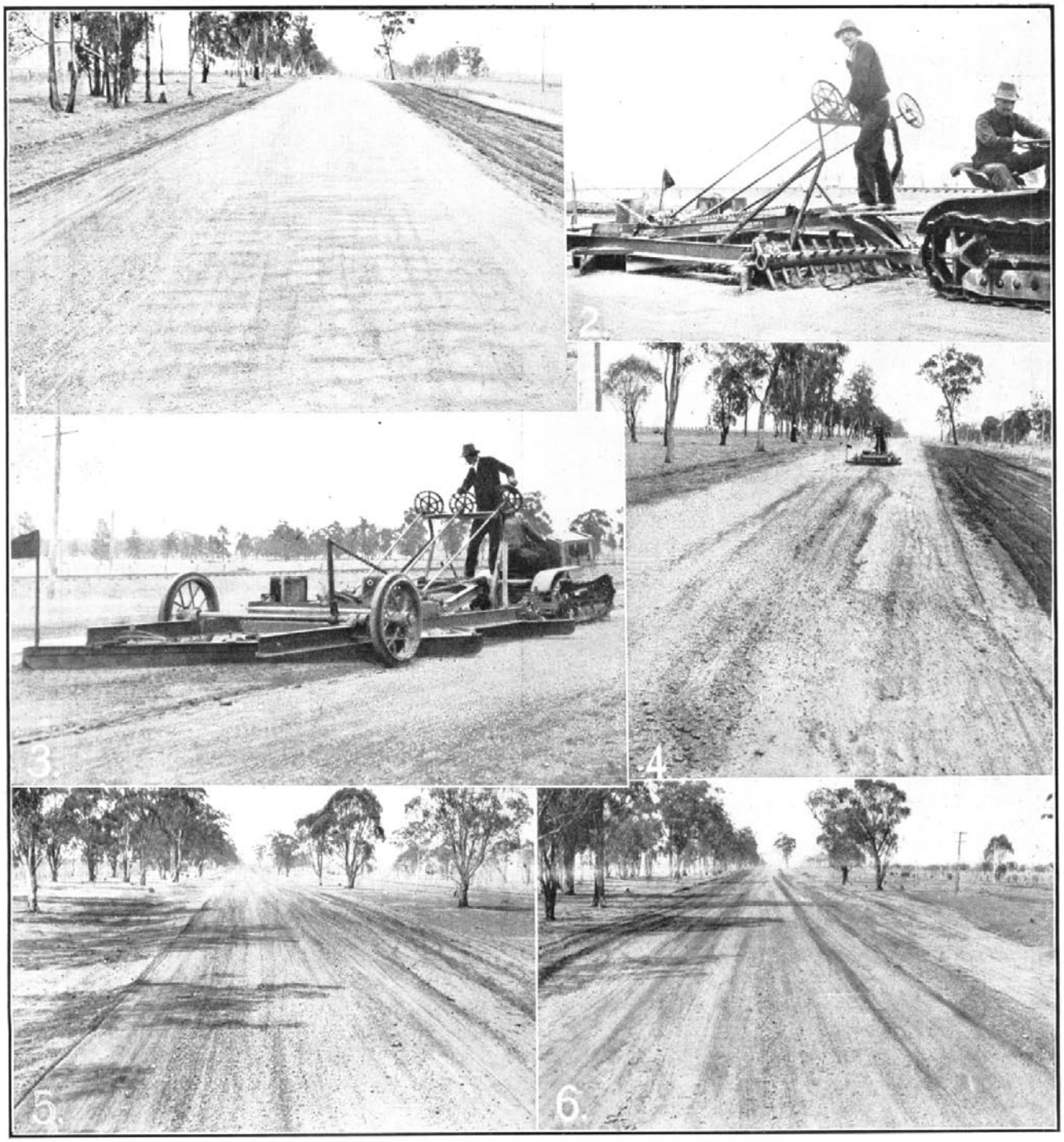
Botany Road.

BOTANY-ROAD was constructed some five years ago by the Botany-road Trust, and its maintenance was later taken over by the Board. More than 10,000 vehicles use portion of this road daily, and, on the eastern side, where the predominating traffic is engaged in the transfer of heavy raw materials, largely carried on steel-tyred vehicles drawn by from two to eight horses, the wear on the cement concrete has become pronounced. Two distinct grooves have appeared in the tracks followed by the horses and wheels. In contrast with the eastern slab, the wear on the western side is very much less, the explanation being that the greater part of the inward transport of manufactured goods is carried on motor vehicles, the steel-tyred lorries which have carried the raw products outwards returning empty.

