MAIN ROADS

A Record of the activities of the
Department of Main Roads, N.S.W.

Painting members of the Main Arch Span, Sydney Harbour Bridge. Painters working from stages suspended from cranes situated on top of arch. Circular Quay, Sydney, can be seen to the left.

MARCH 1949

MAIN ROADS.

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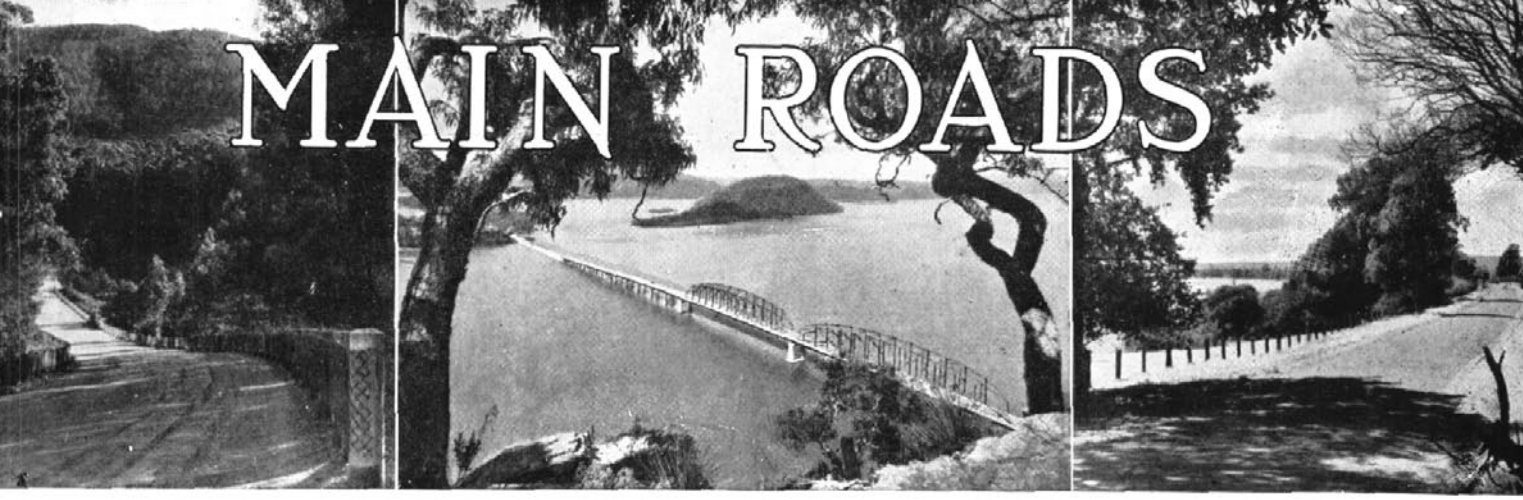

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Maintenance Methods

Sydney Harbour Bridge

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The Sydney Harbour Bridge was opened to road and rail traffic on the 19th March, 1932, and responsibility for the maintenance of the structure, except railway and tramway tracks, was vested in the Department of Main Roads on 9th September, 1932.

In an article entitled "Sydney Harbour Bridge Maintenance" published in the May, 1936, number of "Main Roads," a description was given of the various maintenance operations carried out during the period from September, 1932, to May, 1935. Special reference was made to the need for a high standard of continuous maintenance in order to keep corrosion in check and so eliminate the possibility of costly repairs in later years. Work has been consistently carried out to this end, and a programme of rigid inspection, immediate attention to defects, and preventative measures has resulted in the present satisfactory condition of the bridge.

In the interval since the last report in "Main Roads" considerable effective attention has been given to improving the efficiency of the maintenance organisation generally as well as to improvement of working conditions for the employees. Revised safe-working rules and augmented appliances as well as better means of access to various portions of the structure have contributed to the results in these directions. In the interval, also, extensive investigations and tests have been made to determine the most suitable paint materials, paint specifications and methods of application both for this and other steel bridges maintained by the Department.

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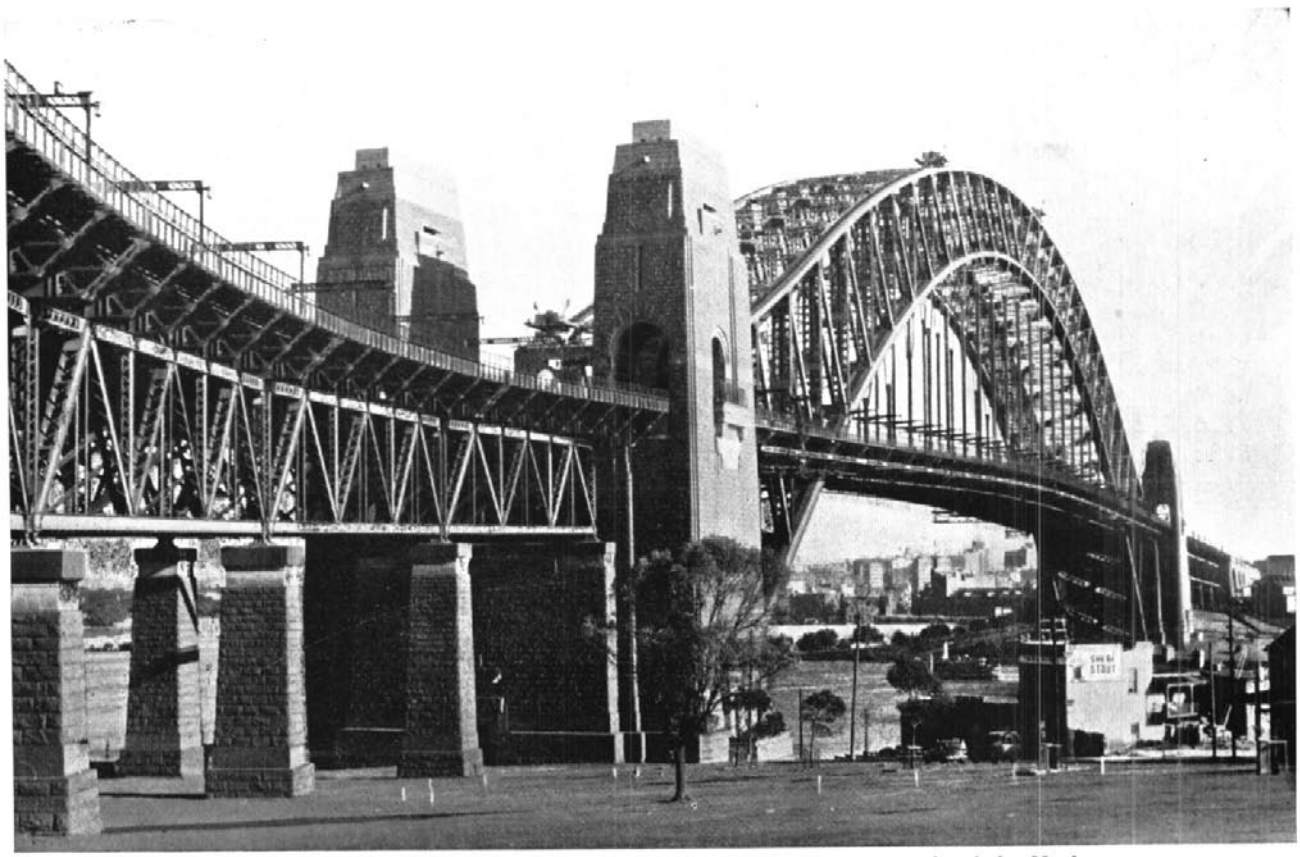
(1) PROTECTION AGAINST CORROSION.

After the initial programme of patch painting, put in hand in September, 1932, the first repainting of the whole structure, without general stripping down to the steel, was undertaken during the period June, 1935, to April, 1940. During the war and approximately for one year afterwards, i.e., from April, 1940, to March, 1946, corrosion was kept under control with a depleted staff which was confined to cleaning down and painting only those portions requiring most attention.

With the re-establishment of the full staff following the return of men from active service, the second complete repainting of the bridge was put in hand in April, 1946, and is still in progress.

Owing to the shortage of linseed oil and other paint materials during and since the war, it was decided after investigation and tests at the bridge to use for cover coat work an alkyd synthetic long oil varnish vehicle, with a micaceous iron ore pigment, in substitution for linseed oil and white oxides of lead and zinc. Paints made from these substitute materials have so far given satisfactory results. The limited quantities of linseed oil procurable during and since the war have been reserved for priming coats, since the red lead oxide pigment used for priming does not mix satisfactorily with an alkyd synthetic varnish vehicle.

Paint is mixed at the bridge itself, and in addition to a cone paint mill and paint mixing machine installed in 1935, a mixing machine of larger capacity of the post type has recently been installed. Paint required



A general view of Sydney Harbour Bridge looking from the northern side of the Harbour.

for other steel bridges throughout the State is also prepared in this mill.

Thorough cleaning and descaling of steel surfaces in preparation for the priming or rust inhibiting coat is an essential factor in the efficient maintenance of steel structures. With the object of improving upon existing manual and mechanical practices, various other methods, including oxy-flame burners, steam cleaning machines and grit blasting equipment for removing rust and old paint from badly affected locations, have been experimented with at the bridge. Of these, sand blasting followed by metal spraying gave the best results, but the tests were carried out on relatively small areas and results were not sufficiently conclusive to enable decisions to be made for large-scale programmes. It was therefore decided to invite tenders for the sand blasting and metal spraying of a much larger area, viz., one panel length (60 feet) of surface on the underside of the deck of the arch span. However, no tender was accepted owing to the cost involved. Consideration is now being given to further tests of a similar nature at certain limited locations where paints prematurely fail to protect.

During the 1935-40 repainting cycle the unit adopted for estimating the progress of the work was in terms of "gallons per man-hour." This unit of measurement proved to be unreliable as a measure of work done mainly owing to variation in the area covered per gallon by individual painters working under similar conditions. The superficial areas of each member in the structure have since been determined and tabulated and the more reliable unit, "square yards per man-day" has now been adopted. The total superficial area of metal-work in the structure is estimated at 578,000 square yards.

(2) CAULKING.

Caulking includes all work necessary to exclude moisture from capillary crevices between steel surfaces in contact and from larger inaccessible crevices or pockets. The drilling of drainage holes and the cutting of openings to prevent ponding and give ventilation are also included in this work.

Caulking has been continued since 1932. In the first five years the more obvious crevices and pockets were caulked and the work has since been carried out wherever incipient corrosion has been observed, generally in pockets between the edges of web plates and/or tie-plates and lacing bars where the heels of main angle bars protrude beyond the edges of the web plates.

The four gusset plates at each panel point of the arch span penetrate the top flange of the lower chord through longitudinal slots. The crevices between the edges of the slots and the gusset plates were originally stopped with a bituminous filler. At the end of five years it was found that this treatment was failing to exclude free moisture. The bituminous filler has since been removed and the slots caulked with shaped

bars of metallic lead compacted into the slots with light pneumatic tools. This has proved more satisfactory.

(3) SAFE-WORKING.

Close attention is given to safe-working in the various sections of maintenance operations at the bridge both in respect to the maintenance employees themselves and the public using the bridge. This applies also to the public in the park areas beneath the approach spans and people on vessels passing down the harbour. A description is given hereunder of some of the various safe-working provisions as applied to the maintenance organisation.

(a) Personnel.

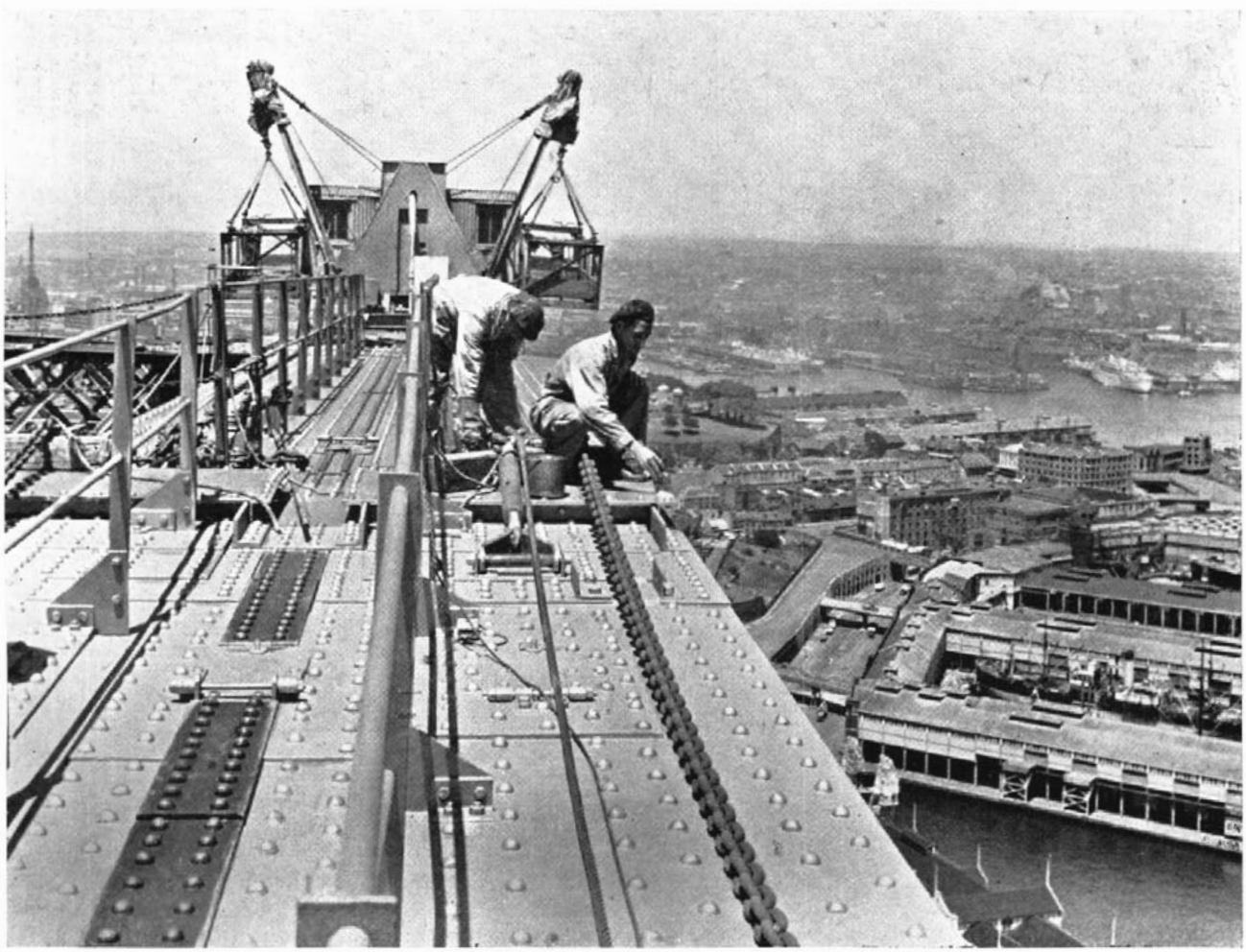
The staff employed are selected for reliability and physical ability to perform the work. Men are addressed on safe-working and specially warned against becoming careless as a result of familiarity. Any manifestation of over-confidence or risk taking in climbing about the structure is immediately checked.

Fully equipped first-aid stations are provided in both north and south pylons with qualified men available for treating any accident cases which may occur. Each man working in a dusty location is supplied with a respirator and the filter pads are changed after each day's work. A token system automatically indicates that a man is still on the structure at knock-off time, possibly injured or otherwise unable to leave. Messing, washing and changing accommodation in the south pylon have recently been reconstructed on modern lines. Similar amenities will be provided in the north pylon in the near future.

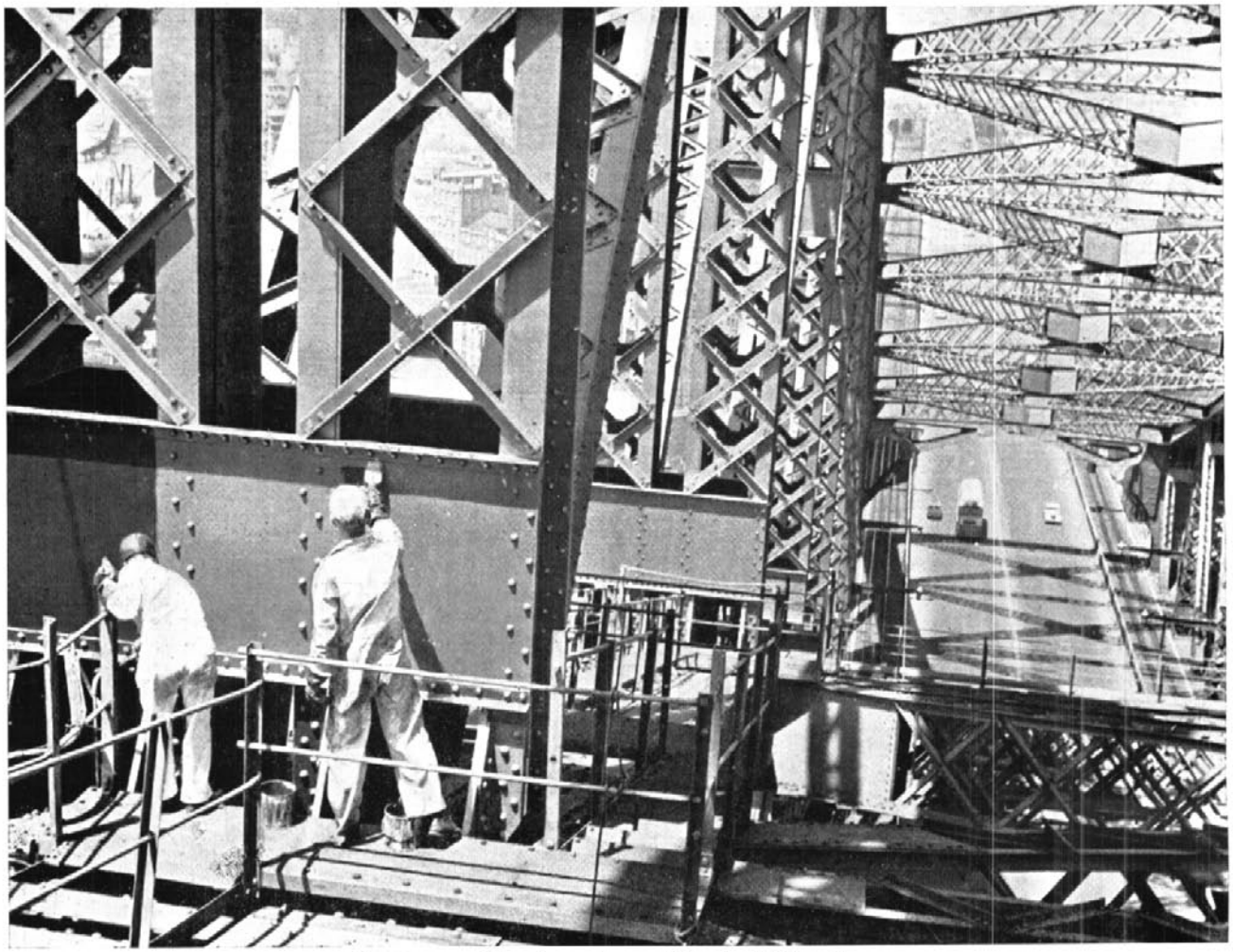
When Foremen and Leading Hands consider that weather conditions make working unsafe, no work is done outside on the structure. Weather reports are closely watched and advice obtained from the Weather Bureau if an adverse change in the weather appears to be imminent. When bad weather occurs, men are employed inside the pylons on maintenance work on Departmental equipment.

