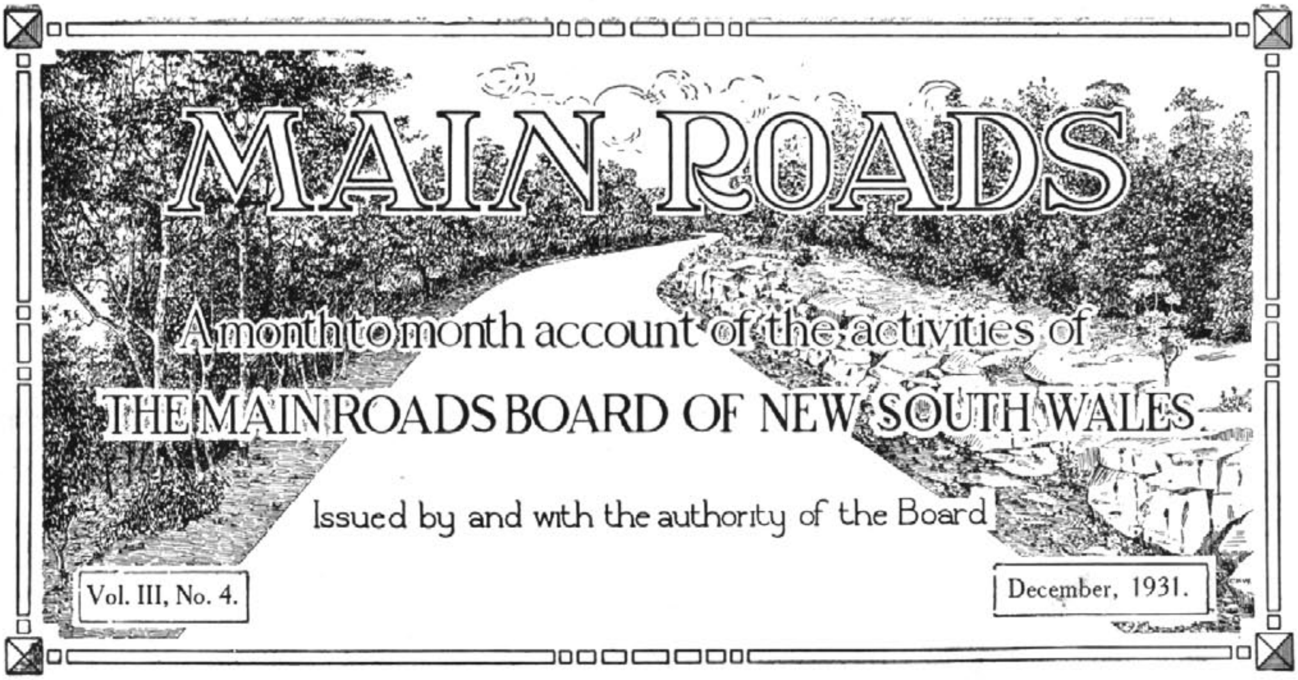


News of the Month.

Metropolitan Division.

Providing an alternative route to Main Road No. 164 (Miller-street and Military-road) for traffic from the northern approaches of the Sydney Harbour bridge to Cremorne, Secondary Road No. 2019 runs through Neutral Bay and Cremorne, via Kurraba-road, Bannerman-street, Murdoch-street, Ranger's-road, and Spofforth-street to Military-road at Cremorne Junction. Spofforth-street, between Ranger's-road and Military-road, is a boundary road between the Municipalities of Mosman and North Sydney. The 12-feet strip between the tram tracks and the kerb on the Mosman side of Spofforth-street had been reconstructed in cement concrete by the Mosman Council prior to the declaration of the road as a secondary road. The North Sydney side, however, being in a very bad state of repair, in July, 1931, the Board finalised arrangements with the North Sydney Council for the latter to carry out the reconstruction of that side also in cement concrete. The work, which included extensive additions to the underground stormwater drainage system, has now been completed.

Portions of the Prince's Highway in the Shire of Sutherland have recently been reconditioned by adding a thin sheet of pre-mixed material without disturbing the existing surface. The sections treated comprise a length of 1 mile between George's River and Port Hacking road, and four short sections, of total length half a mile, between 14 m. and 15 m. Lengths of similar work, amounting to about 1½ miles, have been utilised to restore the riding qualities of the Lower South Coast road (No. 185) between Coalcliff and Clifton, at Scarborough and at Coledale, in the Shire of Bulli. A tar-bitumen mixture was used as the binder in the pre-mixed material.