The protection of the otherwise perfectly sound pavement by means of a wearing surface of asphaltic concrete has been lately undertaken. Short sections were laid last year, primarily with the object of ascertaining suitable methods of protecting the asphalt at the edge adjacent to the tram tracks. This is difficult, owing to the relative levels of the tracks and of the existing slab. Satisfactory means of protection have now been devised. The eastern slab for a distance of 1½ miles (as far as the Australian Iron and Steel Works) and the western slab for one quarter mile only, will be surfaced during the current financial year.

How Narraburra Shire deals with Corrugations.

Illustrated by photographs supplied by Mr. W. M. Scott, Shire Engineer.



1. Corrugated gravel road before treatment.
2. Front view of maintainer, showing tynes.
3. Rear view, showing material being distributed.
4. The result of 20 minutes work on a 5-chain section.
5. Completed work near 1.
6. Another view of completed work near 1.

With the plant shown, one and a half miles of badly corrugated road can be treated twice over in a day of eight hours.

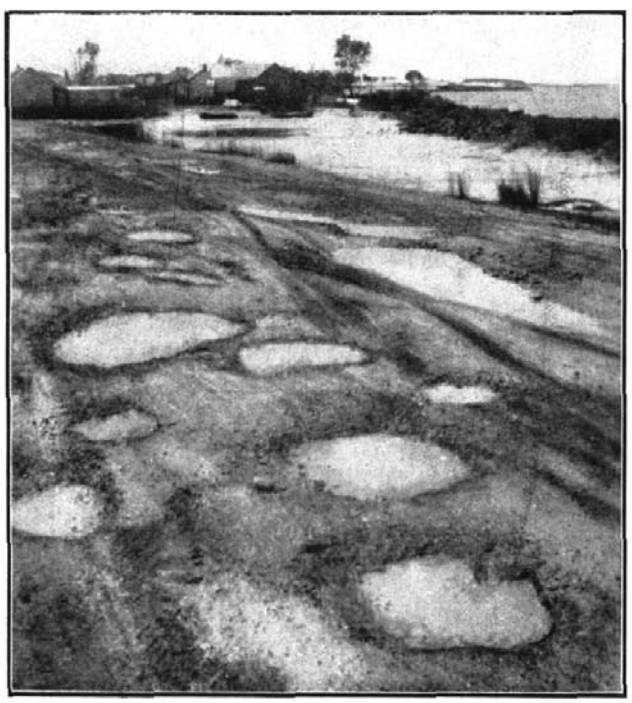
Great Northern Highway.

Works Done to Date and Proposed Programme.

By D. Craig, M.Inst.C.E., M.I.E.Aust.

Chief Engineer.

THE Great Northern Highway (State Highway No. 9) is one of the four arterial highways radiating from Sydney. It connects the two chief cities of the State, viz., Sydney and Newcastle, and is one of the two inter-State routes between



A section of the old road, as it was in 1927, immediately north of Swansea. It has since been reconditioned and tar-surfaced.

Queensland and New South Wales. It passes, along much of its length, through beautiful coastal, lake, or mountain scenery. It is, therefore, a road of great interest to the tourist as well as of major importance to the State. Its usefulness has, up to the present, been somewhat restricted by the lack of through connection between Hornsby and Gosford, two alternative routes via Wiseman's Ferry having to be used until this length is available for traffic. This section will be opened for use during 1930, and for the first time in their history, Sydney and Newcastle will then be connected by a direct road. The Highway commences in North Sydney, passes through Hornsby to the Hawkesbury River at Peat's Ferry, thence through Gosford, Wyong, Swansea, Newcastle, Maitland, Muswellbrook, Murrurundi, Tamworth, Armidale, Glen Innes, Tenterfield, Legume, and Woodenbong to the Queensland Border near Mount Lindesay, a total distance of 561 miles.