(b) Cranes, Crane Stages and Chains.

The crane and gantry equipment on the bridge consists of four travelling electric cranes on the top chords of the arch span, each carrying two working stages or platforms. One power-driven and six hand-operated gantries command the underside of the deck of the



Painters at work on Top Chord of Main Arch Span, showing Travelling Crane with Crane Stages attached



Painters working from Lower Chord of Main Span.

main span and two travelling gantries operate beneath the roadway of the northern and southern approach spans respectively.

The eight stages suspended from the cranes on the arch have been considerably improved in the Bridge Workshop both in construction and methods of suspension and tying up. Stage suspension wire ropes are renewed from time to time and all shackles, links and M.S. rings used in connection therewith are periodically annealed and proof tested by the Lifting Appliances Branch, Department of Railways.

"Hanging Off" steel wire preventers have been attached to all crane stages. These are anchored to the front and rear of frame chassis at the completion of work each day. Crane stages are secured when not in use by ⅞ inch diameter adjustable wire rope guys anchored fore and aft on the crane.

In order to avoid accidents arising out of mistakes in signalling to the crane driver from the stage, bell and telephone communications have been installed between the men on the stage and the crane driver. Plate-glass observation windows have been provided in the floor of the cranes to improve the driver's vision of stages in all positions. By press-button, men on the stage can cut off power in an emergency. Limit switches have also been installed to prevent overwinding, and foot brakes have been installed for use in the event of the failure of solenoid brakes. Maintenance work is so arranged that electrical and mechanical equipment of each crane is inspected and overhauled one day per month.

The four cranes are traversed up and down the steep slopes of the top chord by electric winches which wind on to chains, 180 feet in length, anchored at their upper extremities. The original ¾-inch traversing chains have been replaced by 1-inch diameter chain, and the crane winches have been modified and improved to suit.

(c) Approach Span Gantries.

The method of suspension and haulage mechanism of each of the four approach span gantries were considerably improved during the first few years of maintenance work.

Further improvement by the replacement of the chain haulage equipment on these gantries by motor-driven winches is now under consideration.

Painter working off Crane Stage.

(d) Maintenance of general rigging equipment.

All rigging operations are closely supervised by the leading-hand rigger, and ropes are replaced as required. Considerable improvement has been made in the anchorages of steel wire catenary cables supporting horizontally sliding stages, i.e., along outside of footways and outside of approach trusses. Wherever practicable permanent anchorage cleats have been provided throughout the structure.

(e) Access.

Access for maintenance employees and equipment at all parts of the structure has been improved from time to time, including—

(i) Provision of additional ladders at the quarter points of the arch trusses connecting upper and lower chords.

(ii) Catwalks providing access between trusses at the quarter points in the lower and upper chords. Stairways giving direct access from pylons to deck level between railway and tramway tracks.

(iii) Steel ladders inside arch hanger members and ladders giving access to the top chords of approach spans from deck level to cross girders.

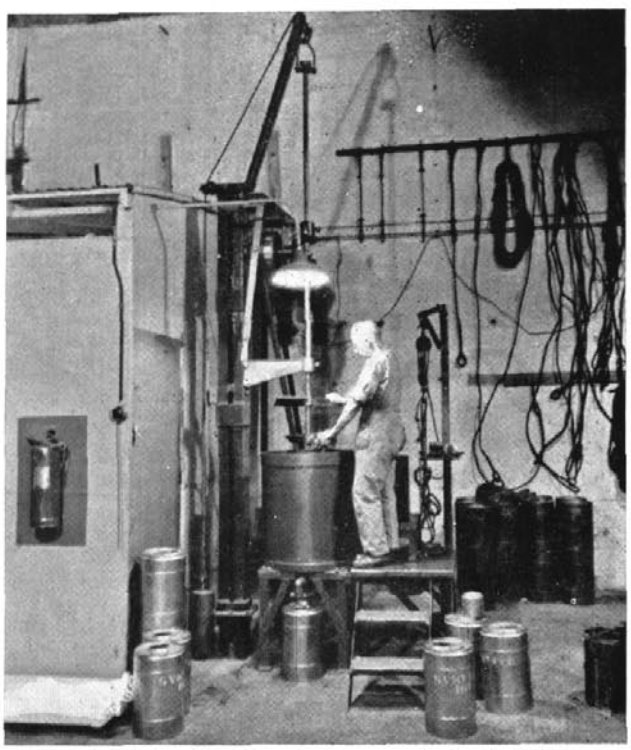
(iv) Permanent staging beneath the deck through pylons (work in hand).

Scraping and painting of Under Span Gantry.

(f) Prevention of objects falling from Bridge.

Additional deck planking has been laid between railway and tramway tracks, together with wire mesh screens at the sides of deck planking to prevent objects falling from rolling stock.

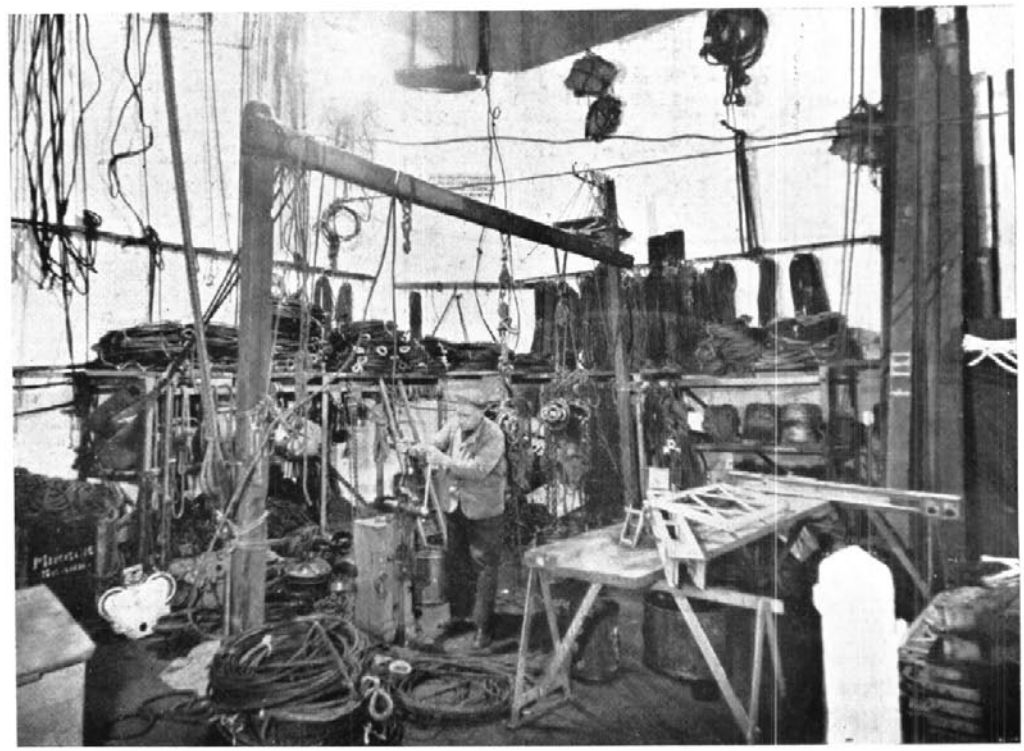
Daily inspections are made in all locations where men are working to ensure that nothing loose is left lying about and to ensure that planks used for stages are securely lashed, and all entrances to access stairways are seccurely locked each evening. Floors of stages and gantries are provided with "edge" boards to prevent objects falling therefrom.



Paint Mixing Machine in basement, S.W. Pylon.

Each employee working on the structure is issued with a canvas tool bag in which to carry and hold all small tools. The bag can be carried by hand or slung over the shoulder for ease in climbing. The rope fastening for closing the top of the bag is long enough to attach to steelwork or stage at the location of the work. A lanyard with a spring clip attached is issued to all operators using paint pots so as to secure pot handles to stage handrails or to steel members being painted.

Inspections of those portions of the structure subject to severe vibration from rail traffic are made at regular periods. These portions include the rivetted connections in the arch hangers supporting the deck, and rivets connecting the railway stringer girders to the top flanges of supporting cross girders. Fractured



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Rigging Store in Basement, S.W. Pylon.

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rivets have been replaced by fitted bolts of larger diameter in the lastmentioned location after consultation with representatives of the Railway Department.

(4) MAINTENANCE OF ROADWAY AND FOOTWAY MILD STEEL TROUGHINGS.

The pavement on the main and approach spans consists of a sheet of rock asphalt 2 inches thick on a base of metallurgical coke-breeze concrete poured to a depth of 4 inches over the crest of the mild steel trough sections which run parallel with the centre line on the roadway. The asphaltic pavement on the two footways lies directly on shallower steel troughing.

The maintenance of a waterproof pavement to keep the case course dry and prevent the percolation of moisture on to the troughings receives close attention.

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Road Barrier Equipment being prepared for painting during wet weather in basement of S.W. Pylon.

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Portion of Workshops in basement of S.W. Pylon.

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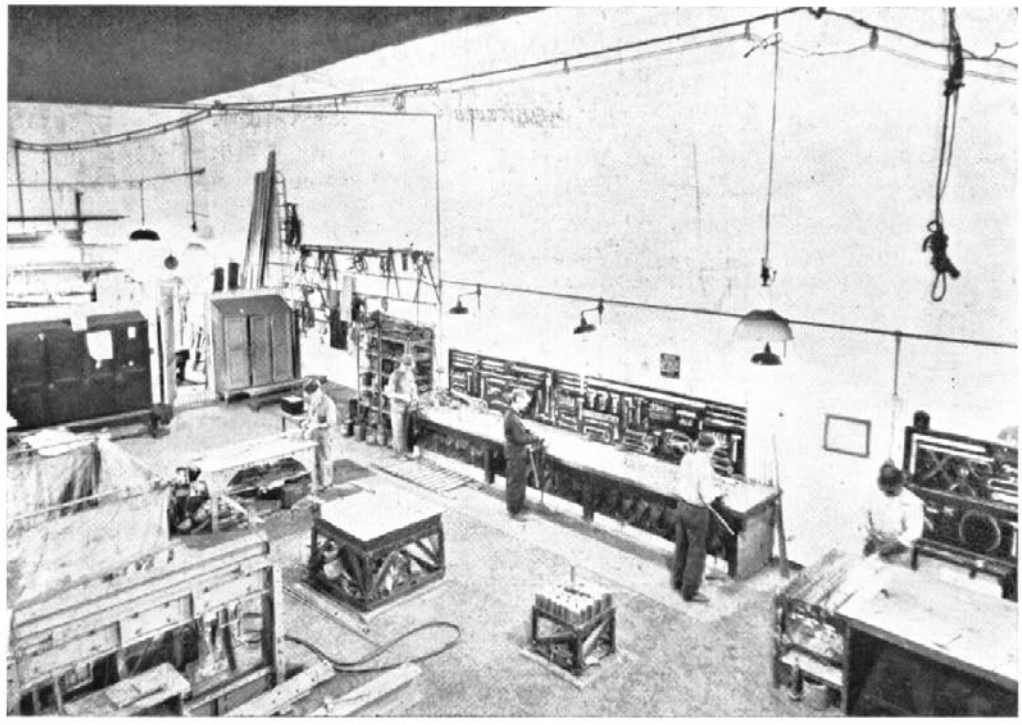

Pavement surface cracks are sealed immediately they develop. A recent examination of the troughings by opening up at about twenty locations throughout the deck showed the troughings generally to be in good condition. The coke concrete was found to be extremely hard and required a pavement breaker to excavate through it.

The troughings on the footways throughout the main and approach spans have been adversely affected by corrosion caused by moisture penetrating transverse cracks in the 2-inch pavement. These cracks occurred without exception at every cantilever bracket supporting the footway, and were probably caused by vibration from rail traffic.

Practically the whole of the footway pavements had to be taken up, the troughings and kerb plates descaled and primed and the pavement re-laid. The troughings were cut back at the extremities of each footway span to provide a break in the pavement over cantilever supports. Steel bulkheads were welded at the ends of troughings to maintain a gap between spans of approximately ½ inch.

Corrosion has occurred in the footway and roadway kerb plates at and below pavement level. This has been caused by moisture in the cracks between the mild steel kerb plates and the bituminous pavement. Special fillers have now been used which adhere reasonably well and extension of the trouble has been arrested.

(5) MAINTENANCE OF EXPANSION JOINTS.

Regular inspection, cleaning and lubrication of the sliding surfaces of the numerous expansion joints throughout the structure is necessary to ensure against seizing of the bronze slippers. The shearing of the set screws securing the upper and lower bronze slippers of an expansion bearing in 1933 was caused by seizure from grit falling from the roadway. The joints were subsequently protected by fixing keep-plates at the extremities of the slippers. The lubrication and care of all these joints require continuous attention. Movements of expansion joints as shown by indicators are plotted on a graph kept at the bridge. Readings are taken each month by a fitter engaged on the routine maintenance of these sliding bearings. Sluggishness due to excessive friction in any of these bearings can be immediately detected by any change in the shape of the graph.

(6) MAINTENANCE EMPLOYEES.

At the 31st December, 1948, the maintenance strength comprised—

1 Foreman.
1 Sub-Foreman.

Painting—

2 Leading-hand painters.
1 Leading-hand rigger.
27 Painters.
19 Ironworkers (cleaning and priming).
7 Riggers.
3 Crane drivers.
2 Crane drivers' assistants.

Caulking and general Boilermaker's work in Bridge Workshop and on structure—

5 Boilermakers.
1 Boilermaker's apprentice.
4 Ironworkers' assistants, assisting tradesmen.

Maintenance of cranes, gantries, expansion joints and general fitting work—

1 Fitter.

Making and assembling stages, ladders and timber work generally—

1 Carpenter.

General repairs to concrete parapets and concrete footway pavements on approaches—

1 Plasterer.
1 Builder's labourer.

Miscellaneous—

3 Attendants cleaning messrooms, tollhouse and other accommodation for employees.

Total 81

(7) CLEANSING OF ROADWAY AND FOOTWAY PAVEMENTS.

This work, formerly carried out for the Department by the Sydney City Council, has recently been taken over by the Department and is now done by the Road Maintenance Section of the Metropolitan Division. A light mechanical road-sweeping machine has been purchased and sweeping will be done once per day after flushing down with fresh water.

(8) ROADWAY TRAFFIC SAFETY.

Bridge tolls are collected from road traffic on the south approach to the bridge at a barrier providing for six lanes of traffic, and those lanes which are open for traffic in each direction are indicated by an "OPEN" or "CLOSED" neon sign. At present there is a marked difference between the volumes of "in" and "out" traffic over the bridge at peak periods, and during these periods it is practicable and necessary to use five lanes for traffic in one direction and one lane for traffic in the other direction. Movement of the predominating flow of traffic has been further expedited by employing collectors in tandem, one of each pair standing some yards in advance of the barrier. As the morning peak hour occurs in daylight throughout the year this system works very well and no difficulty is experienced in marshalling the traffic in the other direction into a single lane. On the winter afternoons, however, the peak hour is at or after dusk, and to ensure the safety of the forward collectors in the tandem lanes "no traffic" zones have been painted on the pavement in line with toll cabins and the collecting area is flood lighted. The marshalling of city inwards traffic into one lane by manual direction involved some risk to the traffic controller standing on the roadway in the dusk. To avoid this two movable illuminated signs were plugged into the roadway during winter afternoon peak hours. One reading—

KEEP
LEFT,
FORM
ONE
LANE,

was stationed about 900 feet in advance of the toll and 20 feet from the kerb, and the other reading—

KEEP
LEFT,
ONE
LANE
ONLY,

about 500 feet in advance and 14 feet from the kerbs. These signs proved effective in the winter and their use has been extended to week-day evening peak periods throughout the year. The signs are kept in racks on the balustrades flanking the roadway and are taken out, plugged into the road and later removed by two of the Department's employees.

Additional line marking on the road pavement forming a "comb" in which traffic approaches the toll barrier has also been provided. Plans have been prepared and work will commence shortly on the construction of a new 12-lane toll barrier a few hundred feet closer to the city end of the approach. When proposed new road connections to the approach are made later the barrier will be increased to 16 lanes which will then be sufficient to pass the full road traffic capacity of the bridge without delays and queues.

SYDNEY HARBOUR BRIDGE ACCOUNT.

Income and Expenditure for period 1st July, 1948, to 31st December, 1948.

Income.

	£
Road Tolls	188,085
Contributions—	
Railway Passengers	65,259
Tramway Passengers	9,145
Omnibus Passengers	6,078
Rent from Properties	5,287
	£273,854

Expenditure.

	£	£
Cost of Collecting Road Tolls		11,465
Maintenance and Minor Improvements		30,463
Alterations to Archways		8,076
Administrative Expenses		950
Loan Charges—	£	
Interest	124,000	
Exchange	13,500	
Sinking Fund	33,500	
Management Expenses	500	
		171,500
Miscellaneous		1,341
		£223,795

Progress With Developmental Road Construction—Typical Works Now In Hand To Aid Settlement.

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Large Soldier Settlement Area near Delungra to be Served by New Roads.

A developmental road and a developmental work have been proclaimed to serve soldier settlement on the 36,000 acre Gragin Estate near Delungra. The Councils of the Shires of Ashford, Macintyre and Yallaroi have placed construction in hand. Most of the thirty blocks comprising the estate are already occupied.

The Gragin Estate situated north of Delungra was acquired by the Crown in 1947 for the purpose of subdivision for War Service Land Settlement. The estate comprised some 36,000 acres and has been divided into thirty blocks ranging in size from 800 acres to 1,600 acres.

The land was used previously almost exclusively for grazing. Large areas are suitable for agriculture and an aim in planning the area was that each block should include some land suitable for agriculture. The average annual rainfall is 27 inches. Water is available from wells and bores in addition to the supply from rain. It is anticipated that the new settlers will, in general, produce wheat, wool and fat lambs, with sorghum (milo), barley and oats as secondary crops.

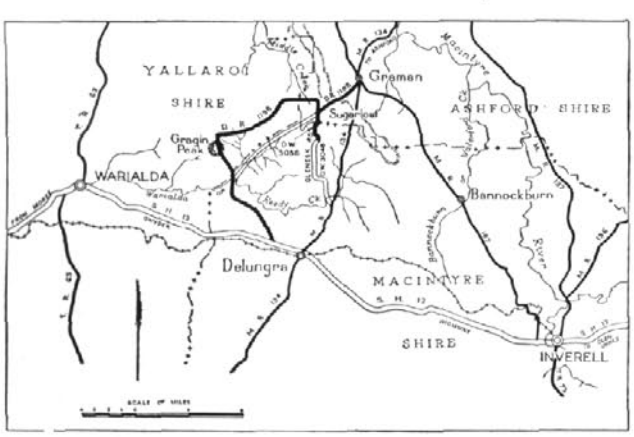
The nearest railhead is at Delungra, the average distance being approximately 16 miles. Fairly convenient access is also available from the estate to Inverell to the east over good roads and to Warialda in the west in dry weather. Wheat silos are available at each of the three centres mentioned.

The subdivided area is composed almost entirely of heavy black soil, and existing unformed tracks are untrafficable after rain. Much of the produce will need to be hauled to railhead between November and February, and it is during this period that the heaviest falls of rain are likely. Improved roads are, therefore, an important factor in the continued development of the district.