Bulli Pass, Prince's Highway.

Outer Metropolitan Division.

The divisional bridge maintenance gang has recently repaired two bridges, and is now engaged upon a third, on the Prince's Highway between Albion Park and Nowra. The timber beam bridge over Macquarie Rivulet has been redecked, and some girders and a pile renewed. A similar type of bridge over Tandingulla

Creek, some miles nearer Nowra, has been reconstructed and widened. At the bridge over Bomaderry Creek, near Nowra, the piles are being protected against erosion of the river bank and consequent attack by cobra. Jointed reinforced concrete pile armour is being placed around the piles, and filled with concrete.

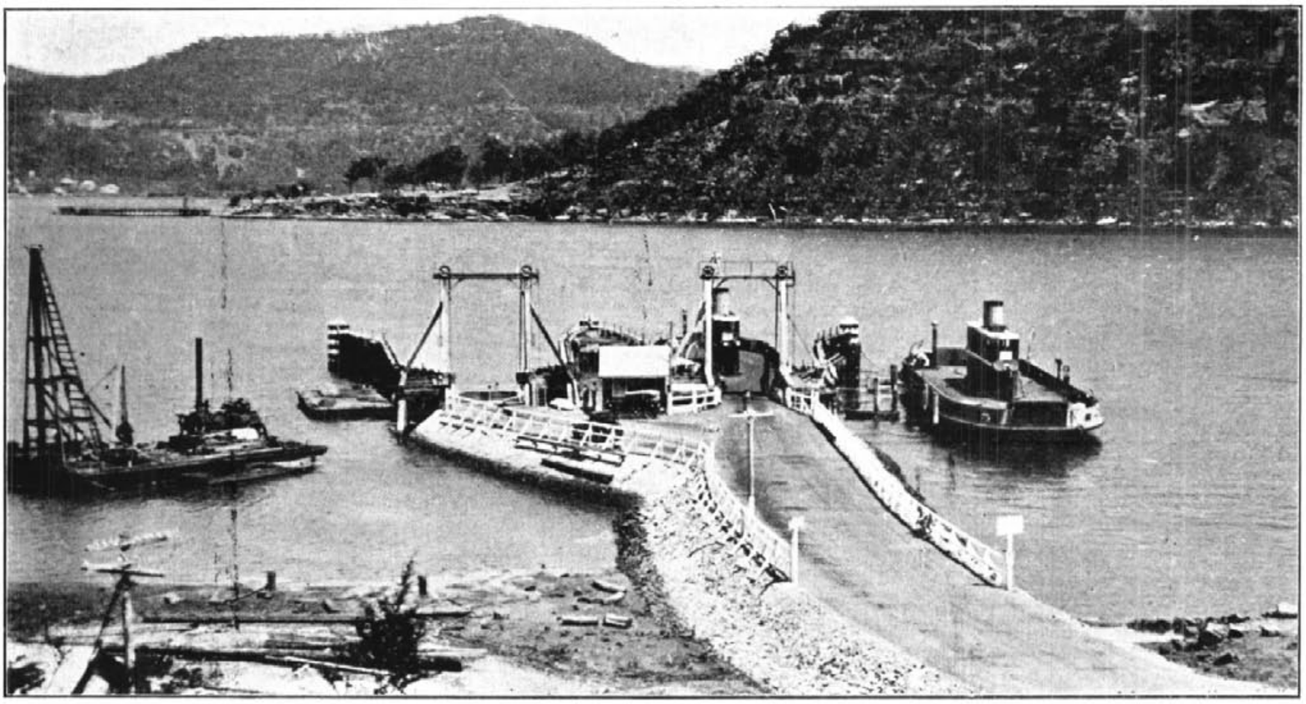
The Bathurst Municipal Council is resurfacing a length of 1 mile of the Great Western Highway at Kelso, using tar from the council's gas works.

Parts of the Prince's Highway through Berry are being resurfaced with tar by the maintenance staff. Opportunity is being taken to extend the surfacing south of the township about a quarter of a mile to connect up with existing work of the same type.