A full account of the works completed and in progress between Sydney and Newcastle was given by the Deputy President of the Board (Mr. H. H. Newell) to the Shires Association Conference on 22nd May, 1929, and has been published elsewhere. It will not, therefore, be repeated in detail here. The position may be summarised by saying that the whole of the new formation work between Hornsby and Newcastle necessary to allow the Highway to perform its functions fully, with the exception of two short deviations in the vicinity of Swansea (which are now about to be commenced), has been completed, embracing a total length of 92 miles, while 45 miles of pavement have been laid, and 25 miles are in hand.

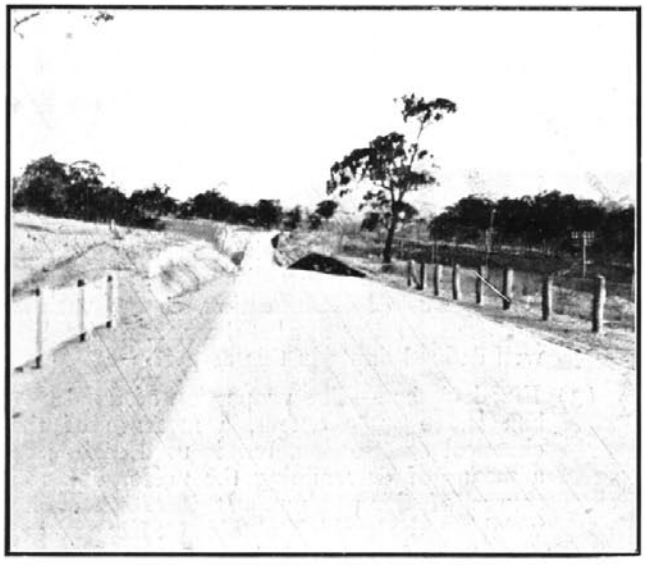
The only gap in the pavement south of the Hawkesbury River is between Mount Colah and the river, a length of 11 2-3 miles, where a cement concrete pavement is to be laid. Operations on the laying of the pavement between the river and Berowra (8 miles) commenced at the river on 10th September, 1929, and are proceeding—time lost on account of wet weather being excluded—at the rate of 1 mile per fortnight. At 10th October, 1¼ miles of this pavement had been laid. The length between Berowra and Mount Colah will have to wait until the banks are fully consolidated before the pavement is added.

The road as reconstructed in cement concrete, between Belmont and Newcastle.

For crossing the Hawkesbury River, two vehicular power-driven ferries, each with a capacity of thirty vehicles, are under construction by Messrs. Poole and Steel, Ltd., of Balmain. The first of the two ferries is due for delivery before the end of March, 1930, and the second nine weeks later. Tenders for the construction of the ferry docks have been called, closing 18th October, 1929. Tolls will be levied for transport by the ferry.

From Hawkesbury River to Mooney Creek, a distance of nearly 14 miles, the construction of the road has been practically completed with a gravel pavement. It is anticipated that this will carry the traffic for a year or two, and after final consolidation of the embankments a bituminous wearing course will be added, using the gravel pavement as a base course. A bridge 214 feet long is under construction over Mooney Creek; the piers and abutments are complete, and the erection of the steel superstructure is about to be commenced. Between Mooney Creek and Gosford, a distance of 8 miles, the roadway has been formed and a sandstone Telford base course laid, which is being surfaced with gravel, the whole to ultimately form a base for a bituminous wearing course at a later date. From Gosford to Wyong, 13½ miles, the original pavement was in sufficiently good condition to admit of being tar surfaced, and this has been done throughout. At a later date, when the pavement warrants reconstruction, certain improvements to the grading and alignment, in keeping with the importance of the road, will be made.

From Wyong to Swansea, a length of approximately 24 miles, the formation of nearly 10 miles of deviations has been completed, and the laying of a new pavement throughout is proceeding. This will consist on the first 15 1-3 miles of either a sandstone Telford or a gravel base with a premixed or penetration tar or bituminous macadam wearing course. The remainder will be gravelled.