Newly constructed section of D.R. 1198 from M.R. 134 near Graman.

The scheme of road improvements has been to proclaim, as Developmental Road No. 1,198, the road leading northerly from the Gwydir Highway (State Highway No. 12) about 2 miles west of Delungra to the Gragin homestead at Reedy Creek. The proclamation also included a new extension of this road northerly to a point 10½ miles from the Gwydir Highway from where it turns generally easterly to join the Graman-Delungra Road (Main Road No. 134) near Graman. The total length of the new road is approximately 22 miles.

Settlers in the eastern part of the Gragin area will be given improved access by an extension of the Glenesk



Locality Map.

Typical country served by D.R. 1198.

Road which will link up with Developmental Road No. 1,198. This extension was proclaimed Developmental Work No. 3,056.

Plans for the works in the three Shires on Developmental Road No. 1,198 have been completed, and construction works are now in progress at an estimated cost of over £20,000.

Low-level timber beam bridges are to be built over Reedy Creek near the Gragin Homestead, and an arm of Reedy Creek.

It is anticipated that authorised work will be completed by the autumn of 1949.

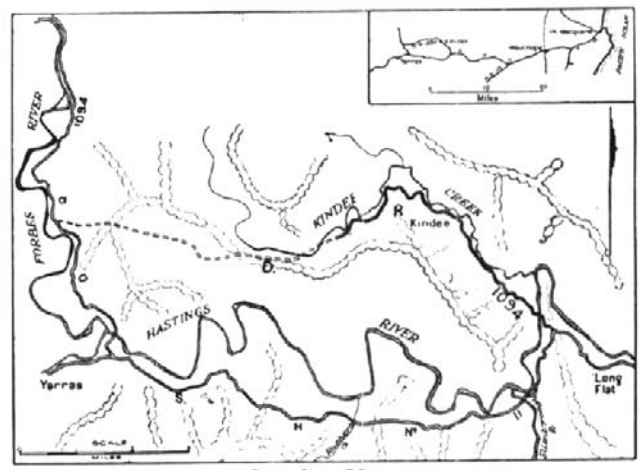
Road Extension follows Development in Dairying District.

Successful development made possible by road and bridge construction has led to a need for a short extension of the Kindee Valley Developmental Road in the Shire of Hastings.

Kindee Valley is a tributary valley of the Hastings River. The Oxley Highway is situated along the southern side of the river between Wauchope and Yarras, a distance of about 30 miles. The Kindee Valley is on the northern side of the river, 20 miles above Wauchope, and is served by a spur road which is Developmental Road No. 1,094.

The Kindee Valley contains about 10,000 acres of rich flats and fairly steep wooded slopes, devoted mainly to dairying, and has twenty dairy farms ranging in area from 150 to 600 acres. Owing to the narrowness of the valley, settlement has taken place mainly near both banks of Kindee Creek. The road follows the western bank closely, is above high flood level, and serves most settlers with the minimum of feeder roads.

The Kindee road was proclaimed as developmental in 1931. At that time the transportation of dairy produce, calves and pigs to the railway, and butter factory at Wauchope, and the haulage of supplies to the settlers, was difficult and irregular, particularly during wet weather. The only outlet from the valley involved fording the Hastings River, which under most



Locality Map.

conditions were hazardous to motor transport. By 1933, an amount of £15,000 had been expended in the construction of approximately 4½ miles of all weather road from the north bank of the Hastings River, north-westerly along the valley. Although further development followed road improvements, the full benefits could not be realised until the Hastings River was bridged in 1935, when a high-level single lane suspension bridge 396 feet long was opened to traffic, thus providing all weather access into the valley. The bridge was designed to carry 10-ton loads, and cost approximately £6,000. Where previously dairy produce had been hauled by sulky and sledge to a collecting point on the southern bank of the Hastings River, lorries now collected primary produce and delivered supplies almost to the limit of settlement. In addition, a daily bus service from the valley to Wauchope was instituted. This enabled school children above primary

Improved farming land in Kindee Valley served by D.R. 1094.

Recently completed work on D.R. 1094. View looking westerly up Kindee Valley.

standard to obtain Central School education at Wauchope.

Further assistance to settlers is now being given by the construction of a further 115 chains. Construction of 65 chains was completed in 1947 and 50 chains has since been authorised and will eliminate two wet crossings of Kindee Creek. On completion of this work, a total length of 5 miles 4,520 feet will have been built at a cost of approximately £19,000, not including the bridge.

All road work has been carried out by contracts by the Hastings Shire Council.

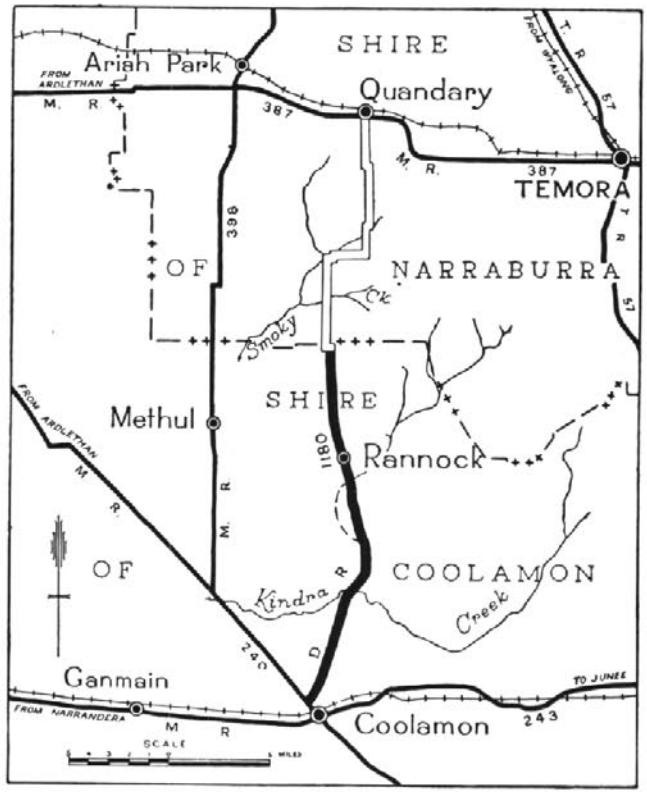
New Developmental Work Serves Closer Settlement Areas in Liverpool Plains Shire.

Subdivision of large estates for closer settlement on Breeza Plain has led to the need for roads to facilitate more intensive development. 7,000 acres of Clifton Station were made available in 1942, and 18,500 acres of Piallaway Station in 1946. The area is suited in part for wheat growing and in part for sheep and cattle.

A fair road serving the area existed for the greater part, but special improvement from the Developmental Roads Fund was considered warranted over a length of 1.6 miles, which included the more difficult black soil sections. This section was therefore proclaimed Developmental Work No. 3,051. Road work costing about £3,000 is now being carried out by the Liverpool Plains Shire Council, which has thereby been aided in providing an access road of the required standard to serve the closer settlement areas, and other country adjacent to the road.

Wheat Growing Area Served by 8 Miles of New Road.

A further 8 miles of new construction is in progress on Developmental Road No. 1,180 in the Shire of Coolamon, and will complete its construction within the Shire. About 10½ miles of construction was done in



Locality Map.

pre-war years. The country is gently undulating and lends itself to cheap road construction.

Developmental Road No. 1,180 serves an extensive wheat farming and grazing district, and connects it with the railhead at Coolamon, the rapid development of which was aided by road works carried out earlier.

The eight miles of new work will cost in the vicinity of £2,500.

Fishing Centre Receives Improved Access.

The village of Sussex Inlet in the Shire of Shoalhaven is the centre of a small fishing industry based on St. George's Basin and the Inlet connecting the basin with the sea. The area is also popular for holidays.

The 8 miles of road linking Sussex Inlet and the Prince's Highway had been lightly formed and gravelled for about 2 miles in the past, but the balance was mainly a narrow winding track passing through sandy undulating timbered country which contains some farms.

In 1946, the Sussex Inlet road was proclaimed a Developmental Road No. 1,196. It has since been cleared throughout by Council by contract, and a 2-mile section at the western end has been reconstructed and gravelled by the Council by day-labour, and further work over a length of one mile has been authorised over the swampy section at the eastern end. The total cost of these works is approximately £6,600.

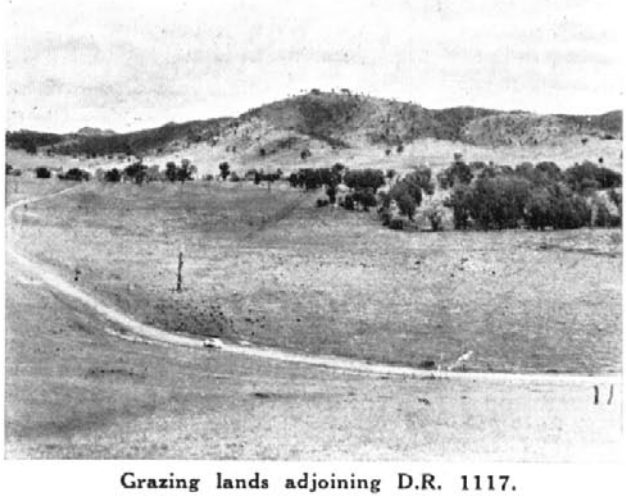
Scene on road to Sussex Inlet.

Access to Sussex Inlet has thus been materially improved, but the construction of the balance of the road will be necessary to provide the road service warranted.

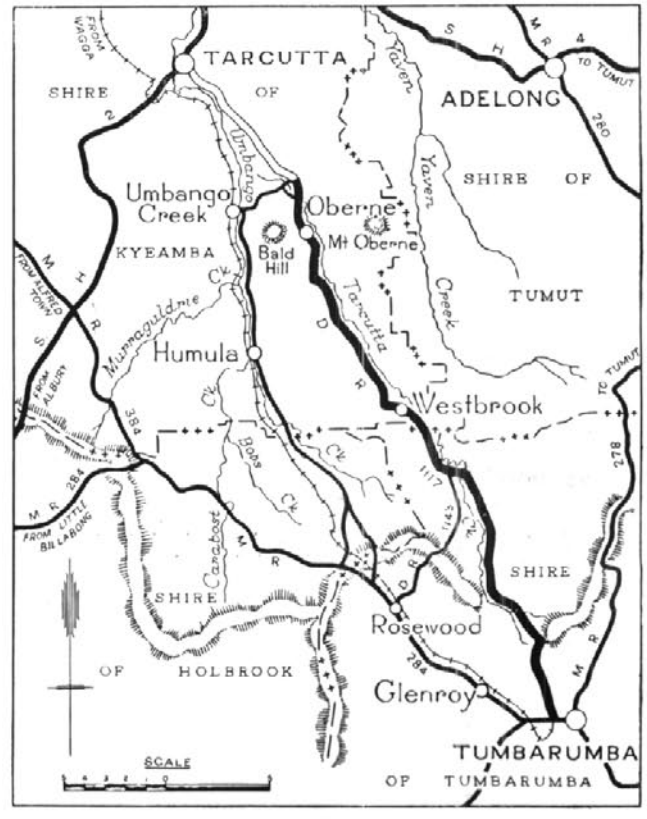
Work Resumed on Tumbarumba-Obern Developmental Road No. 1,117, Shires of Kyeamba and Tumbarumba.

Developmental Road No. 1,117 leads from Main Road No. 278 near Tumbarumba in the Shire of Tumbarumba for 16 miles 60 chains northerly to the Shire boundary, and a further 14 miles 25 chains in the Shire of Kyeamba to Obern, about 8½ miles south-east of Tarcutta. With the exception of a short section of hilly timbered country near the Shire boundary, the road traverses very good grazing land used for both sheep and cattle. Some small dairy farms are also passed. The country is undulating to hilly with some excellent flats along the creeks.

Six miles of new construction was carried out in pre-war and early war years in the Shire of Tumbarumba. A further 3 miles has recently been authorised

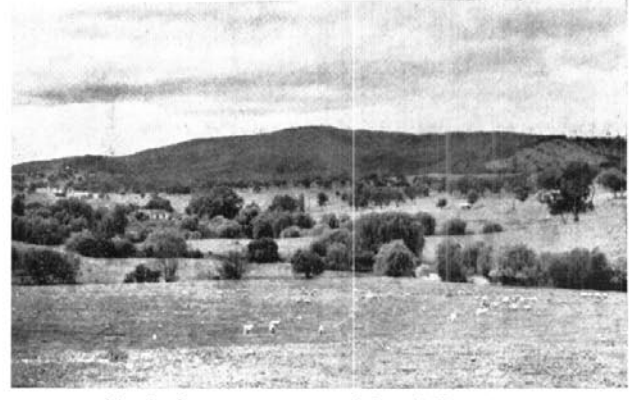


Grazing lands adjoining D.R. 1117.



Locality Map.

in the Shire of Tumbarumba, and is being carried out by Council by contract. Five miles is being constructed in the Shire of Kyeamba by contract.



Typical country served by D.R. 1117.

The new works, together with that previously carried out, are providing reasonable access to towns and railhead. The new road replaces a narrow winding track difficult to traverse in wet weather. Work authorised in the two Shires since the war are likely to cost a little in excess of £10,000.

Historical Roads of New South Wales.

Roads from Sydney to the Hunter River Valley and Newcastle.

Captain Cook was the first person to record the site of Newcastle. When sailing north along the eastern Australian coast in May, 1770, about six miles out, he noticed "a small clump of an island" close in shore. This island is situated at the entrance to the Hunter River. It is now known as "Nobby's," and artificially connected to the mainland.

When Governor Phillip established the first permanent Australian settlement at Port Jackson in 1788, the people were solely dependent on the stores carried by his ships and on later relief ships. The potentialities of the country behind Sydney Cove were quite unknown, and Phillip, after providing temporary shelter, immediately set himself to the clearing and development of suitable land for growing food.

Phillip soon realised that it would be necessary to discover land more suitable for farming and more fertile than that found adjacent to Port Jackson. Some good land was found at the head of the Parramatta River, and a settlement which he called "Rosehill" was started. The name was later altered to Parramatta.

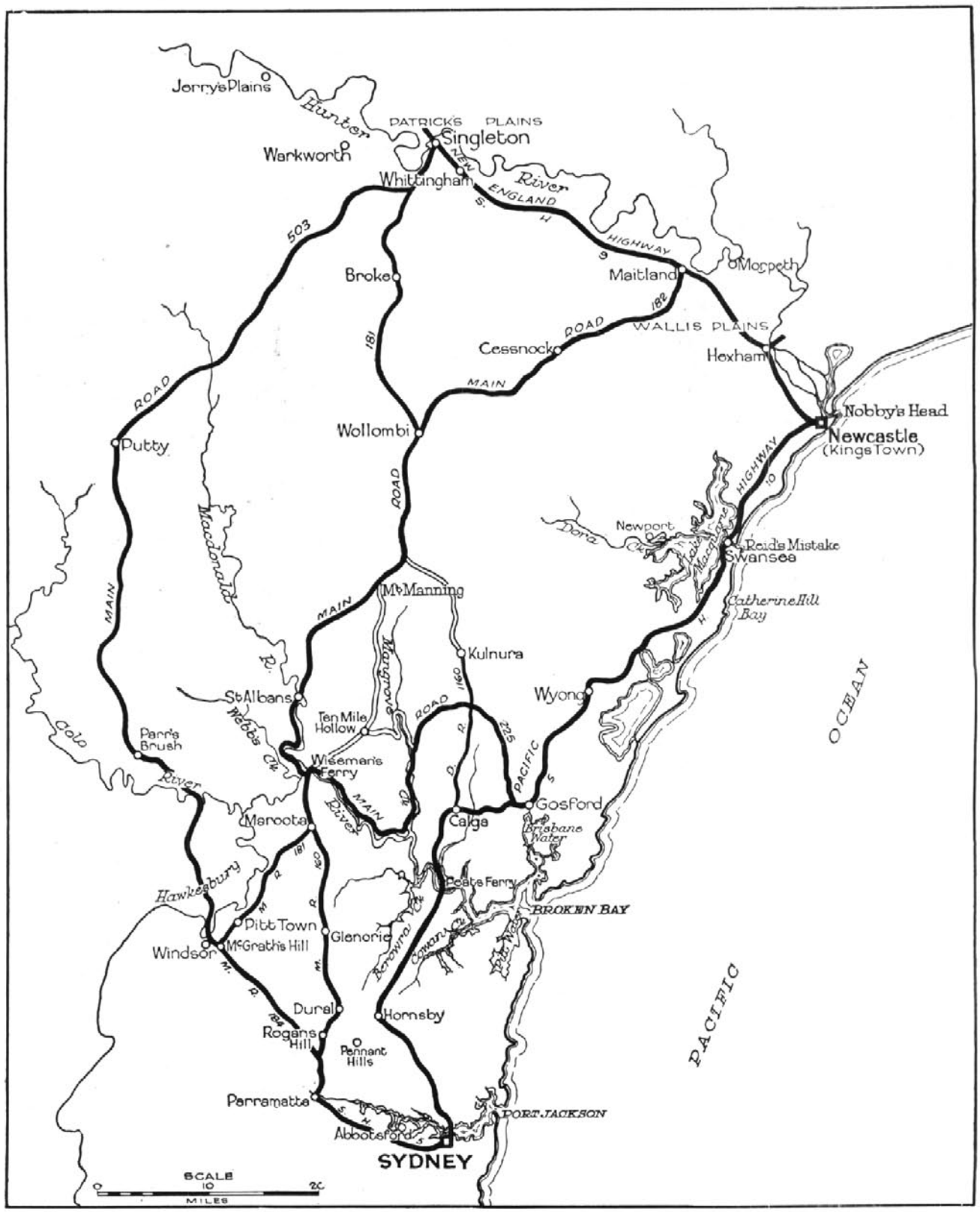
The range of mountains (the 'Blue Mountains'), seen to the west by Phillip from a point near Pennant Hills north of Parramatta, led him to believe that a great river must have its source somewhere there, and that in all probability good farming land would be found along its banks. Captain Cook had referred to an opening in the coast north of Port Jackson and Phillip took an expedition there on 2nd March, 1788, in his search for land to grow food for his company. The opening seen by Cook is that now known as Broken Bay. Phillip explored the two arms of Broken Bay naming the southern Pittwater and the northern Brisbane Water, but he was not impressed by the surrounding country for farming purposes. He returned to Broken Bay on 6th June, 1789, and on this occasion discovered the mouth of the Hawkesbury River which discharges into Broken Bay. Shortage of provisions prevented him from exploring the river for more than about 20 miles. A few weeks later he set out again and followed the Hawkesbury as far as navigable. This time he found the good agricultural land he sought along the upper reaches of the river.

A settlement was established on the Hawkesbury River in 1794, near the site of the present town of Windsor and apparently a line of communication with Sydney by land was soon established. Lieut-Governor Grose reported in August, 1794, "I have caused a very good road to be made from Sydney to the banks of the Hawkesbury, by which we discover the distance from this place by land is much less than we expected." Although it was found that the river flats around Windsor were subject to flooding, the land was fertile and became the principal source of Sydney's food supply, until the country west of the Blue Mountains was opened up following the discovery of a route by Blaxland, Lawson and Wentworth in 1813.

Early Newcastle and the Hunter River Valley.