On the Tenterfield-Casino trunk road (No. 64) in the Municipality of Casino, 2,076 lineal feet of 2-inch tar-penetration macadam is being constructed by the council.

The sections of the Gwydir and Great Northern Highways, in the Municipality of Glen Innes, which are at present badly potholed and worn, are being reconditioned with a scarifier-grader plant made available by the Board to the council. The section of the Gwydir Highway towards Grafton has already been completed, and work is now in progress on the section of the Great Northern Highway towards Tenterfield.

The Tenterfield-Ballina trunk road (No. 64) is today in better condition throughout its length than at



The Hawkesbury Ferry, Pacific Highway. Mooney Point docks, with the two ferry vessels in the foreground, and Kangaroo Point docks in the left background.

any time since the inception of the division, due to regular patrol maintenance of the gravel sections in Tenterfield Shire, and the gradual reconditioning and improvement of the waterbound macadam pavement in Kyogle, Tomki and Gundurimba Shires. Similar work to the fine crushed rock construction undertaken in Kyogle Shire, and referred to in *News of the Month* in the October, 1931, issue of *Main Roads* is being carried out in Gundurimba Shire. In Tintenbar Shire, two lengths of existing bitumen surfacing near Alstonville have been widened from 15 feet to 18 feet, and the crossfall, which was very steep, reduced to 1 in 24.

On the Gwydir Highway, in the Municipality of Inverell, a length of 4,800 lineal feet east of the Inverell post office is to be tar-surfaced this year, completing a continuous length of tar-surfacing from the eastern municipal boundary to Roslyn-street.

Tweed Shire Council has completed 1¼ miles of formation and gravelling on the Murwillumbah-T...

The signposting of the Prince's Highway is now complete within the division, *i.e.*, from Bulli to Nowra.

In the past, lengths of the Moss Vale-Kangaroo Valley-Nowra road (No. 261) have been very difficult for travellers, especially during wet weather, but a considerable improvement has been effected by the Councils of Wingecarribee, Cambewarra, and Moss Vale under the 1931 maintenance programmes.

Upper Northern Division

Nymboida Shire Council is constructing two standard reinforced concrete arch culverts on the Gwydir Highway between South Grafton and Newton Boyd, each replacing a worn-out timber structure. The culvert at Frenchman's Creek, 47.8 miles from South Grafton, will be 10 feet high, and that at Bruce's Creek, 58.4 miles, 5 feet high.

Heads road (No. 142), at 19 miles 4,400 feet from Murwillumbah. This eliminates the last unsurfaced length on this road.

Lower Northern Division.

During the past winter, the Quirindi-Gunnedah road (No. 126), was impassable, owing to the state of the black soil on Breeza Plain. This has now dried out, and the road, which is the shortest route from Quirindi to Gunnedah, Narrabri, and Moree can now be traversed in safety. Recent maintenance work undertaken by the Tamarang Shire Council has put the section from Quirindi to Coeypolly into good order. Between Coeypolly and Breeza, the road crosses the black soil and is rather rough, but improving in that respect under traffic. Between Breeza and Gunnedah, the Liverpool Plains Shire Council has undertaken extensive maintenance operations during the past few months; this section, although not formed in places, is in good running order for practically the whole of its length.