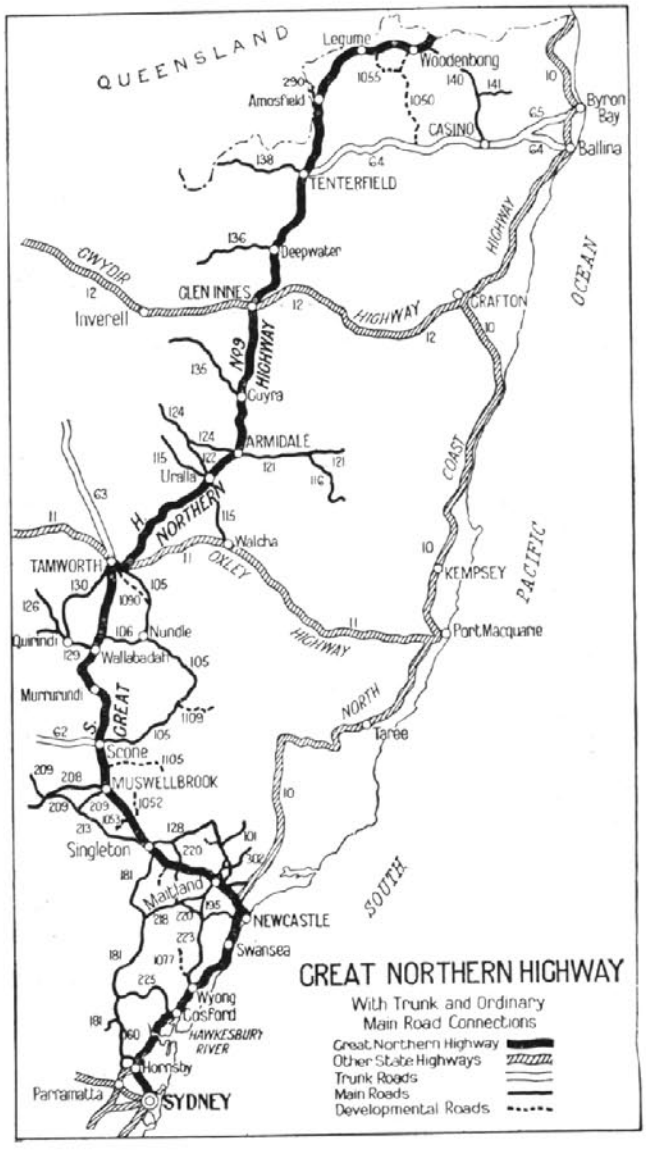


Surface-treated gravel road, Warland's Range deviation, Shire of Warrah.

Up to date, on the bituminous length, 4 miles of the pavement have been laid, together with a further 5 miles of base course. On the length which is to be gravelled only, 1 mile has been so treated. It is anticipated that the whole length of pavement will be completed in 1931. A new concrete bridge to replace the old narrow timber structure over Wallarah Creek is under construction.

From Swansea to Belmont, about 5 miles, the original gravel surface has been tar treated, while from Belmont to Newcastle (Hamilton), a distance of approximately 12 miles, a cement concrete pavement has been laid, with the exception of a short section just under a mile long in Adamstown and Hamilton, where the road is being widened. The terms of resumption are nearly all finalised, and during the next twelve months the properties will be cleared and the pavement laid.

From Hamilton to the eastern boundary of the Municipality of Waratah, the road has been reconstructed in cement concrete, and from that point to East Maitland,



with either a premixed or penetration tar slag wearing course on a slag foundation. Through East and West Maitland, it has been reconditioned and tar surfaced. Through Kearsley, Patrick Plains, Muswellbrook, and Upper Hunter Shires, short sections have been reconstructed, and the remaining lengths reconditioned by intensive maintenance. However, the condition of some sections of the road is such that, until reconstructed, no permanent improvement can be expected, and consideration is at present being given to the

reconstruction of a 4-mile length in Kearsley Shire and a 6-mile length in Muswellbrook Shire, for which surveys, plans, and specifications are in hand.

In the Shire of Warrah, a deviation about 7½ miles long over Warland's Range has been constructed with a gravel pavement, and was opened to traffic in April, 1929, while 5 miles of road immediately to the north of the deviation and through the municipality of Murrurundi have been reconditioned. On this length, 4 miles have been surface treated with tar or bitumen.

Between Murrurundi and Legume, no extensive new construction works have been carried out. Here the roadway, which is gravel surfaced for the greater part of its length, has been considerably improved by reconditioning and resurfacing where necessary. By constant dragging and grading, with the addition of some new gravel where required, the Councils are keeping the road in fair trafficable condition throughout.