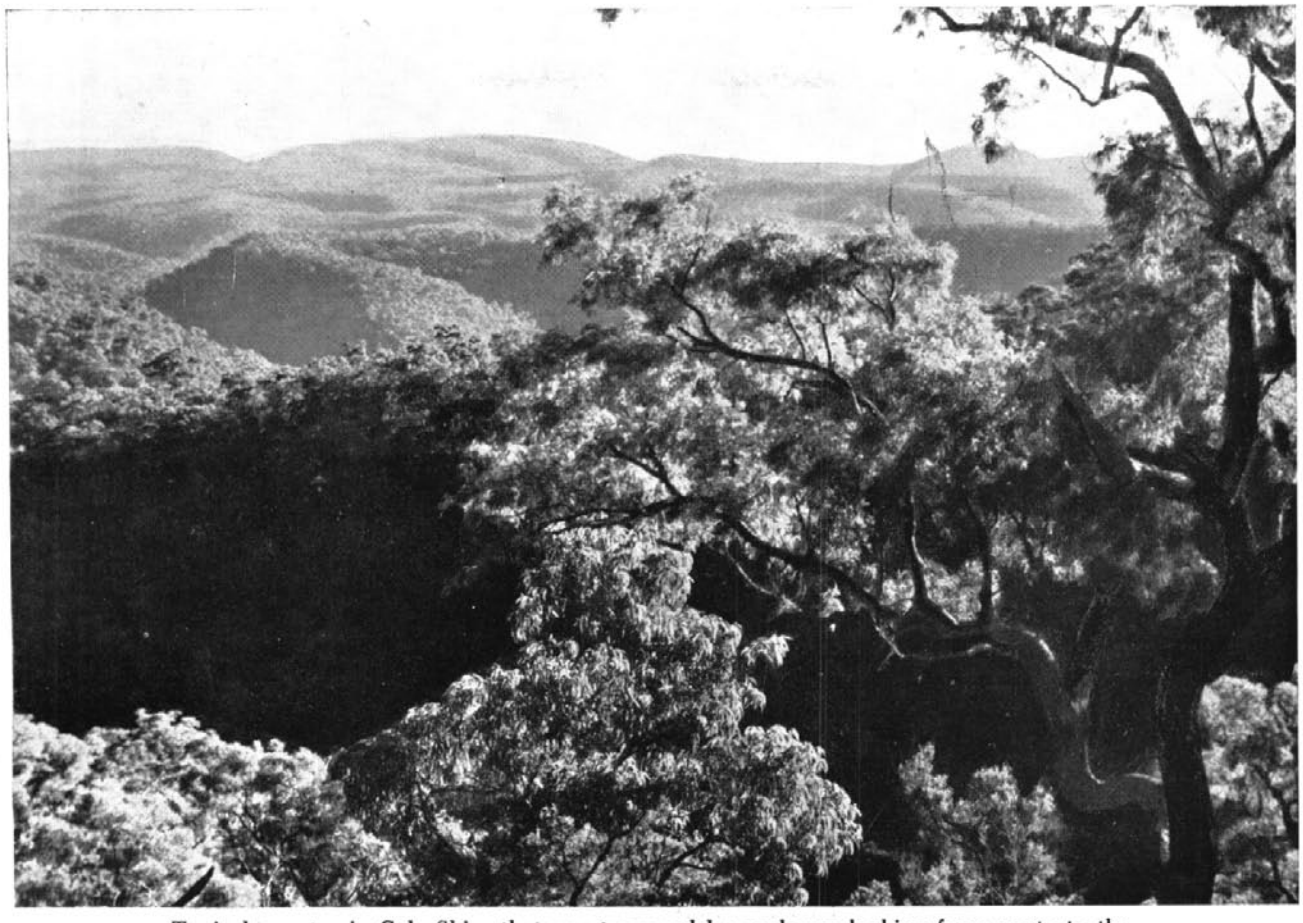
In September, 1797, the "Cumberland" a small coastal vessel was proceeding up the coast from Sydney with stores for the settlers along the Upper Hawkesbury. Near the mouth of the river it was hailed by a party in a small boat. The "Cumberland" was boarded by the party who turned out to be escaped convicts. The coxswain was informed by the convicts they intended to seize the boat and make their escape. The convicts were well received on board by a number of the "Cumberland's" crew, who agreed to join the enterprise. The coxswain could do nothing but submit. Taking those of the crew who wished to remain with him, he was landed at Pittwater. This remnant of the "Cumberland's" crew made their way overland along the coastline to Port Jackson. Governor Hunter "Not having any fit vessel to pursue upon such occasion, I despatched two row boats, well armed, the one went about sixty miles northward along the coast, and the other forty miles southward, but without success, a gale blowing soon after the escape of the second boat, which obliged the officer in pursuit to land upon the coast." The boat that went northward was in command of Lieut. Shortland. On his return journey from the unsuccessful pursuit of the "Cumberland," he entered a river which he named the "Hunter's River," and thus discovered the site and harbour of the future Newcastle, and the gateway to the fertile Hunter valley. Shortland explored the harbour and noticed coal deposits "lying so near the waterside as to be conveniently shipped, which gives it in this particular, manifest advantage over that discovered at the southward." Shortland brought specimens of the coal back to Port Jackson. In the next two years several ships were sent to the Hunter in search of coal and by 1799 sufficient quantities had been brought to Sydney to make a complete shipment for export —it went to Bengal.

Governor King displayed great interest in the possibilities of the coal at "Kings Town" as it was then known. On 9th June, 1801, he commissioned Lieut. Grant to take the "Lady Nelson" and the "Francis" together with a party including Lieut.-Col. Paterson to the "Hunter's River" and "when arrived there you will give every assistance to Ensign Barrallier in making as complete a survey as possible of the entrance and inside of that river . . . you will take under your command the 'Francis' colonial schooner, and cause her to be laden with the best coals that can be procured." Paterson and his party explored the river



Locality Map.

past the present position of Maitland to somewhere above the site of Singleton, about 50 miles inland. He reported that the "excellent soil in its neighbourhood and not subject to floods would, in my opinion, be a very fitting situation for forming a settlement for the cultivation of grain and grazing."



Typical country in Colo Shire that was traversed by explorers looking for a route to the north. View taken from the present main road linking Windsor and Putty.

The suitability of coal mining as a convict occupation, added to the distance from Sydney the absence of any road or track and the rough nature of the intervening country, made a site on the "Hunter's River" particularly favourable for a penal settlement for the more difficult characters among the convict population of Sydney. Apart from the nature of the intervening country, the passage of the broad Hawkesbury River would be a difficult proposition for escapees, and would tend to confine them to the Hunter River district. All communication between Sydney and the Hunter River settlement would it was thought necessarily be only by sea.

In 1801, therefore, Governor King established a small convict post at the mouth of the Hunter River under Corporal Wixstead, where coal was to be secured. Another party was sent up the river to collect cedar. Owing to the unsuitability of both Wixstead and his successor, Dr. Mason, the settlement was abandoned in 1802. It was re-established in 1804 under Lieut. Menzies, not because of any economic benefits that might accrue to the colony by reason of its natural resources, but because of its value as an isolated location for the more difficult of the convicts. The event that prompted Governor King to send a further party to the Hunter was a serious mutiny that broke out among the convicts at Castle Hill. Governor King, writing to Lord Hobart, 6th April, 1804, referred to "the short lived insurrection of those deluded Irish." He further stated that any "similar attempts being carried into effect, has been fully guarded against by sending a number of the most active to the coal works." To lay complete emphasis on the purely penal nature of this latest settlement, no private persons were to be allowed to work without a permit from the Governor and if any vessel entered the port without a licence the crew were to be confined and the vessel scuttled. The convicts were to be employed in procuring coal and cedar.

By 1819 Governor Macquarie realised that the purpose for which Newcastle had been established, i.e., as a place for more severe punishment of convicts, had outlived its usefulness. In a despatch dated 8th March, 1819, he pointed out to the Home Government "Extensive rich and fertile land being found at no great distance along the three principal sources of the River Hunter whose embouchure is at Newcastle . . . these plains now become an object of valuable consideration in the necessary increase of the population, and hold out important advantages for the establishment of free settlers upon them. An inducement of another kind to such settlement arises out of the

Section of the first road built between Hawkesbury River and Hunter River. 25m. north of Windsor.

consideration that Newcastle now ceases to be of that material benefit, which it was formerly to the principal settlement at Port Jackson as a receptacle for our worst characters, in consequence of the interior having been explored and the passage thence to Windsor on the Hawkesbury River having become familiar to several of those persons who have been transported thither, and who now find little difficulty in deserting from thence and returning to this place. . . . I conceive it would be highly expedient to remove the convicts and others under colonial sentence from Newcastle thither" (to Port Macquarie) "and in such a case it would be no less judicious to establish settlers on the plains along the River Hunter." With the admission of free settlers, the need for the isolation of the Hunter Valley passed and attention could be turned to the development of a land route for the passage of stock, and as an alternative means of communication with Sydney.

It can be assumed that impressions and details of routes would not be secured from escapees and therefore were not recorded. The first report of such an escape appeared in the Sydney Gazette of 22nd December, 1805. Four convicts escaped from Kings Town (the former name for Newcastle) and were pursued by a "party of military." One of the convicts was soon caught up with and escorted back by one of the party. The remainder "reaping every information from the natives, they continued the pursuit, and near Reid's Mistake (at the entrance to Lake Macquarie) overtook the other three, whom they conducted into Castle Hill (near Sydney) after a painful and fatiguing travel, and who were received in town on Friday, to be returned to Kings Town." This party can be regarded as the first white overlanders between Newcastle and Sydney of which there is a record. The following year, 1806, the "Governor King" a small coaster was wrecked at Newcastle. One of the crew set out with a native and reached Sydney. There is no record of the route followed, but it is probable they followed the coast via Broken Bay.

The first serious attempt to discover a route connecting the Sydney district and the Hunter River Valley was by Benjamin Singleton, who set out from Windsor with a party in 1818. He failed to reach the Hunter mainly because his provisions were getting low and because of his uncertainty regarding treatment by a party of natives. The natives, however, informed him of a big river to the north, which must have been the Hunter. Singleton kept a journal during the expedition which he forwarded to Governor Macquarie.

Singleton's journal apparently proved of sufficient interest to Macquarie for him to direct that a further expedition be undertaken to open up a track to the north. As a consequence John Howe, the chief constable at Windsor, set out with six others on 24th October, 1819. It is highly probable that he followed Singleton's track and was assisted by information given him by Singleton. This expedition crossed the Colo River near its junction with the Hawkesbury, followed the ridge dividing the Colo River from Webbs Creek (the Wheelbarrow Ridge) to Parr's Brush, and then proceeded generally in a northerly direction to the Hunter River, which was reached on 5th November not far from the site of the present town of Jerry's Plains.

Writing to Governor Macquarie on 5th February, 1820, John Howe said, "Your Excellency was pleased to signify your wish that I should explore the River I have lately discovered. I will very cheerfully do it. . . ." He accordingly set out again following his original track for the most part and reached the Hunter River on 15th March, 1820 at a point below that reached on the first expedition. He proceeded downstream and reached Patrick Plains (now Singleton) on 17th March. Howe named the locality "Saint"

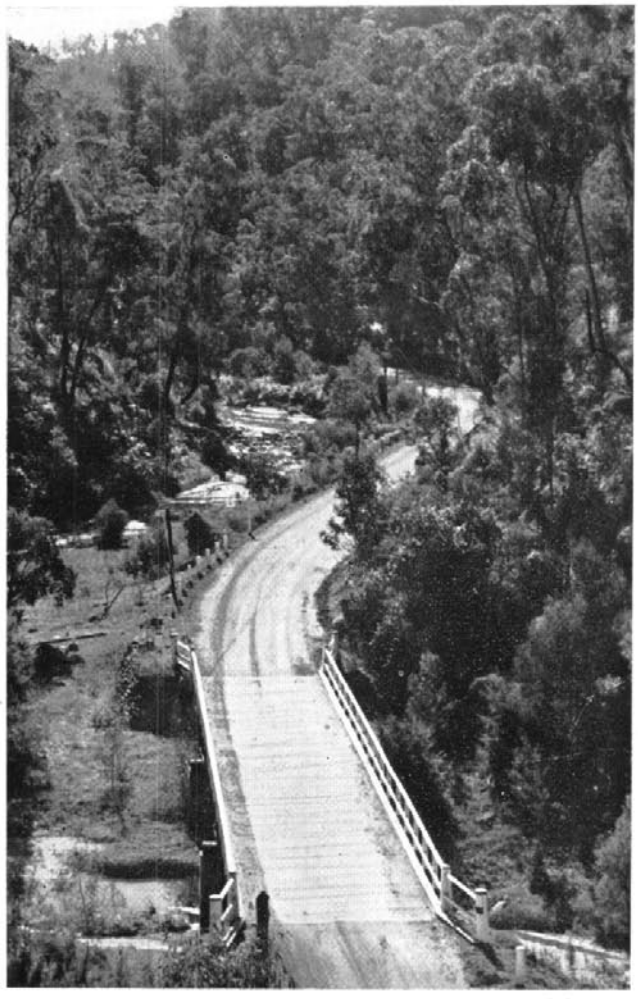
Patrick Plains in honour of the day he discovered it, but the "Saint" dropped out of the name many years ago. He explored the river as far as Wallis Plains (now Maitland).

The route to the Hunter River Valley pioneered by Howe was somewhat roundabout. It passed through rough sandstone country densely timbered and for much of its length water was scarce in dry periods. It was used only by the more venturesome of those who journeyed north to take up land along the Hunter River. The present day Main Road 503 (Windsor-Putty-Singleton) follows the general line of Howe's route for the greater part of its length.

The number of settlers along the Hunter River was increasing and they began to agitate for a shorter and easier route to Sydney. The agitation became so persistent that in 1825 the Governor, Sir Thomas Brisbane issued instructions to Mr. Surveyor Heneage Finch to carry out a survey with a view to finding a better route. Mr. Finch succeeded in locating a ridge leading from Castle Hill near Sydney to near the site of Wiseman's Ferry on the Hawkesbury River north of Windsor. The line then crossed the Hawkesbury River about a mile below the present ferry, ascended the main range on the northern side, and followed the crest of Judge Dowling's Range to the head of the Wollombi Brook. Except for one or two alterations referred to later, the present Main Road 181 (Wiseman's Ferry-Wollombi-Singleton) follows closely the line surveyed by Finch.

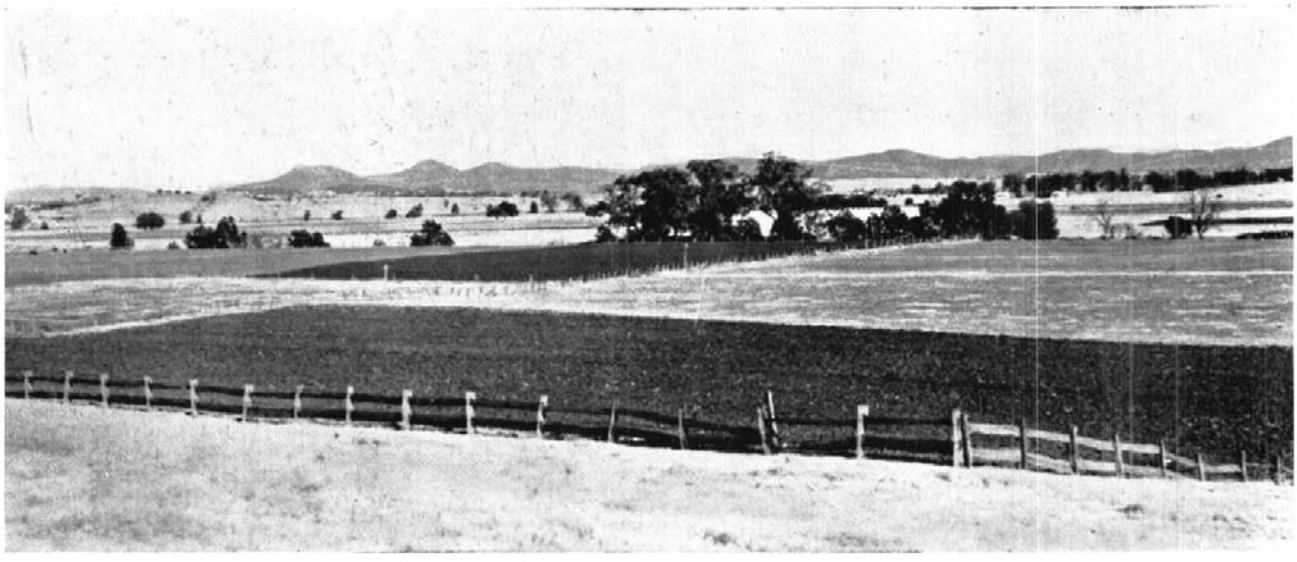
It is probable that a track along this line was used immediately by travellers to the Hunter River, but the road was not commenced till 1826. "The Australian" announced on 24th May, 1826, "The Great North Road is to be commenced, we believe this day, Mr. Oxley and Mr. Dumaresq having left town for the purpose of marking it out." Governor Darling travelled over the completed section as far as Wiseman's and the *Sydney Gazette* reported that "His Excellency was much struck and expressed his gratification at the state and progress of this noble looking and serviceable road." Darling raised one objection, however, and that was the ascent on the northern side of the Hawkesbury as marked out by Finch. This ascent was steep and difficult, and the Surveyor-General (Mitchell) was instructed to carry out a detailed survey with a view to improving the approach to the Hawkesbury on the north side. Mitchell succeeded in finding a better ascent and when this was completed the site of the river crossing was altered, which had the effect of shortening the road by 2¾ miles.

It is appropriate at this point to mention Solomon Wiseman, whose name will always be associated with the locality at the first regular crossing of the Hawkesbury River. Solomon Wiseman had been transported to Australia in 1805 for stealing 704 pounds weight of Brazil wood, valued at £24. During his time he had ships built and traded on the coast. He became an innkeeper in 1813 when a licence was issued to him for premises in Bligh-street, Sydney. He had licensed premises on the Hawkesbury in 1821, and received a grant of land in 1823. On 4th September, 1827, he wrote to the Colonial Secretary informing him that he had built a punt and requesting a lease of a ferry site on the Hawkesbury near his residence. He was informed there would be no objection to granting a lease of the ferry site for a period of seven years, subject to such regulations as might be drafted by the Council, and subject to horses and property belonging to the Government being allowed free passage. In addition to a main cattle punt and horse boat, Wiseman kept smaller boats in readiness. Persons forwarding cattle had the choice either of swimming them across or transporting them by punt. Wiseman, junior, opened an inn at the head of the Wollombi Brook about October, 1827.



Scene at Darkey Creek about 4 m. from Milbrodale in Patrick Plains Shire.

Surprise has been expressed from time to time that the early road builders did not at once find a route to Newcastle closer to the coast, somewhat following the present Pacific Highway route, instead of the longer and more circuitous route through the rugged country between Wiseman's Ferry and Wollombi. It must be understood, however, that at that period the authorities were not concerned primarily in establishing road communication with Newcastle. That town was of less importance than the larger agricultural settlements which had developed on the rich country



A section of the Patrick Plains near Singleton.

further up the Hunter River. Morpeth (or as it was then known, Greenhills) became the terminus of steam packets from Sydney, and for many years Newcastle was regarded as a minor port of call. Maitland was the centre of a big farming district and its produce was shipped via Morpeth. During the 1820's and 1830's Newcastle seemed to fall into the doldrums. The Rev. John Dunmore Lang in his "New South Wales" says, "The town of Newcastle, I have already observed, has somewhat the appearance of a deserted village. It is reviving, however, though rather slowly." . . . "The Monitor" of 13th December, 1827, has this to say: "Accommodations for visitors are exceedingly meagre. . . there is no society. . . There is scarcely an agreeable walk about Newcastle, nothing but rock and sand. The only moving objects are the Government Gangs, employed about the wharf, the mines, etc."