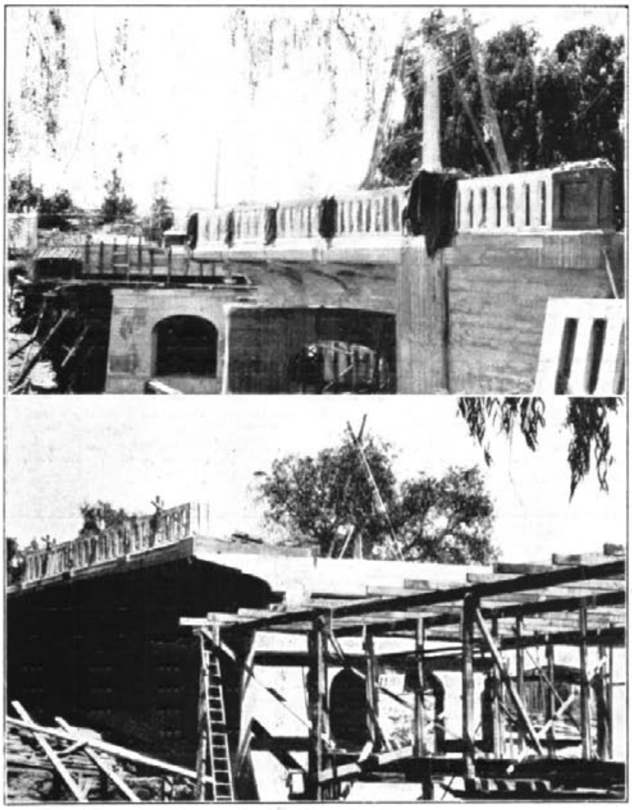
A single-span timber beam bridge has just been completed on the Bellingen-Dorrigo road (No. 119), 7½ miles from Bellingen, in Bellingen Shire. This bridge replaces an old, unsound, timber structure which was approached by a steep, narrow road having dangerous lack of visibility. The new work includes a deviation 650 feet long, giving much improved grading and alignment.

The substructure of the new five-span low level timber beam bridge over the South Arm of the Bellinger River at Blake's Crossing, on the Bellinger-Kalang developmental road (No. 1136) in Bellingen Shire, is complete. A novel method of pile-driving has been employed here. The river bed consists of about 13 feet of quartz gravel, overlying hard shale. To ensure that the piles would be secure against floods, holes were excavated through the gravel to the shale, in which bores 4 feet deep were made. The bores were then charged at the rate of 8 lb. of gelignite per pile, and, after firing, the piles were driven in the ordinary way into the shattered rock.

Central Western Division.

Repairs to the bridge over the Lachlan River at Cowra, on the Mid-western Highway in the Municipality of Cowra, have been completed by the divisional bridge gang. The work included partial renewal of timber truss members, cross girders, stringers and decking. The gang is at present repairing the piers and superstructure of the bridge over Belubula Creek, on the same highway in the Municipality of Carcoar.

The reconstruction of Gaskell-street, Canowindra, portion of the Orange-Canowindra-Grenfell road (No. 277) and the Canowindra-Woodstock road (No. 310) in the Shire of Boree, is being carried out by the council by day labour. The pavement consists of a 6-inch waterbound macadam base and a 3-inch penetration macadam surface course. The base course has been practically completed and the surface course will shortly be commenced. Considerable difficulty was experienced in consolidating the subgrade owing to seepages, extensive subsoil drains having to be provided to deal with the water. The pavement is being constructed from kerb to kerb, the Board sharing the cost of the central 20 feet.



Reinforced concrete bridge under construction in Short-street, Young.

Goobang Shire Council is making good progress with reconditioning the Forbes-Peak Hill trunk road (No. 56) by scarifying, reshaping, adding gravel, and consolidating by watering and rolling.

Southern Division.

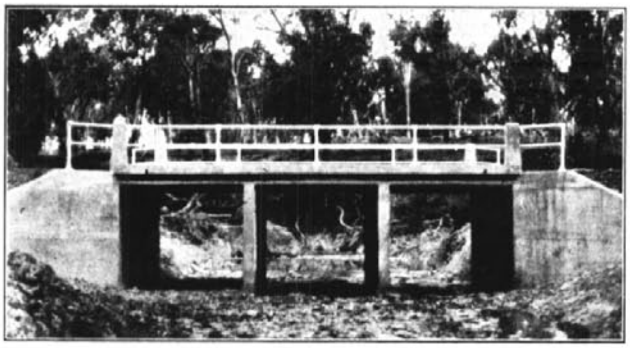
Goulburn City Council will shortly be moving 2,000 feet of watermain from the middle of the roadway to the side on the Goulburn-Dalton road (No. 251), preparatory to reconstruction in penetration macadam.

On the Hume Highway in the Shire of Mulwaree, Contractors Lane and Peters have completed the pouring of the concrete on their contract for the construction of 5 miles of pavement through Marulan.

Contractors Cooper Bros. and P. J. Freebody have completed the supply and stacking of 1,150 cubic yards of maintenance gravel on the Federal Highway in the Shire of Gunning.

Mulwaree Shire Council has completed by day-labour 2 miles of new gravel pavement, with culverts, on the Federal Highway, south-west of Yarra.