Further north, in Tenterfield Shire, a deviation 8 miles long is under construction between Oakey Creek and Old Koreelah, which will eliminate the existing steep grades and bad alignment over the Black Nob. The earthworks on the deviation are practically completed, and a commencement is about to be made with the laying of the pavement. Between Old Koreelah and Woodenbong, a preliminary survey of the road has been made, and plans have been completed for the reconstruction of 3 miles at the southern end. This work is about to be put in hand. From 2 miles north of Woodenbong to the Queensland Border, the road has been reconstructed by the Public Works Department, the work having been put in hand prior to the constitution of the Board.

At the Queensland Border, the Great Northern Highway junctions with a length of road newly constructed by the Queensland Main Roads Commission, which forms part of the direct connection to Brisbane.

In addition to road reconstruction, which embodied substitution, where necessary, of concrete pipe or concrete box culverts for timber culverts and open causeways, there has been constructed and opened for traffic a number of bridges, including one at Carlyle's Gully, north of Tamworth, and one over the Severn River near Dundee. The principal of those now in course of erection is one over Maryland River, in Tenterfield Shire. Tenders have just closed for two bridges on the Koreelah Creek Deviation, and tenders are about to be invited for three other bridges in the same shire.

The Testing of Bitumen for Road Use.

By A. C. Mack, B.E.,

Testing Officer.

THE purpose of testing any material is to determine its suitability for particular uses. The uses to which materials are applied usually depend upon selective physical or chemical properties which control their special application in practice. On this account, tests may be physical or chemical.

The composition of bitumen is so complex that chemical methods are impracticable, nor would they provide information which could be used in controlling its application. A series of tests has, therefore, been evolved, in which certain physical properties are examined and compared against standard values which have been obtained by noting the behaviour of bitumens under working conditions.

Twelve such tests are included in the Board's specifications in order to establish the quality and suitability of a bitumen for road purposes.

(1) Foaming—To avoid possible danger in use, bitumen must be free from any ingredient such as water which is likely to cause foaming or boiling over when heated. It is, therefore, specified that foaming must not occur below the temperature to which the material is likely to be heated in the field, and a small quantity of bitumen is tested to observe whether this is complied with.

(2) Specific Gravity—Bitumen is added to the road either at the rate of so many gallons per square yard of surface, or so many gallons per cubic yard of mixed material. It is purchased by the ton. It is, therefore, necessary to know its specific gravity in order that purchase and application may be correctly arranged. In addition, s.g. also serves as a means of identification, as the various bitumens on the market have more or less well defined limits in this respect.

(3) Fixed Carbon—The proportion of fixed carbon is, to some extent, a measure of the chemical constitution, but is used mainly as a means of determining the uniformity and source of the product. It is estimated by weighing the residue obtained after heating one gram of the sample in a platinum crucible for seven minutes either over a bunsen flame, or in a muffle at a dull red heat.

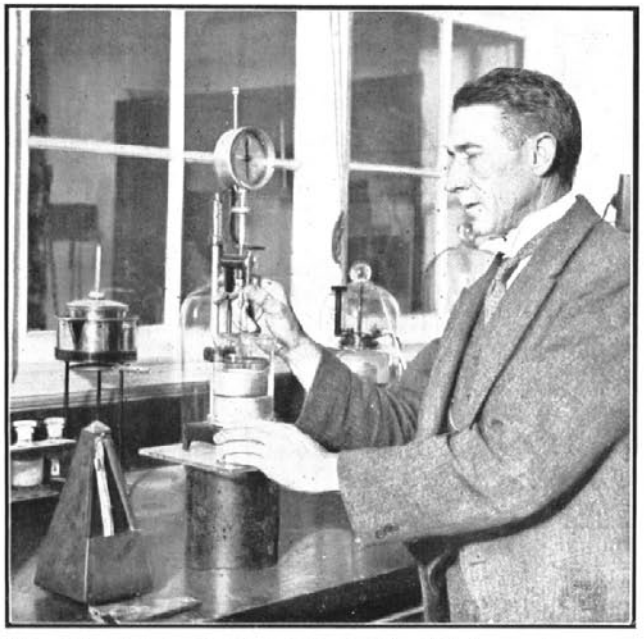
(4) Softening Point—This is the temperature at which bitumen flows readily and is clearly of considerable importance in determining the manner in which the material will act in the road under the summer sun.

(5) Solubility in Carbon Bisulphide—This test is a measure of the purity of a sample, and provides a means for detecting the presence of carbonaceous material such as coal tar or pitch.