The position of Windsor was another factor influencing the early routes to the north. Communication by road had long been in operation between Sydney and Windsor, and Windsor was, therefore, the natural commencing place for any attempt to penetrate further north.

Major Mitchell reported in 1829 on the best line for a road between the Hawkesbury and Hunter Rivers. This survey had been carried out on instructions from the Governor to decide on "the line of road to be pursued on to Wallis Plains (Maitland) from the Twelve Mile Valley." Mitchell's report runs: "It is desirable that two extreme points, between which the road is required, should be determined before any intermediate part is made or decided upon. . . The principal objects of the road northward appear to be:—

1. A direct communication by land to the central upper districts of Hunter River including the Goulburn River.
2. The most direct communication by land to the township of Maitland or lower district of Hunter's River, and
3. The continuation of the road further northward, in the direction most eligible under these various circumstances.

Sydney being one point, the next to be determined is that at which the road should reach the Hunter River District, so as to admit of branch roads at equal angles right and left to the points of ultimate destination.

It is obvious from the map that that point is the head of the Wollombi Brook, and that this is a fortunate circumstance inasmuch as the direction of the ravines and ridges, a circumstance also to be considered, leaves little room for selection elsewhere. . . and it is plain that any deviation further to the westward would be a more circuitous route northward from Sydney."

This report emphasises the points which should be joined by road and makes no mention of Newcastle as being a place of importance that should be connected to Sydney.

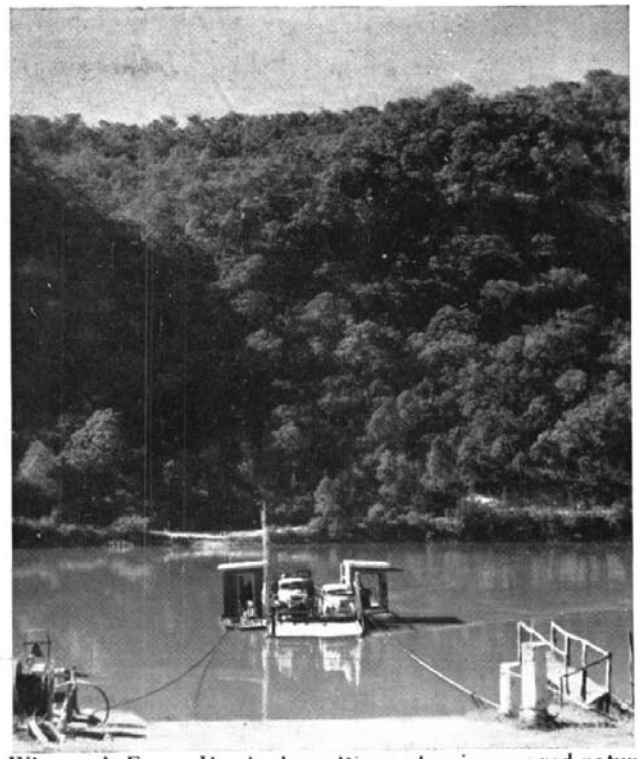
Between Newcastle and Wallis Plains (Maitland) there had been a bridle track through the Hexham Swamps prior to 1826. On 14th June of that year the "Australian" reported: "We have the satisfaction to state that the new road between Newcastle and Wallis Plains is open for travellers on horseback. The difficulty of a land communication between the two districts is therefore at an end. The distance is about eighteen miles, and the abominable swamps, which, in the winter, the traveller is obliged to wade through, almost up to the chin in water are now avoided. At the same time, it is a very inferior road . . . ."

In his report of 1829, Mitchell pointed out that the road had been made from Maitland to within about ten miles of Wollombi, and from Wiseman's Ferry to Twelve Mile Hollow (now known as Ten Mile Hollow on the old section of the road from Wiseman's Ferry along Judge Dowling's Range to Mt. Manning). Acting on his principle that "considerable saving of road-making may be effected between three points by carrying one road for a certain distance in an intermediate

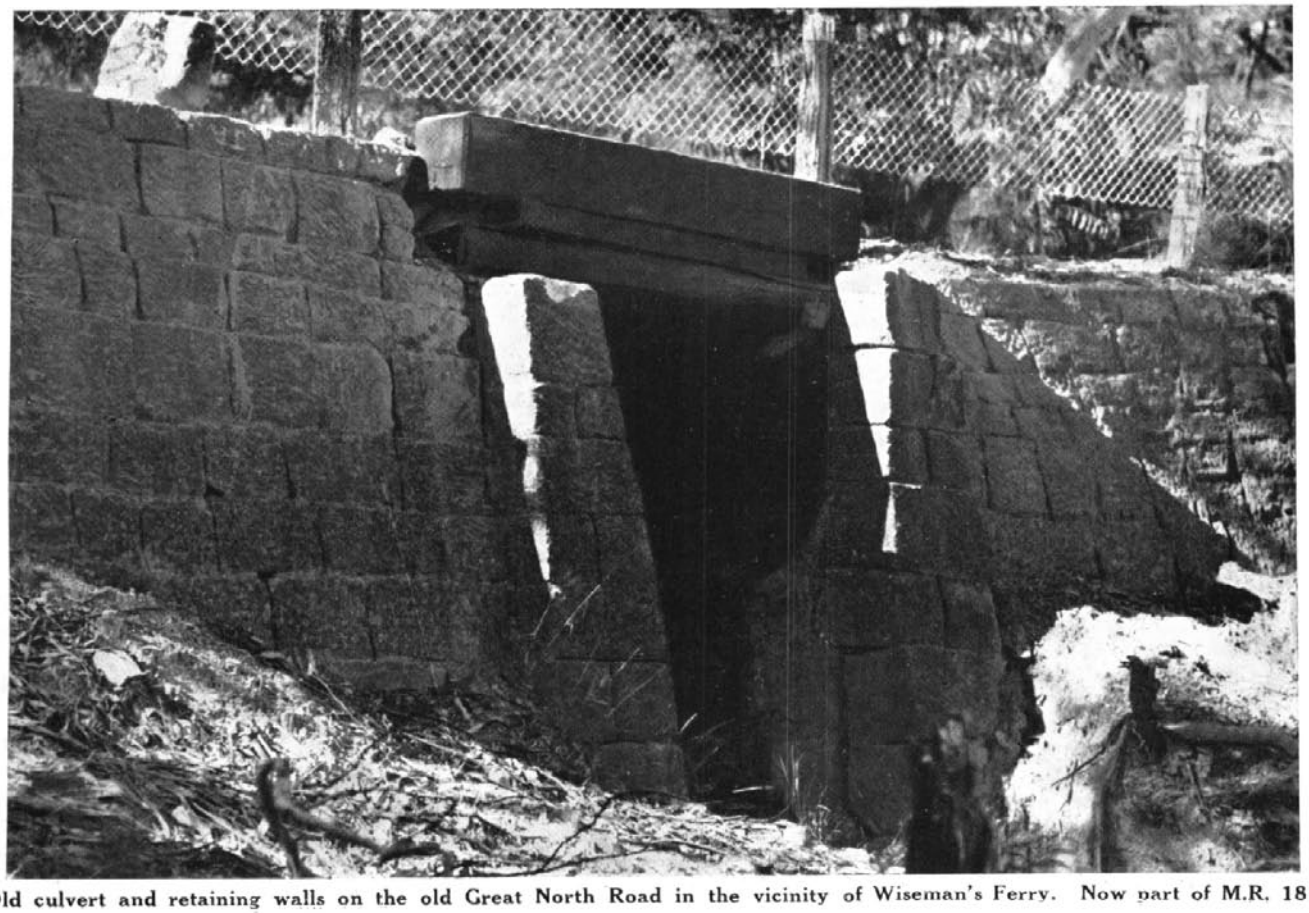
direction, so as to describe the letter "Y" rather than "V", he recommended that the road should branch at Wollombi, one arm leading to Maitland, and the other to Broke. At Broke the road was to separate again, with branches to Patrick's Plains and Warkworth. From Warkworth the road was to continue to Jerry's Plains and the districts of the Goulburn River. The final link in the system was a road from Warkworth along the Hunter River to Patrick Plains, and on to Maitland.

The grand purpose of Mitchell's scheme was that "the communication between Sydney and all the northern parts would be united in one road to the reserve of the village of Corobeare (later Wollombi) where the road would separate 'to serve' the districts of the Upper Hunter, the Goulburn River, Kingdon Ponds, Liverpool Plains and Maitland" with the interconnecting link between Maitland and Warkworth.

The Surveyor-General objected to "the angle formed by the road at Parramatta." To eliminate this angle he suggested a crossing of the Parramatta River at Kissing Point. The punt actually crossed from the point now known as Abbotsford to Bedlam Point, and a route was opened up in 1832 through Ryde, Carlingford and Dundas joining the original road from Parramatta, at the present day Rogan's Hill. The road never came into general use, and the punt eventually ceased



Wiseman's Ferry, Hawkesbury River, showing rugged nature of country.



Old culvert and retaining walls on the old Great North Road in the vicinity of Wiseman's Ferry. Now part of M.R. 181.

running. That part of the road leading from Parramatta-road through Five Dock to Abbotsford is still known as the Great North Road.

Alterations took place in the route of the Great North Road as settlements developed. Thus as settlement extended north from Windsor and Pitt Town, a track from Cattai Creek along the Maroota Ridge was surveyed and a road formed, joining the Great North Road at Maroota. The road from Parramatta through Castle Hill and Glenorie became disused, and the route of the Great North Road became diverted to that through Parramatta, Windsor, Pitt Town and Cattai Creek to Wiseman's Ferry, now embraced within Main Roads Nos. 184 and 181.

North of the Hawkesbury River, the settlements along its tributary, the Macdonald River could be reached as far as St. Albans only by river. A track was developed, however, from the Great North Road near Wiseman's to Whalan's Punt (later Book's Ferry) on the Macdonald River and up that river to St. Albans. This section of the road gradually became adopted for northern traffic in lieu of that through Ten Mile Hollow and Judge Dowling's Range. The main route to the north thus became established through Windsor, Wiseman's Ferry, St. Albans and Wollombi.

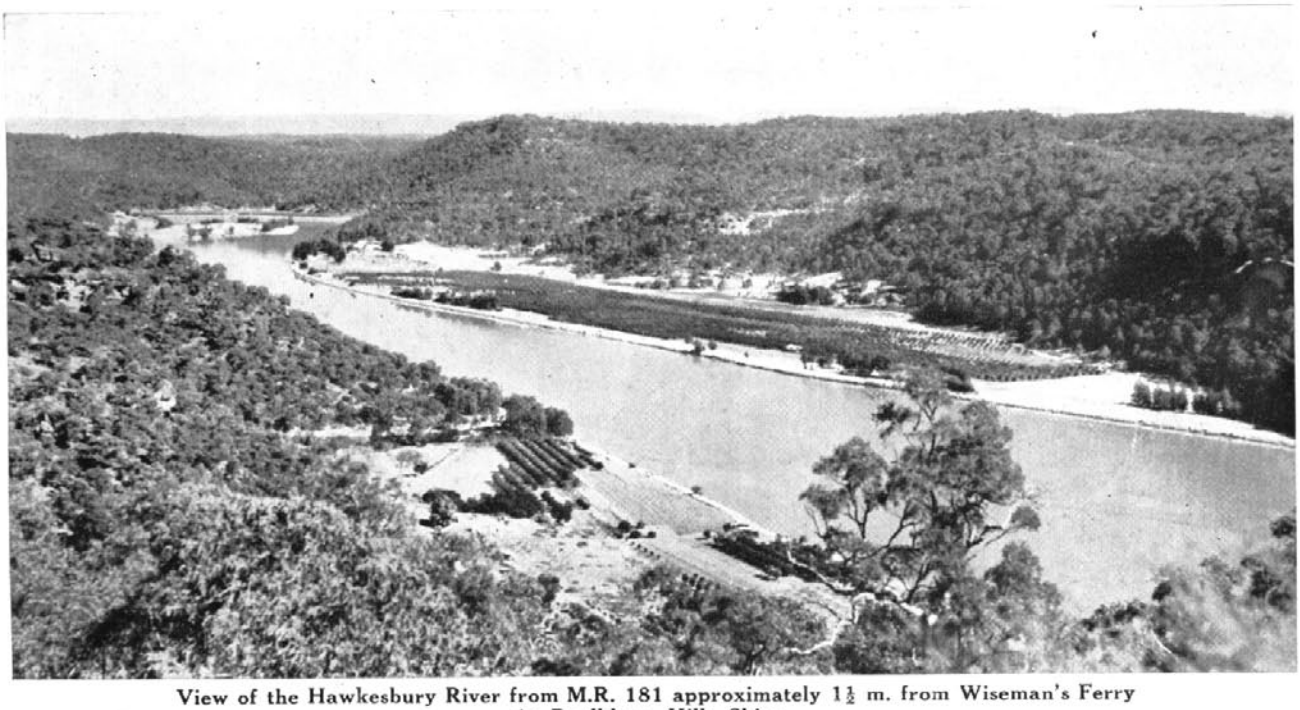
The Early Coastal Route.

While it was natural that the first roads to the north from Sydney should follow the settled districts, and lead to the primary producing centres of the Hunter Valley, the development of tracks nearer the coast was not neglected. There is evidence that as early as 1824 the country through which the Pacific Highway was to run was receiving attention. On 1st August, 1824 Thomas Edwards received a "ticket of occupation" for a point of land "known by the name of Kangaroo Point near Long Island" for use as a grazing run. The *Sydney Gazette* also advocated the provision of access between Newcastle and the "settlements at or near Broken Bay. That fine settlement is almost unknown from the present want of ferries and roads. . . Settlers, newly arrived, are beginning to cry out there is no land while millions of acres lie entombed upon the sea side." Surveyor Govett reported on 16th July, 1829: "It has occurred to us that considerable saving both in time and inconvenience might be effected in the route from Sydney to Brisbane Water by the formation of a line of road to meet the Hawkesbury at a point near the vicinity of the heads in lieu of the long, tedious and circuitous journey at present resorted to by the great north road and it appears that the plan has not merely been proposed, but acted upon and that there are no less than two separate lines marked out, the one to cross at the mouth of Mangrove Creek, the other at Mr. Peat's residence a few miles lower down. Without wishing in the least to interfere with the proposed arrangements, we may be permitted to observe that the originality of the measure was, we believe, Mr. Peat's, who long since following the guidance of a native black, well versed in the geography of the country, undertook and carried out the measure of marking the entire line from Brisbane Water to his residence, and from thence again to near Sydney, proposing at the same time to establish a punt at Fairview in the event of the measure being approved and supported. The other and later candidate for having found a new cut is, we understand, Mr. Taylor, the publican at Mangrove, who has already established a punt from his premises and we imagine is sanguine in the preference given to this line. As far as our knowledge of the locality extends, we are decidedly in favour of the original measure proposed by Mr. Peat, considering the journey from Sydney to Cowan decidedly the most direct and every way convenient route; the transit at Fairview is likewise unobjectionable, from whence the continuation by Mooney Mooney Creek is easy and direct until it meets the present track a few miles from Gosford."

The line proposed by Taylor commenced at Dural and ran west of Berowra Creek to the Hawkesbury which it crossed at the entrance to Mangrove Creek where he had an Inn. From this point the route ran north and joined an existing track from Mangrove Creek to Gosford. Taylor's proposal was rejected, the Brisbane Water District Council deciding that the best route would be via Fairview, Mr. Peat's property.

George Peat established a ferry across the Hawkesbury at Kangaroo Point in 1844. Announcing this fact the *Sydney Morning Herald* described it as "pregnant with great advantage" and was sure "the increased traffic will amply remunerate the spirited proprietor." Land was being taken up along Brisbane Water, and the landholders had approached the Government in 1833 to give them a road joining with the Great North Road, but nothing was done. The settlers along the Hunter River were also asking for a shorter route to Sydney. It must be remembered that the road from Sydney to Newcastle was then 165 miles long, passing through Windsor, Wiseman's Ferry, St. Albans, Wollombi and Maitland. It was suggested that a route could be found from the Hunter Valley through Wollombi to Peat's Ferry and thence along the coast to Sydney. On 5th March, 1845, it was reported that "they had partially succeeded in finding such a line by taking a course to the eastward of the Warawallong Ranges." It was found that a "bridle road is capable of being used, which crossing the old post road from Hawkesbury to Brisbane Water, near the turn off to Brisbane Water will join the new line from Gosford to Sydney and give an immense saving of distance besides avoiding the inconveniences and jumps up of the Great North Road. The Messrs. Milson have just left to determine upon the practicability of the route and we beleive there is little doubt that a good road might be constructed through these hitherto unused sierras."

In 1849 the Deputy Surveyor-General, Capt. Parry surveyed the line personally from Peat's Ferry to Wollombi acting under instructions from the Colonial Secretary—"to do whatever was necessary regarding surveys so that it could be brought forward for proclamation." This also followed a memorial which had been presented to the Governor, praying "that a sum of £200 be placed on the estimates for the purpose of



View of the Hawkesbury River from M.R. 181 approximately 1½ m. from Wiseman's Ferry in Baulkham Hills Shire.

completing the line of road from Sydney to Jerry's Plains via Peat's Ferry." In his report Captain Parry stated that "several gentlemen who have travelled the line referred to represent it to be free from any serious difficulties." It would appear that the road was started but not completed, due probably to the Opposition of Sir Thomas Mitchell who had never shown any enthusiasm for the proposal. In a note in his handwriting he referred to "this (to me) most unpleasant subject." The proposed route can be travelled to-day if the Pacific Highway is followed to Calga, thence along Developmental Road No. 1160 through Kulnura and on Main Road No. 181 the Wiseman's Ferry-Wollombi-Singleton road, which is joined about 35 miles north of Wiseman's Ferry.

In 1854 the Colonial Secretary approved of the expenditure of £570 per annum for the maintenance of the road from Sydney to Wollombi via Peat's Ferry and for working the punt at Peat's Ferry. The route was apparently little used and it was not thought worth while to make it fit for wheeled traffic. It was used only by horsemen and for the passage of cattle and other stock.

The route from Sydney to Peat's Ferry passed through St. Leonards to Aaron Pearce's Farm (Hornsby) then followed the range between Berowra and Cowan Creeks to the ferry.

Maitland to Gosford.

A road from Maitland to Gosford was mentioned with some enthusiasm by *The Australian* on 4th February, 1841: "It is a great advantage to the inhabitants of these districts (bordering Maitland) that the new road from Maitland to Gosford, discovered by Mr. W. H. Wells, proves so excellent a one. It avoids the hilly range of Wyee and the Sugar Loaf Mountain and it is also shorter than the road lately in use. It is, our readers will observe, upon this new road that the town of Newport is situated, having Lake Macquarie on the one side and the road on the other. . . . It seems obvious that the settlers on Jerry's Plains will instead of going out of their way to Newcastle or Maitland bring down their wool to Newport direct, as shipping can lie within a cable length of the shore.

The 'Kangaroo' will shortly be engaged to perform a trip from Sydney to Newport passing through the Strait called Reid's Mistake, and affording the passengers a view almost for the first time since the existence of the colony, of Lake Macquarie in its entire beauty." Newport was a township on Dora Creek, "contiguous to that part of the coast known as Reid's Mistake or the embouchure of Lake Macquarie." An advertisement for a land sale at Newport in April, 1841, after describing the beauties and advantages of this district stated "The Great Gosford and Maitland NEW ROAD under a Government Surveyor, passes through the western part of the town and brings Gosford within a distance of fifteen miles."