(6) Solubility in Carbon Tetrachloride—This test is very similar to No. (5), but serves to detect the presence of carbenes. The latter are soluble in carbon bisulphide but insoluble in this solution, and their presence is regarded as a sign of overheating during manufacture.

(7) Solubility in Baumé Naphtha—This test is a measure of the asphaltenes present, which although soluble in carbon bisulphide are insoluble in Baumé Naphtha. Asphaltenes tend to give body and consistency as well as cementitiousness to the materials in which they occur.

(8) Flash Point—This is measured by heating a sample until the vapours liberated at its surface ignite when a small flame is brought in contact with them. The temperature at which this takes place is the flash point and indicates the readiness of the bitumen to decompose by heat.



Measuring the penetration of a sample of bitumen by means of the Penetrometer in the Board's laboratory.

(9) Penetration—This is a convenient test for measuring consistency. It expresses in degrees, each of which represents 1/250 of an inch, the depth to which the point of a standard needle, when placed in a vertical position and weighted with 100 grams, will penetrate into a sample in five seconds, the temperature of sample being 77° F. The degree of penetration to be desired depends largely upon climate, the nature of traffic, and the mineral matter to be used with the bitumen.

(10) Ductility—This characteristic is a measure of a bitumen to expand and contract without breaking or cracking, and, therefore, denotes its cementing strength. Ductility is tested by drawing specimens of fixed cross section at a defined rate under water maintained either at 77° F. or at 34° F. The test at the former temperature gives high ranges of ductilities but is selective for specimens lower than the assumed standard. Compliance with the test at the latter temperature is essential for success in application, where low temperatures occur.

(11) Loss on Heating—This test indicates the amount of evaporation at high temperatures and is a measure of the tendency of a bitumen to lose its ductility.

(12) Penetration after Heating—This test is carried out in the same manner as (9), after the bitumen has been subjected to prolonged heat. It is, therefore, a measure, to some extent, of the consistency of the bitumen at the time of its application in practice.

The above tests have, by long experience both in the field and the laboratory, been demonstrated to be necessary to determine the quality and suitability of so complex a material as bitumen.

Low Cost Gravel Roads.

A RECENT number of the *Engineering News Record* includes a description of an interesting method of utilising local stream gravel for the construction of secondary mountain roads in the American State of North Carolina.

The gravel is loaded into light six-cylinder tipping motor trucks by small quarter or one-third cubic yard power shovels, and is delivered directly to the road, without any selection or screening. The material ranges in size from "one man stone" downwards, and, during spreading, men with rakes pull all the stones larger than about 2-inch gauge to either side of the road. Consolidation is by traffic only.

The stones raked to the roadside are crushed as soon as practicable by a travelling crusher. This machine consists of a small jaw crusher, coupled to a petrol engine, mounted on a special steel truck, and is drawn along one side of the road by a small tractor. As the crusher proceeds the stones are forked in or thrown in by hand from the roadside. After reduction the material falls on to the road, and is spread by hand in a layer 1 to 2 inches deep. The total depth of gravel surfacing ranges from 5 to 8 inches, according to the nature of the subgrade.

For several weeks after the addition of the crushed gravel surfacing, the road is kept in shape with a grader drawn behind a motor truck. Experience, in this instance, has indicated that blading gives better results than dragging.

The chief point to be noted is that the valuable properties inherent in small-gauge crushed gravel surfacing —tight bond and amenability to mechanical maintenance—have been provided without incurring the charges incidental to the conventional and expensive semi-portable gravel-crushing and screening equipment.

Tenders and Quotations Accepted.

The following is a list of the Tenders and Quotations accepted by the Board during the month of September, 1929:—

TENDERS.

Work or Article.			Name of Successful Tenderer.	Amount of Accepted Tender.
Municipality or Shire.	Road No.	Description.		
				£ s. d.
Gunning and Yarrowlumla.	3	Construction of approximately 10 miles of earthworks and culverts.	Farley and Lewers ...	35,528 1 6
Erina	9	Haulage of approximately 108 tons of fabricated steelwork from Gosford railway station to Mooney Mooney Creek Bridge site.	A. Marshall	@ 17s. 3d. per ton.
Erina	9	Loading and haulage of approximately 5,000 cubic yards of spalls from quarry about 4 miles north of Wyong.	Hawkins, Ltd. ...	@ 2s. 6d. per cub. yard.