Modern Developments.

The completion of the last link in the railway between Sydney and Newcastle in 1889—the building of the railway bridge across the Hawkesbury River—naturally reduced the use of the roads considerably.

Peats Ferry ceased to run which left the route, regarded as the Great North Road, as that via Parramatta, McGrath's Hill (Windsor), Pitt Town, Wiseman's Ferry, St. Albans, Wollombi, Broke, Whittington, Singleton and beyond. At Wollombi a road branched via Cessnock to Maitland and thence to Newcastle.

Road to Ten Mile Hollow—Section of the old road to the north, via Mangrove Mountain.

An alternative route from Sydney to Newcastle was via Mangrove Mountain. This road branched from the Great North Road at Wiseman's Ferry and went via Ten Mile Hollow, Mangrove Creek, Mangrove Mountain to Gosford and thence to Newcastle via Wyong, Catherine Hill Bay and Swansea.

When motor traffic began to develop from 1905 onwards, Newcastle was already growing to become the next largest city to Sydney in New South Wales. In its first annual report in 1926, the Main Roads Board observed "although 129 years have passed since the discovery of what is now Newcastle, no direct road yet links the two cities." The weight of importance had swung from the farms of Morpeth and Wallis Plains to the highly developed industries at Newcastle, and just as the early settlers on the Hunter agitated for a direct link with Sydney in 1819, so in 1925 the pressure was on for a shorter road linking Sydney and Newcastle.

The construction of the road was one of the first tasks confronting the Main Roads Board when it was constituted in 1925. A review of existing and previous routes showed that none was suitable throughout its whole length as a through road for modern traffic. If the existing road from Newcastle to Gosford were further developed and joined to a new road to be built between Gosford and Sydney via Peat's Ferry, the construction would be justified by the saving in distance alone, namely fifty miles. The work was at once put in hand and was completed in 1930, including the re-establishment of Peat's Ferry with modern vessels. Traffic increased rapidly and not many years passed before it became evident that the ferry must be replaced by a bridge.

A detailed account of construction of the Pacific Highway may be found in the Journal of the Institution of Engineers, Australia, Vol 4, Nos. 5, 6 and 7 written by Mr. T. H. Upton, O.B.E., M.Sc., M.C.E., M.I.E. Aust., who was a member of the Main Roads Board during its construction. The road bridge across the Hawkesbury River at the old Peat's Ferry crossing is described in the May, 1938 and November, 1939, numbers of this Journal, and also in a brochure "The Hawkesbury River Bridge" issued at the time of its opening in 1945.

Acknowledgments.

Material has been used from the following publications:—

Various volumes of the Journal of the Royal Australian Historical Society, particularly articles by Mr. J. Jervis.

The Establishment of Direct Road Communication between Sydney and Newcastle—T. H. Upton, O.B.E., M.Sc., M.C.E., M.I.E. Aust.

Road Engineering and its Development in Australia, 1788-1938—H. H. Newell, C.B.E., M.Inst.C.E., M.I.E. Aust.

The Newcastle Packets and the Hunter Valley—J. H. M. Abbott.

The Hawkesbury River Bridge—Pacific Highway—Brochure.

Newspapers—*The Australian* and *The Sydney Gazette*. —Mitchell Library.

The N.S.W. Calendar and Directory—1835—Mitchell Library.

Two Years in New South Wales—P. Cunningham, Surgeon, R.N. (1827)—Mitchell Library.

Report on Roads, 1827-1855 by Sir Thomas Mitchell—Mitchell Library.

Locating Natural Materials for Road Construction.

USE OF GEOLOGICAL AND SOILS MAPS.

Geological and soils maps provide often a means of facilitating the work of the engineer in determining the presence or likely presence of natural materials suitable for road-making. In addition, such maps will often give an indication of probable soil types, and thus aid in assessing the likely required thickness of a proposed road pavement, or indicate unfavourable soil conditions which may be of significance in determining the location of a new route.

Natural materials suitable for use in the construction of road foundations or pavements comprise certain soils, gravels and rocks. Each specific type, dependent upon properties and economic availability, may be developed for use to meet the varying conditions of traffic and climate. For example, a very resistant rock type may be suitable for use in a concrete pavement or in a broken stone base course which is subject to heavy traffic of say five or ten thousand or more vehicles per day, but may be economically unsuitable for light traffic of say thirty to forty vehicles per day.

Earth formations which have been properly drained, both on the surface and in the subsoil, will serve as a road to carry light traffic. In the case of many soils, however, such a road will become impassable in protracted wet weather. In order to provide a reasonable all-weather road surface, a soil must be resistant to deformation in both wet and dry weather. Whereas either sand or clay alone forms a poor surface, a mixture of both, containing approximately 70 per cent. of well-graded sand and 30 per cent. of clayey soil will provide a reasonable road surface or foundation capable of carrying a fair volume of traffic.

Gravel as used for road construction usually consists of a mixture of stone particles and fine material. It occurs in nature under a variety of conditions such as water deposition in a former stream bed or lake or on a beach, or residual deposition from a glacier, or from surface weathering of rock strata, or from chemical action as in the case of ironstone calcareous and bauxite gravels. Its suitability depends on the quality, size and shape of the rock fragments, and on the properties of the material surrounding them and which serves as a binder.

Hard durable rocks are used in the form of broken or crushed stone, mainly in combination with other materials, to provide concrete or bituminous pavements or very stable foundations. On account of the high cost of quarrying and crushing rock, its use is generally confined to roads carying heavy traffic.

Crushed rock is required also for "aggregate" to spread on bitumen in undertaking the bituminous surfacing of roads. Suitable screened gravel, if available, may also be used for this purpose.

Unsuitable natural materials may sometimes be rendered suitable by mixing with other local materials, or by screening out deleterious matter.

In determining the character of a required road pavement in any area, reference must be made to the following:—

1. The nature and volume of traffic to be served. Traffic is largely dependent on distribution and density of population, and these in turn are mainly determined by climate, topography, nature of soil, and distance from the seaboard. In New South Wales, the greatest population density per square mile and thus the greatest traffic intensities, are near the coast, whereas the population in the western portion of the State is sparse, and the traffic correspondingly light.
2. The nature of the soils in the particular locality.
3. The nature of the rocks, i.e., the geology of the area.
4. Funds available for construction and maintenance.

A generalised geological map of New South Wales is shown in Figure 1, showing separately the granites and porphyries, the basalts and andesites, and the sedimentary rocks. The latter are differentiated into two areas—those where outcrops of rock are common, and those where outcrops are rare.

Granite rocks owing to hardness, brittleness and crystalline structure do not prove as satisfactory for road purposes in New South Wales as the more homogeneous and tougher basic rocks, such as basalt and andesite. Partially decomposed granite is frequently used, however, as a form of gravel, although careful selection is required, as the presence of a high percentage of mica or kaolinite may adversely affect the ability of the pavement to support any bituminous surface treatment which is to follow.

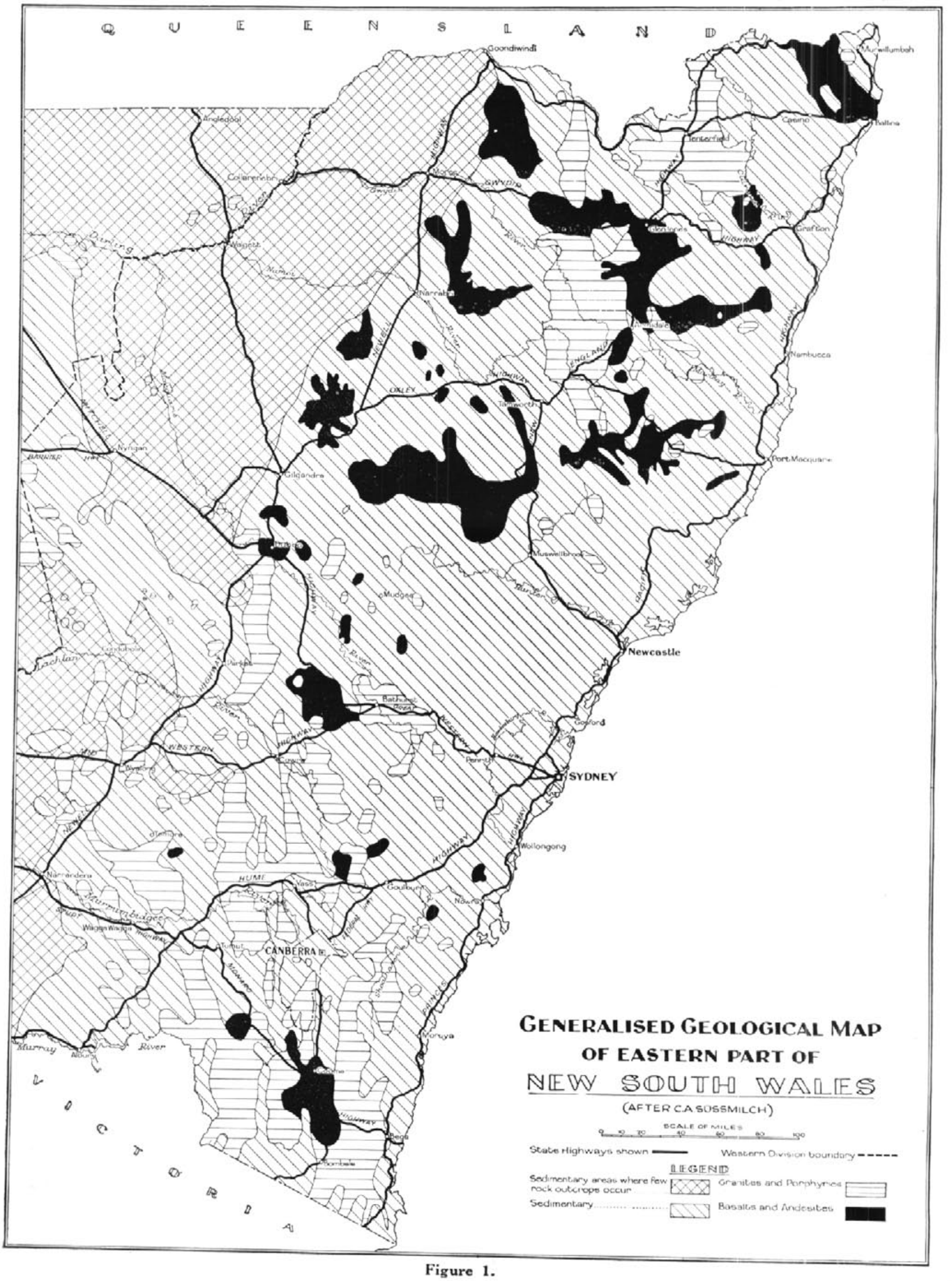

QUEENSLAND
VICTORIA
Goondiwindi
Murwillumbah
Ballina
Casino
Tenterfield
Grafton
Glen Innes
Armidale
Nambucca
Tamworth
Port Macquarie
Narrabri
Gilgandra
Nyngan
Muswellbrook
Mudgee
Newcastle
Bathurst
Gosford
Penrith
SYDNEY
Wollongong
Cowra
Parkes
Narrandera
Yass
Goulburn
Nowra
Wagga Wagga
Tumut
CANBERRA
Moruya
Albury
Bega
Bombala
Collarenebri
Walgett
Angledool
Murray River
Murrumbidgee
Lachlan
Darling
GENERALISED GEOLOGICAL MAP
OF EASTERN PART OF
NEW SOUTH WALES
(AFTER C.A. SUSSMILCH)
SCALE OF MILES
0 10 20 40 60 80 100
State Highways shown
Western Division boundary
LEGEND
Sedimentary areas where few rock outcrops occur
Sedimentary
Granites and Porphyries
Basalts and Andesites

Figure 1.

Basalts and other basic lavas are extensively used for aggregate for bituminous and concrete road pavements, but vesicular basalts should be avoided. The use of disintegrated basalts to form a "basalt gravel" must be regarded with great suspicion, as the product resulting from weathering is usually very clayey. They should only be used after rigid laboratory tests. The soil which results from the decomposition of basalt rock types has poor supporting power when wet, and Figure I therefore shows the areas where especially thick pavements are likely to be required on this account.

The sedimentary rocks vary considerably in type and in value for road-making. Many sedimentary rocks are suitable for pavements for lightly trafficked roads, or as base courses on more heavily trafficked roads. Shales need to be viewed with suspicion due to tendency to breakdown to clay, and should only be used after stringent test. It is in the sedimentary rock areas that ridge gravel may often be found on hills

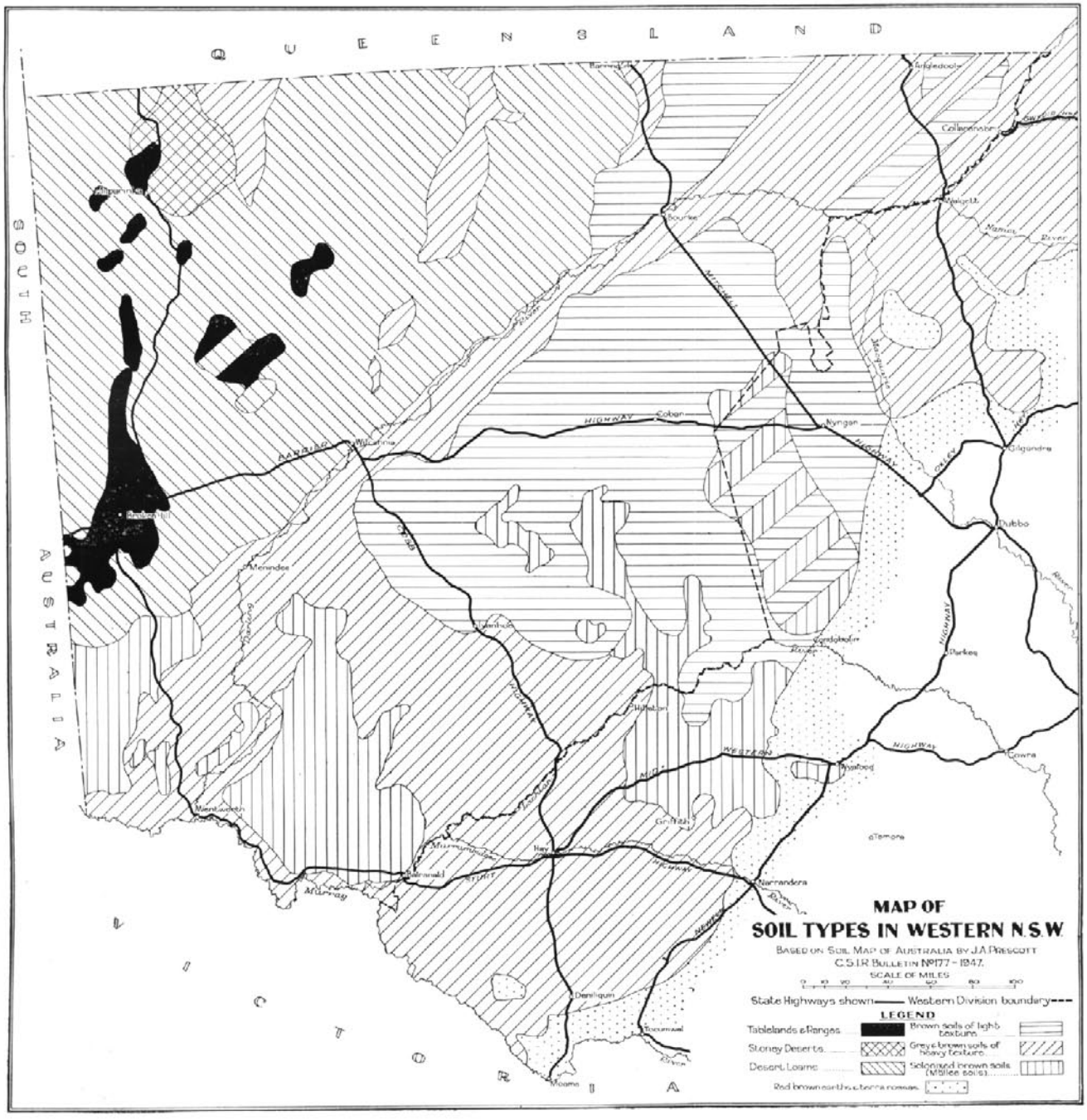


Figure 2.

or ridges. These gravels are generally nodular ironstone gravels formed by chemical solution and re-deposit of iron.

There are large portions of western New South Wales where rocks do not generally outcrop at the surface, being covered by beds of alluvium, or water deposited soils (see unshaded area in Figure 1). In a large part of these areas, if recourse is not to be had to the haulage of rocks and gravels from a distance, reliance for pavement materials must usually be placed on selected soils of the sand-clay types, or on secondary deposits of limestone which are available below the surface in some areas.

Figure 2 shows soil types in western New South Wales. The eastern part of the State has been excluded from the map because the soils in the eastern portion are generally not suitable for constructing road pavements to suit the traffic volumes prevailing, as little of the sand-clay type exists in this area. Further, the eastern portion of the State is generally well supplied with gravels and rocks, and there is little need for use of soils.

Considering the western portion of the State, it will be seen from the map that the alluvial soils consist of several distinct types, the principal being as follows:—

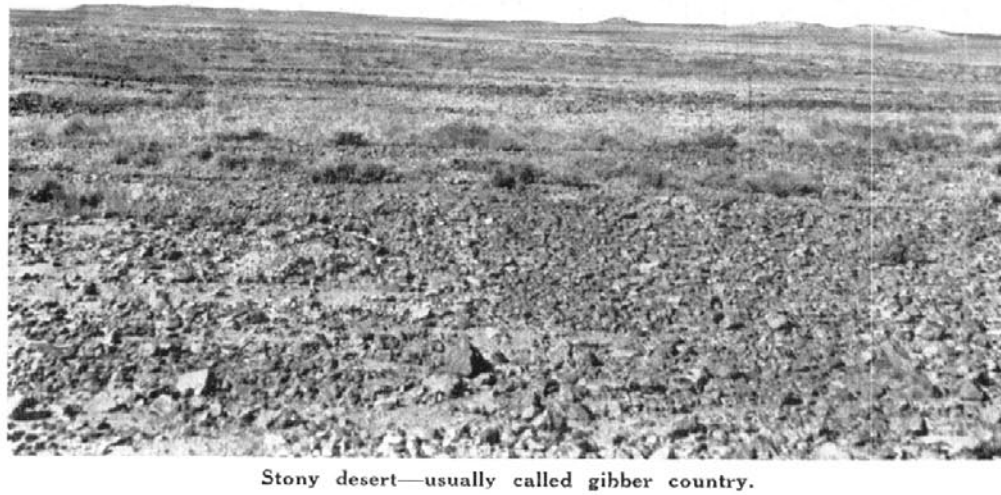
1. Grey and brown soils of heavy texture. Wide belts of these soils exist along the main streams.
2. Brown soils of light texture.
3. Desert loam soils.
4. Mallee soils (Solonised brown soils).
5. Red-brown earths and terra rossas.

The grey soils of heavy texture are mainly of the type generally known as "black" soil and provide no suitable road-making material. On the other hand, they have little load supporting strength when wet, and under conditions of protracted rain soon become impassable. A pavement is essential if heavy traffic is to be carried in all-weathers, and the pavement must have substantial thickness. The incorporation of sand into the surface of a black soil formation can considerably facilitate the movement of traffic in wet weather.

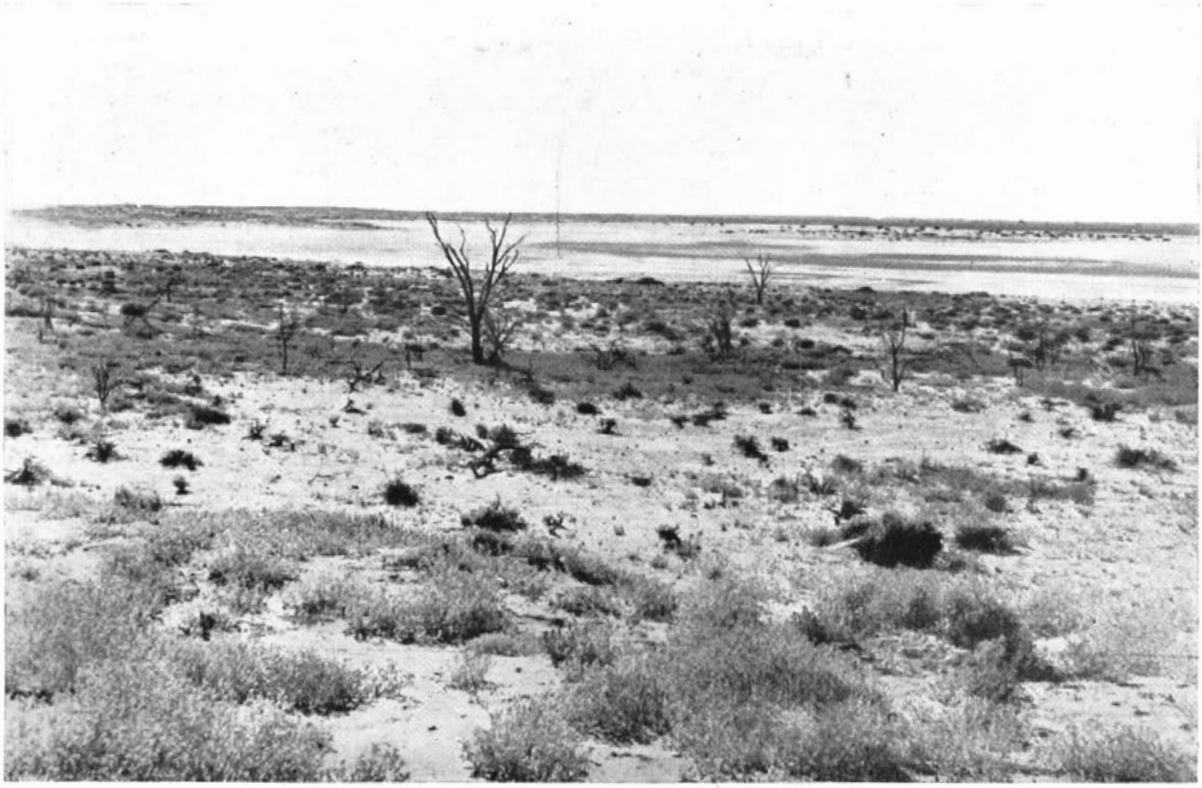
Grey soil of heavy texture usually referred to as black soil.

The brown soils of heavy texture often contain deposits of "sandy loam" of various grades, the best being a natural sand-clay. These materials are generally found along the lines of old stream channels. Quality is very variable and considerable search is often necessary to secure material with most favourable characteristics.

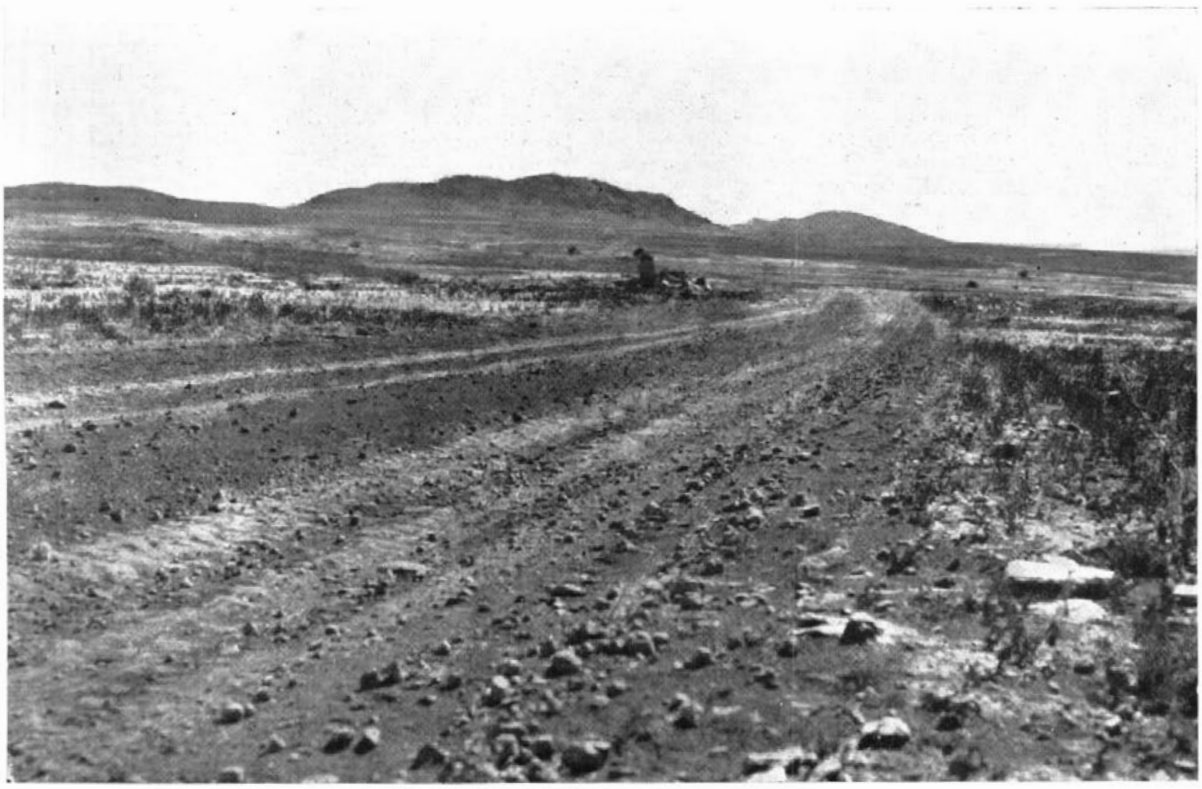
The brown soils of light texture provide a good natural road surface, the material often containing a percentage of ironstone nodules, which assist in providing stability and resistance to wear.



Stony desert—usually called gibber country.



Desert loam area, showing large clay pan in distance.



Typical tableland and range country.

The desert loams usually provide a reasonable natural running surface when wet. The soil has frequently a good mixture of rock fragments, and in many places where wind and water erosion has removed portion of the soil, a loosely bonded gravel suitable for a road remains. Should the soil at any place be unfavourable for road-making, better road surfacing soil can generally be located at no great distance.

The mallee soils are of a sandy nature, but usually bond sufficiently under traffic to meet the needs of the very light traffic in the mallee areas of the western part of the State. In some cases admixture with clay is carried out, if clay is readily available. In other cases sheeting with gravel may be necessary.

The "red-brown earths and terra rossas" comprise much of the wheat belt of the State, and gravel for road-making is generally available throughout this area.

In some parts of the western portion of the State particularly mallee areas, there are extensive deposits of secondary limestone, found in a layer just below the natural surface. Much of this forms an excellent gravel road surface. An inferior variety known locally as "kopie" is also available but is less durable as a road surface and somewhat greasy when wet.

From the foregoing, it will be seen that in setting out to determine the availability of road-making materials in any area, reference should first be made to all available geological maps, as these disclose the probability of finding rocks likely to be suitable for crushing, and show the areas in which ridge gravels and other disintegrated rock products of value may be found. The geological maps also indicate where basaltic soil is likely to exist.

Where the rocks are covered by a considerable layer of alluvium, the soil types map can give a definite indication both of the types of materials likely to be available for road purposes, and the extent to which there will be need for a pavement on an earth formation to carry light traffic.

A detailed geological map of the State to a scale of 16 miles to an inch is available from the Department of Mines. Separate geological maps of most of the various regions of the State have been published to a larger scale by the Premier's Department based on information supplied by the Department of Mines.

Many local areas throughout New South Wales have been studied by geologists in great detail and descriptions and maps published by the Department of Mines and by such bodies as the Royal Society of New South Wales, and the Linnean Society of New South Wales. The Department of Mines will always advise as to what detailed descriptive matter or maps are available regarding any area. That Department will also furnish information to local governing bodies regarding the potentialities of sites under consideration for development as quarries.

PAYMENTS FROM THE ROAD FUNDS FOR PERIOD 1st JULY, 1948, TO 31st DECEMBER, 1948.

	Amount Paid. £
COUNTY OF CUMBERLAND MAIN ROADS FUND:	
Construction of Roads and Bridges	277,824
Acquisition of Land and Buildings for Road Widening	5,729
Maintenance of Roads and Bridges	231,594
Interest, Exchange and Repayment of Loans	19,041
Other Expenditure	39,529
Total	£573,717
COUNTRY MAIN ROADS FUND:	
Construction of Roads and Bridges	518,962
Acquisition of Land and Buildings for Road Widening	4,711
Maintenance of Roads and Bridges	863,570
Interest, Exchange and Repayment of Loans	99,224
Purchase and Repair of Plant and Motor Vehicles	82,571
Other Expenditure	79,642
Total	£1,648,680
DEVELOPMENTAL ROADS FUND:	
Construction of Roads and Bridges	36,160
Other Expenditure	2,223
Total	£38,383
SUMMARY ALL FUNDS:	
Construction of Roads and Bridges	832,946
Acquisition of Land and Buildings for Road Widening	10,440
Maintenance of Roads and Bridges	1,095,164
Interest, Exchange and Repayment of Loans	118,265
Purchase and Repair of Plant and Motor Vehicles	82,571
Other Expenditure	121,394
Total	£2,260,780

Improved Link With Queensland in West.

Bourke to Hungerford Main Road Constructed Throughout

The town and railhead of Bourke, north-western New South Wales, serves many thousands of square miles of pastoral country in New South Wales and Queensland. Nine main roads radiate from Bourke, of which two, the Bourke-Barringun Road and the Bourke-Hungerford Road extend to the Queensland border and connect with the Queensland roads system, leading to Cunnamulla (Queensland) and to Eulo and Thargomindah (Queensland) respectively. Hungerford is a village on the border in Queensland. Between Bourke and Hungerford are located the small villages of Ford's Bridge and Yantabulla, 42 miles and 82 miles respectively from Bourke.

Both roads carry live-stock traffic proceeding to the meat works at Bourke, serve the needs of general inter-communication between centres of population in the two States, and provide road service to those resident along their length.

The Bourke-Barringun Road, a length of 85½ miles (part of State Highway No. 7) was reconstructed during recent years and, as it approached completion work was put in hand on the Bourke-Hungerford Road, a length of 132 miles (Main Road No. 404).

The country passed through between Bourke and Hungerford is mainly lightly timbered with red-brown soils. Black soils occur at drainage depressions, and some extensive clay-pans and cane grass swamps are crossed—vast treeless and wind-swept plains, which are liable to submergence after rain. Away from the drainage depressions clay-pans and cane grass swamps the route traverses gently undulating country with frequent low sandy ridges. The average annual rainfall along the length of the road varies from about 13 inches at Bourke to about 10 inches at Hungerford.

The country served by the Bourke-Hungerford Road in New South Wales is mainly devoted to sheep raising for wool, whereas on the Queensland side cattle predominate.

The standard of construction aimed at was an earth formation throughout, gravelled over black-soil areas, and provided with firm crossing places or causeways at streams and drainage depressions.

Some improvement work had been carried out in earlier years. About three-quarters of the road from Bourke to the Warrego River at Ford's Bridge, a

View of recently completed road 70 m. from Bourke towards Hungerford.

distance of 42 miles, had been lightly formed, and sections of this over black soil had been lightly gravelled. From Ford's Bridge to Hungerford, a distance of 90 miles the first 22 miles only had been lightly formed, and thereafter only short lengths of weak formation existed across the worst of the natural depressions. All major streams had been bridged or provided with stone crossings. Otherwise the road over this 90 mile length was just a rough winding track.

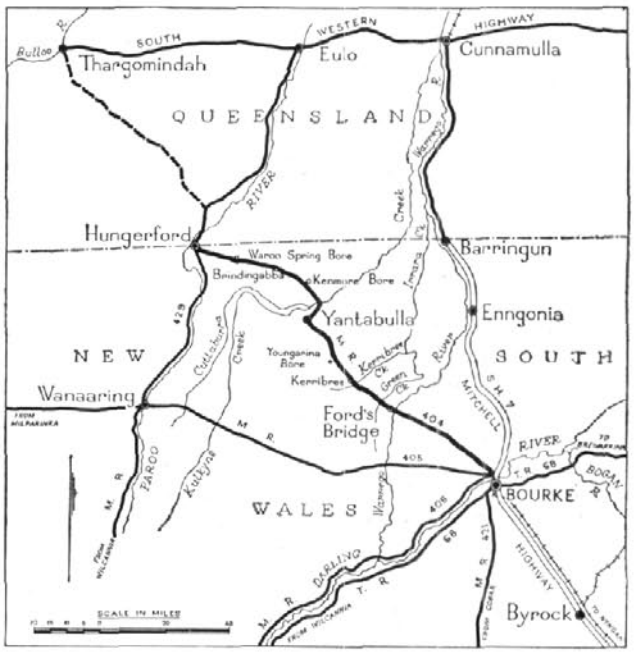
The work recently completed has comprised the following:—

(*a*) Clearing of trees and scrub for a length of 63 miles. Bulldozers were used for this work.

(*b*) Construction of 36½ miles of raised formations approximately 18 inches above natural surface over clay-pans and flat country subject to flooding. The most suitable and most efficient plant for this work is the elevating grader, a description of which appeared in the June, 1948, issue of this journal.

(*c*) Formation and reformation of 89½ miles by motor graders, tractors, drawn graders and power rippers over sandy and stony ridges and other sections of relatively high country.

(*d*) Provision of drainage by the construction of numerous causeways totalling nearly two miles in length, installation of forty-four pipe culverts under the formations and the construction of long lengths of roadside drains.



Locality Map.

(*e*) Gravelling black soil formations and supply of gravel for subsequent maintenance. The quantity of gravel involved was 26,500 cubic yards, the work being done by contract.

Road across red stony ridge 67 m. north of Bourke.

The cost of the work carried out was approximately £50,000.

The Bourke-Hungerford Road is now formed throughout. Time of travel has been reduced, wear and tear on vehicles and occupants have been lessened, and the road is usable under most weather conditions. Interruptions to traffic as a result of rain will be considerably briefer than in the past. A firm foundation has been provided for further improvement in the future when circumstances warrant.

The improvement of the Bourke-Hungerford Main Road is typical of the work being carried out by the Department in the Western Division of the State, where the aim is to improve travelling conditions over as great a mileage of main road as possible, and so to provide some benefit to as many road-users as possible. Since the new work was completed, operators of heavy haulage vehicles have claimed to have increased their mileage per gallon of petrol used by as much as 3 miles per gallon.

The improvement effected on the Bourke-Hungerford Road will benefit residents served in both New South Wales and Queensland, will assist in cheapening transport to meat works and railhead at Bourke, and will aid in securing increased production in the district.

The work was carried out under the general supervision of the Department's Assistant Maintenance Engineer, Mr. F. I. Peterson, the District Engineer, Bourke, Mr. J. L. Allan, being in immediate charge of construction.

Tenders Accepted.

The following Tenders (exceeding £1,000) were accepted by the Department during the months of October, November and December, 1948.

Council.	Road No.	Work.	Tenderer.	Amount.
				£ s. d.
Balmain M. / Drummoyne M.	165	New bridge over Iron Cove. Erection of steelwork, construction of deck and final completion.	Hornibrook McKenzie Clark Pty. Ltd.	81,833 4 6
Baulkham Hills S. / Colo S.	182	Construction of Ferry Vessel for use at Sackville Reach...	Morison and Bearby Pty. Ltd.	6,518 0 0
Broken Hill Dist.	81	Broken Hill to Silverton. Supply of 2,370 cubic yards aggregate.	Australian Blue Metal Co., Broken Hill.	3,603 15 0 excluding haulage.
,, ,, ...	81	Broken Hill to Silverton. Heating and spraying binder and application of aggregate between 2m. 1,042 ft. and 13m. 4,798 ft. and Spur Road to Penrose Park.	Grey Roads Pty. Ltd., Brisbane.	2,948 13 5
Broken Hill and Hay Districts.	...	Haulage of aggregate from Mildura Shire Council's quarries at Koorlong, Victoria, to State Highways Nos. 14 and 22.	W. B. Price	7d. per cu. yd. per mile.
Coonabarabran S.	17	Construction of timber bridge at 15m. 1,854 ft.	A. Gam	1,615 10 0
,, ...	17	Construction of timber bridge over Billy Creek	,, ...	2,214 4 0
Namoi S. ...	17	Construction of timber bridge over Andy's Creek ...	,, ...	1,879 5 6
,, ...	17	Construction of timber bridge over Mallallee Creek ...	,, ...	2,371 6 0
,, ...	17	Construction of timber bridge over Station Creek... ...	,, ...	2,939 9 6

The following Tenders (exceeding £1,000) were accepted by the respective Councils during the months of October, November and December, 1948.