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

Work.			Name of Recommended Tenderer.	Amount of Recommended Tender.
Municipality or Shire.	Road No.	Description.		
				£ s. d.
Waugoola	1,098	Forming and gravelling	J. Mackie	250 2 0
Cockburn	1,032	Road construction	J. P. Shedden Ltd. ...	2,399 15 11
Liverpool Plains ...	126	Road construction	J. F. Court	269 12 4
Do ...	126	do	H. Jeffries	444 15 2
Do ...	126	do	H. E. Gardiner ...	1,509 6 8
Weddin	1,116	do	W. Amour	2,212 16 9
Do	1,116	do	S. Jeffries	557 0 0
Patrick Plains ...	220	Construction of bridge over Brinkburn Creek	F. Pryor	1,039 19 3
Namoi	126	Construction of culvert at 1 mile 48 chains	A. J. Hulbert	403 15 0
Carrathool	1,067	Construction, Langtree Siding to Hillston	Finch and Molloy ...	340 0 0
Manning	110	Stone filling and embankment at 15 miles 70 chains ...	G. Styles	159 10 0

QUOTATIONS.

No. of Quotation.	Description of Article.	Name of Successful Tenderer.	Amount of Accepted Quotation.
			£ s. d.
601	Reinforced concrete pipes, 100 ft. x 15 in., 65 ft. x 18 in., 65 ft. x 21 in., 36 ft. x 24 in., 91 ft. x 30 in.	Australian Quarrying Industries, Ltd. ...	161 14 10
	234 ft. x 15 in., 61 ft. x 18 in., 79 ft. x 21 in., 62 ft. x 24 in., 104 ft. x 30 in., 65 ft. x 36 in.	State Monier Pipe Works	319 13 2
615	80 tons Rapid Hardening Cement	Commonwealth Portland Cement Co. ...	468 0 0
621	Blue metal, 200 tons 1½ in., 30 tons $\frac{5}{16}$ in., 50 tons toppings ...	State Metal Quarries	74 7 8
622	Blue metal, 200 tons 2½ in.	Southern Blue Metal Quarries	43 6 8
624	Blue metal, 200 tons 2½ in.	Sydney and Suburban Blue Metal Quarries	75 0 0
625	Chain wire fencing, 800 yds. 24 in. x 8 gauge x 2 in. mesh ...	Cyclone Fence and Gate Company	43 17 6
620	4,180 sq. ft. fabric reinforcement	Dynes, Ltd.	27 1 10
623	Reinforced concrete pipes, 322 ft. x 18 in., 26 ft. x 21 in., 30 ft. x 24 in., 30 ft. x 30 in.	State Monier Pipe Works	102 11 5
629	Reinforced concrete pipes, 53 ft. x 54 in., 33 ft. x 36 in., 35 ft. x 36 in.	Australian Quarrying Industries, Ltd. ...	113 1 11
630	270 tons $\frac{5}{16}$ in. blue metal	Sydney and Suburban Blue Metal Quarries...	128 5 0
632	1 pavement breaker	Noyes Bros. (Syd.), Ltd.	47 14 0
647	Blue metal, 7,000 tons 1½ in., 2,700 tons $\frac{5}{16}$ in.	Newcastle District Municipal Metal Quarries	2,389 11 8
627	Road ploughs (6)	British Standard Machinery Coy.	66 4 0
634	Reinforced concrete pipes, 56 ft. x 24 in.	State Monier Pipe Works	22 18 8
637	Reinforced concrete pipes, 20 ft. x 18 in., 33 ft. x 21 in. ...	State Monier Pipe Works	14 2 4
638	Maple Map Cabinet	H. E. C. Robinson, Ltd.	8 0 0
641	5,000 ft. deformed metallic jointing	F. G. Kerr & Co., Ltd.	86 8 10
574	Road metal spreader	Gibson, Battle & Co.	75 0 0
588	Road drags (5)	Meadowbank Manufacturing Co.	114 12 6
628	Bridge timber	M. Dorsi	110 18 4
640	Pipe handrail fittings	Gibson, Battle & Co.	50 5 0
642	Concrete mixer, ½-bag capacity, petrol engine drive	F. A. Winter & Co.	110 0 0

Sydney: Alfred James Kent, I.S.O., Government Printer—1929.