Council.	Road No.	Work.	Tenderer.	Amount.
				£ s. d.
Berrigan S. ...	331	Supply of 117 tons of bitumen between Shire boundary and Finley.	Bitumen and Oil Refineries Ltd.	1,930 10 0
Bogan S. ...	7	Supply, delivery and spreading 1,656 cu. yds. gravel between 347.3m. and 361.1m.	D. E. Gibson	1,076 8 0
Booloorroo S. ...	12	Supply and deliver 1,070 cu. yds. aggregate between 214.6m.—221m.	R. E. Johnstone ...	1,471 5 0
Byron S.	65	Supply and application of binder	B.H.P. By-Products Pty. Ltd.	1,058 5 0
Canobolas S. ...	61	Supply and delivery of 725 cu. yds. aggregate between 8m. 1,000 ft. and 11m. 3,700 ft. Orange to Parkes.	Broule King Minerals Syndicate.	1,015 0 0
Carrathool S. ...	321	Gravelling between 1m. 30 ch. and 2m. 30 ch. and between 5m. 16 ch. and 6m. 76 ch.	Hardie and Co. ...	1,020 6 10
,, ...	80	Gravelling between 10m. 67 ch. and 15m. 43 ch.... ...	,, ...	1,270 6 10
,, ...	244	Supply, delivery and spreading limestone	,, ...	1,619 15 0
,, ...	6	Gravelling between 47.04m. and 54.2m.	,, ...	1,846 6 10
,, ...	6	Gravelling between 114.75m. and 120.75m.	P. H. Micchel	2,510 0 0

Council.	Road No.	Work.	Tenderer.	Amount. £ s. d.
Cockburn S. / Peel S. ...	1,093	Construction of timber beam bridge over the Peel River at Somerton.	A. Gam	6,921 4 6
,, ...	1,093	Construction of approaches to new timber beam bridge over the Peel River at Somerton.	,, ...	2,516 4 3
Cockburn S. ...	105	Construction of road on new alignment between 5m. 100 ft. and 6m. 2,500 ft. from Tamworth.	H. T. Roach	3,120 16 6
Coolamon S. ..	240	Surfacing	W.B. Carr Constructions	1,027 6 7
,, ...	243			
Conargo S. ...	331	Bituminous surfacing. Supply of 150 tons of bitumen...	Bitumen and Oil Refineries Ltd.	2,425 0 0
Gloucester S. ...	1,110	Construction from 19m. 900 ft. to 21m. 1,600 ft.	H. G. Watson	12,367 4 0
,, ...	10	Supply of aggregate for bitumen surfacing...	B.H.P. By-Products Pty. Ltd.	2,255 10 0
Goobang S. ...	61	Flush sealing with bitumen between Parkes and Manildra. Also through Tullamore, Bogan Gate and Trundle.	W.B. Carr Constructions	4,026 14 4
,, ...	57			
,, ...	350			
Hume S.	80	Surfacing	B.H.P. By-Products Pty. Ltd.	1,805 8 5
,, ...	197			
Jamberoo M. ...	264	Surfacing, including supply of primer and binder... ...	,, ,, ...	1,927 18 5
Jemalong S. ...	17	Supply, delivery and spreading 3,752 cu. yds. gravel between 6.95m. and 30.4m. from Forbes towards West Wyalong.	J. R. Brown	1,095 10 8
Kyeamba S. ...	211	Priming and sealing	B.H.P. By-Products Pty. Ltd.	1,236 9 9
,, ...	384	Priming and sealing	,, ,, ...	1,258 5 8
,, ...	1,117	Construction including earthworks and culvert	W. A. Winnett ...	4,820 3 3
Kyogle S. ...	140	Surfacing	B.H.P. By-Products Pty. Ltd.	2,235 19 5
Lachlan S. ...	377	Supply, delivery and spreading 3,270 cu. yds. gravel between 22m. and 29m.	R. E. Scarce	1,291 16 0
Liverpool Plains S.	3,051	Construction, formation, gravelling and culverts 11.25m. to 11.87m. from Breeza.	R. A. Wilson	2,250 11 7
Lockhart S. ...	59	Surfacing	B.H.P. By-Products Pty. Ltd.	3,326 0 11
,, ...	57	Surfacing	,, ,, ...	4,179 14 10
Macintyre S. ...	12	Surfacing 128m. to 131m.; 161m. to 164m.; and resurfacing 134m. to 139m. and from 151m. to 156m.	Chesterfield and Jenkins.	2,311 4 2
Manning S ...	110	Supply and delivery of aggregate	Manning Sand and Gravel Co.	1,090 18 9
,, ...	111			
,, ...	192			
,, ...	10			
Mitchell S. ...	57	Reconstruction from 6m. 500 ft. to 11m. 3,070 ft. north of Wagga.	L. W. Alexander ...	4,428 13 6
Mulwaree S. ...	2	Surfacing	B.H.P. By-Products Pty. Ltd.	1,048 17 8
Murrumbidgee S.	14	Supply and delivery 19,760 cu. yds. loam...	Hardie and Co. ...	3,700 0 0
Muswellbrook S....	209	Surfacing	B.H.P. By-Products Pty. Ltd.	2,360 1 10
Nambucca S. ...	118	Resealing	,, ,, ...	1,080 3 2
Oberon S. ...	256	Supply and delivery of 6,560 cu. yds. gravel	K. S. Soames	2,542 0 0
Port Stephens S.	506	Supply and delivery of 2,000 cu. yds. of gravel between Karuah Ferry and 65 chns. westerly.	W. & M. Kennedy ...	1,400 0 0
Rylstone S. ...	215	Supply and delivery of 6,560 cu. yds. gravel	J. & A. Lighezzolo ...	3,060 0 0
Shellharbour M.	522	Surfacing between 5.37m. and 8.11m.	W.B. Carr Constructions	1,131 5 4
Snowy River S. ...	286	Bitumen surfacing 41,522 sq. yds.	B.H.P. By-Products Pty. Ltd.	1,960 1 4
Terania S. ...	142	Resealing	,, ,, ...	1,080 3 2
,, ...	306			
Tweed S. ...	142	Resealing	,, ,, ...	3,595 19 0
,, ...	143			
Vaucluse M. ...	339	Supply of ready-mixed concrete	Ready Mixed Concrete (N.S.W.) Pty. Ltd.	7,850 0 0
Wade S.	80	Surfacing	B.H.P. By-Products Pty. Ltd.	2,156 12 4
Wallarobba S. ...	101	Bitumen flush seal and re-seal	,, ,, ...	1,433 9 1
,, ...	128			
Waradgery S. ...	514	Shouldering and sheeting with loam 17.75m. to 30.3m. ...	Vincent Murphy ...	1,586 0 0
Weddin S. ...	17	Supply, delivery and spreading 4,000 cu. yds. gravel between 0m. and 12.5m. at Jemalong Shire boundary.	J. Gam	1,750 0 0
,, ...	6	Supply, delivery and spreading of 5,120 cu. yds. gravel between 216m. and 232m.	A. J. Gam	1,088 0 0
Yallaroi S. ...	12	Surfacing 182.8m. to 188.8m. Supply of 1,340 cu. yds. aggregate.	R. E. Johnstone ...	2,345 0 0

Sydney: Alfred Henry Pettifer, Government Printer—1949.

MAIN ROADS STANDARDS.

NOTE: Numbers prefixed by "A" are drawings, the remainder are specifications unless otherwise noted.

Form No.

EARTHWORKS AND FORMATION.

70* Formation. (Revised, July, 1946.
A 1532* Standard Typical Cross-sections.
A 1149* Flat Country Cross-section, Type A. (Revised, 1930.)
A 1150* Flat Country Cross-section, Type B. (Revised, 1936.)
A 1151* Flat Country Cross-section, Type D1. (Revised, 1936.)
A 1152* Flat Country Cross-section Type D2. (Revised, 1930.)
A 1476 Flat Country Cross-section, Type E1. (Revised, 1937.)
A 1101 Typical Cross-section One-way Feeder Road. (1936.)
A 1102 Typical Cross-section Two-way Feeder Road. (1931.)
A 114 Rubble Retaining Wall. (1941.)

PAVEMENTS.

71* Gravel Pavement. (Revised, January, 1939.)
228* Reconstruction with Gravel of Existing Pavements. (Revised, January, 1939.)
254 Supply and Delivery of Gravel. (Revised, August, 1939.)
72* Broken Stone Base Course. (Reprinted with amendments, August, 1947.)
68* Reconstruction with Broken Stone of Existing Pavement to form a Base Course. (Revised, October, 1933.)
296 Tar. (Revised, March, 1939.)
337 Bitumen. (Revised, February, 1939.)
305 Bitumen Emulsion. (Revised, September, 1942.)
351 Supply and Delivery of Aggregate. (Revised, July, 1941.)
65* Waterbound Macadam Surface Course. (July, 1939.)
301* Supply and Application of Tar and/or Bitumen. (Revised, August, 1946.)
122* Surfacing with Tar. (Revised, May, 1940.)
145* Surfacing with Bitumen. (Reprinted with amendments, August, 1947.)
93* Re-surfacing with Tar. (Revised, May, 1940.)
94* Re-surfacing with Bitumen. (Revised, October, 1947.)
230* Tar or Bitumen Penetration Macadam, Surface Course, 2 inches thick. (Revised, December, 1936.)
66* Tar or Bitumen Penetration Macadam, Surface Course, 3 inches thick. (Revised, September, 1936.)
125* Cement Concrete Pavement (April, 1939) and Plan and Cross-section A 1147 (March, 1932).
166 Bituminous Flush Seals and Reseals—Fluxing of Binders. (March, 1947.)

GENERAL.

342* Cover Sheet for Specifications, Council Contract. (Revised, April, 1939.)
248* General Conditions of Contract, Council Contract. (Revised, August, 1948.)
64* Schedule of Quantities.
39* Bulk Sum Tender Form, Council Contract. (Revised, August, 1946.)
38* Bulk Sum Contract Form, Council Contract.
121* Provision for Traffic (Revised, June, 1947) with general arrangement, A 1323* and details A 1325* of temporary signs. (Revised, January, 1947.)
A 1342* Warning Signs, Details of Construction.
A 1346 Iron Trestles for Road Barriers.
A 1341 Timber Trestle and Barrier.
A 1824 Light Broom Drag. (1941.
A 1924 Pipe Frame Drag.
A 178 Mould for Concrete Test Cylinder.
A 1381-3, A 1452-5 Tree Guards, Types A, B, C, D, E, F, and G.
197* Hire of Council's Plant. (Revised, April, 1937.)
A 478* Specimen Drawings, Rural Road Design, with drawings A478A* and A 478B*.
A 478C* Specimen Drawing, Flat Country Road Design.
A 1113* Rural Road Plan and Longitudinal Section Form (tracing cloth).
A 1114* Rural Road Cross-section Form (tracing cloth).
A 1115* Urban Road Plan Forms (tracing cloth).
193 Duties of Superintending Officer (instructions). (Revised, July, 1938.)
314 Standard Regulations for Running of Ferries. (Revised, January, 1947.)
A 1645 Stadia Reduction Diagram. (1939.)
355* Instructions for Design of Two-lane Rural Highways (1937).
A 1487* Horizontal Curve Transitions (diagrams).
A 1488*, A 1488A*, A 1488B*, and A 1488C*.—Horizontal Curve Transitions (tables for speeds of 30, 40, 50, and 60 miles per hour).
A 1614 Widening of Shoulders on Crests.
369* Instructions for Design of Urban Roads (1939).
288 Instructions for Design of Intersections (Revised, January, 1948.)
402 Instructions for Design of Rural Intersections (acceleration and deceleration lanes). (1941.)

Form No.

KERBS, GUTTERS, AND GULLY PITS.

243 Integral Concrete Kerb and Gutter and Vehicle and Dish Crossings (Revised, July, 1939) and Drawing. (A134A.)
245 Gully Pit (Revised, May, 1939) and Drawings (*a*) with grating (A 1042); (*b*) Kerb inlet only (A 1043); (*c*) with grating and extended kerb inlet (A 1352); (*d*) extended kerb inlet (A 1353).
A 190 Gully Grating. (1933.)
A 1418 Concrete Converter. (1936.)

FENCING.

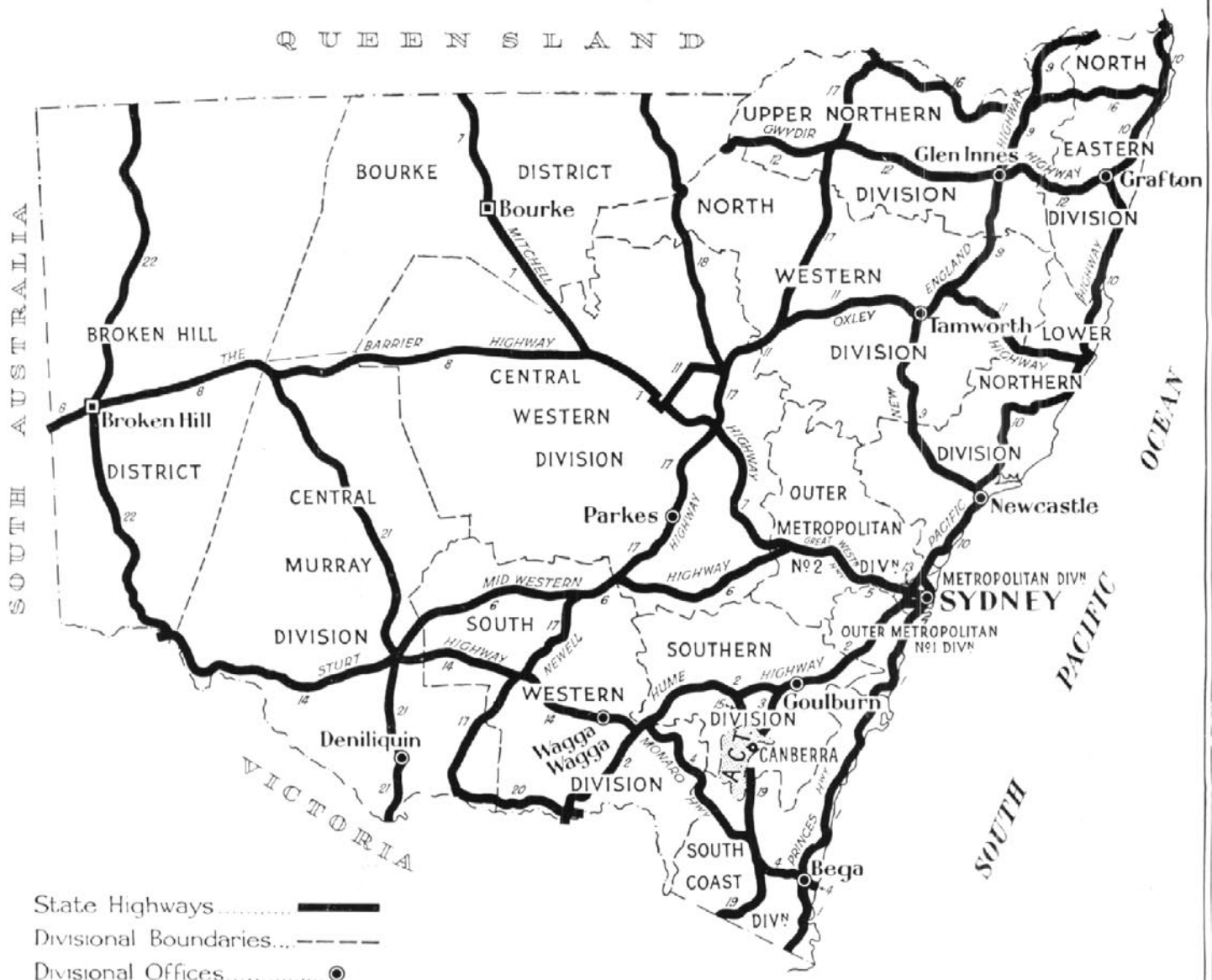
142 Split Post and Rail Fencing and Drawing (A 43).
141* Post and Wire Fencing (Revised, December, 1947) and Drawings (*a*) Plain (A 494); (*b*) Rabbit-proof (A 498); (*c*) Flood gate (A 316).
143 Ordnance Fencing (Revised, February 1934) and Drawing A 7 (Revised, November, 1939.)
144 Chain Wire Protection Fencing and Drawing (A 146).
246 Location of Protection Fencing (instruction). (Revised, May, 1940.)
A 1301 Motor Traffic By-pass 9 feet wide. (1936.)
A 1875 Motor Traffic By-pass 20 feet wide. (1942.)

BRIDGES AND CULVERTS.

A 4 Standard Bridge Loading (general instruction). (1948.)
A 4A Standard Bridge Loading (instruction for dead-end Developmental Roads.) (Revised, 1938.)
18* Data for Bridge Design. (Revised, August, 1944.)
84* Data accompanying Bridge or Culvert Designs.
A 26 Waterway Diagram. (Revised, 1943.)
371 Waterway Calculations. (1939.)
A 421 Boring Gear, 2 inches. (1930.)
A 44 Boring Gear, 3½ inches. (1926.)
A 2847 Rod Sounding Apparatus. (1945.)
A 2995 Rod Sounding Apparatus, with tripod (1947).
25* Pipe Culverts and Headwalls (Revised, December, 1939) and drawings, Single Rows of Pipes, 15 in. to 21 in. dia. (A 143*), 2–3 ft. dia. (A 139*), 3 ft. 6 in. dia. (A 172*), 4 ft. dia. (A 173*), 4 ft. 6 in. dia. (A 174), 5 ft. dia. (A 175), 6 ft. dia. (A 177); Double Rows of Pipes, 15 in. to 21 in. dia. (A 211*) 2–3 ft. dia. (A 203*), 3 ft. 6 in. dia. (A 215), 4 ft. dia. (A 208), 4 ft. 6 in. dia. (A 207), 5 ft. dia. (A 206), 6 ft. dia. (A 213); Treble Rows of Pipes, 15 in. to 21 in. dia. (A 210), 2–3 ft. dia. (A 216), and Straight Headwalls for Pipe Culverts, 15–24 in. dia. (A 1153*).
A 1* Joint for Concrete Pipes. (Revised, August, 1933.)
A 142* Inlet Sump Pipe Culverts for 3 ft. dia. or less. (Revised, December, 1947.)
138* Pre-Cast Concrete Box Culvert (Revised, February, 1948) and drawings, 9 in. high (A 485*), 12 in. (A 446*), 1 ft. 6 in. (A 447*), 2 ft. (A 448*), 2 ft. 6 in. (A 449).
A 311 Concrete Arch Culvert, 5 ft. high. (1931.)
A 314 Concrete Arch Culvert, 10 ft. high. (1931.)
206* Reinforced Concrete Culvert (Revised, February, 1948) and instruction sheets (A 305, A 359, A 306, A 304).
A 1832 Cast-in-Place Concrete Pipe Culverts. (1942.)
A 309* Concrete Culvert Posts. (Revised, June, 1937.)
300 Pile Drivers, specification for 25 ft., and drawings for 50 ft. (A 209), 40 ft. (A 253), and 25 ft. portable (A 1148).
A 1886 Arrangement of Bolting Planks for various widths of deck. (Revised, September, 1948.)
A 45 Timber Bridge, Standard Details. (Revised, October, 1947.)
A 1791 Timber Beam Skew Bridge Details. (1941.)
164 Timber Beam Bridge (Revised, April, 1947) and instruction sheets, 16 ft. (A71), 18 ft. (A 68), 20 ft. (A 70) and 22 ft. (A 1761). (Amended August, 1946.)
A 1226 and A 1165 Low Level Timber Bridges, instruction sheets for 16 feet, and 18ft. between kerbs. (1932.)
A 1222, A 1166, and A 1223 Single Span Timber Culverts, instruction sheets for 16 ft., 18 ft. and 20 ft. between kerbs. (1931.)
139* Timber Culvert and drawings, 1 ft. 6 in. high (A 427), 2 ft (A 428), 3 ft. (A 429), 4 ft. (A 430), 5 ft. to 8 ft. high, (A 431). (1928.)
326 Extermination of Termites in Timber Bridges. (Revised, October, 1949).
A 222* Pipe Handrailing Details. (Revised, July, 1947.)
350 Reinforced Concrete Bridge. (Revised, January, 1946.)
495 Design of Forms and Falsework for Concrete Bridge Construction (September, 1947.)

Standards marked * may be purchased from the Government Printer, Sydney. Others may be purchased from the Head Office of the Department of Main Roads, 309 Castlereagh Street, Sydney, single copies being free to Councils.

State Highway System of the State of New South Wales



State Highways .....
Divisional Boundaries .....
Divisional Offices .....

SCALE
50 0 50 100 150 200

Area of New South Wales, 309,433 square miles.
Length of public roads within New South Wales, 126,058 miles.

MILEAGE OF ROADS CLASSIFIED UNDER THE MAIN ROADS ACT, AS AT 1st JULY, 1948.

State Highways	6,490
Trunk Roads	3,741
Main Roads	12,635
Secondary Roads (County of Cumberland only)	56
Developmental Roads	2,801
	25,723
UNCLASSIFIED ROADS, in Western part of State, coming within the provisions of the Main Roads Act	2,309
TOTAL	28,032