The divisional bridge gang is effecting repairs to the bridge over the Bega River on the Bega-Bermagui



New triple 10-ft. x 9-ft. concrete culvert, over Keajura Creek, on the Hume Highway in Kyeamba Shire.

road (No. 272), in the Municipality of Bega. This bridge of five 90-feet timber trusses and nineteen timber beam approach spans was built in 1894.

Contractor G. Warne has completed the supply, delivery, and spreading of 1,914 cubic yards of maintenance gravel between Rhinefalls and Adaminaby, on the Monaro Highway in the Shire of Dalgety.

Riverina Division.

At the new three-span concrete bridge in Short-street, Young (referred to in the September issue of *Main Roads*), the piers and abutments have been completed. The deck of the span at the Harden end has been concreted and the forms are ready for the concreting of the deck of the span at the Young end.

A single-span timber bridge has been constructed by Conargo Shire Council on the Deniliquin-Conargo trunk road (No. 59), at Piccaninny Creek (an anabranch of Forest Creek), where a washaway occurred during the recent floods. Plans are being prepared for the construction of a second bridge over Forest Creek, on the same road near Conargo, where further damage took place.

Expenditure from 1st July, 1931, to 31st October, 1931.

	Expenditure from 1st July, 1931, to 30th September, 1931.	Expenditure for month of October, 1931.	Total Expenditure to 31st October, 1931.
	£ s. d.	£ s. d.	£ s. d.
County of Cumberland Main Roads Fund—			
Construction of Roads and Bridges	6,180 16 7	4,918 2 9	11,098 19 4
Cost of Land Resumptions	19,785 0 7	2,033 3 2	21,818 3 9
Maintenance of Roads and Bridges	45,234 11 11	13,537 6 11	58,771 18 10
Repayment of Loans	28,080 6 7	12,827 16 8	40,908 3 3
Survey, Design, Supervision and Administration	19,934 15 9	6,357 5 10*	13,577 9 11
Miscellaneous	....	....	....
Totals ... ... £	119,215 11 5	26,959 3 8	146,174 15 1
Country Main Roads Fund—			
Construction of Roads and Bridges, including Resumptions ...	33,356 16 10	6,796 1 2	40,152 18 0
Maintenance of Roads and Bridges	159,940 7 9	54,388 6 0	214,328 13 9
Repayment of Loans	....	16,761 3 6	16,761 3 6
Survey, Design, Supervision and Administration	16,164 5 6	17,785 4 8	33,949 10 2
Miscellaneous	2,119 8 10	4,022 14 7	6,142 3 5
Totals ... ... £	211,580 18 11	99,753 9 11	311,334 8 10
Federal Aid Roads Fund—			
Construction of Roads and Bridges, including Resumptions ...	33,264 17 3	6,457 19 0	39,722 16 3
Miscellaneous	50 16 2	8 0 0	58 16 2
Totals ... ... £	33,315 13 5	6,465 19 0	39,781 12 5
Developmental Roads Fund—			
Construction of Roads and Bridges	12,573 7 4	2,866 19 3	15,440 6 7
Survey, Design, Supervision, and Administration	504 2 9*	931 9 11	427 7 2
Miscellaneous	15 5 2	136 1 3	151 6 5
Totals ... ... £	12,084 9 9	3,934 10 5	16,019 0 2
Summary, All Funds—			
Construction of Roads and Bridges, including Resumptions ...	105,160 18 7	23,072 5 4	128,233 3 11
Maintenance of Roads and Bridges	205,174 19 8	67,925 12 11	273,100 12 7
Repayment of Loans	28,080 6 7	29,589 0 2	57,669 6 9
Survey, Design, Supervision, and Administration	35,594 18 6	12,359 8 9	47,954 7 3
Miscellaneous	2,185 10 2	4,166 15 10	6,352 6 0
Grand Total ... ... £	376,196 13 6	137,113 3 0	513,309 16 6

* Credits.

Construction Standards for Spur Developmental Roads.

IN the Board's Third Annual Report, under the heading *Future Developmental Roads Policy*, it was pointed out that developmental roads may be divided for construction purposes into two broad groups, viz.:—

(i) Those which after construction have a reasonable prospect of carrying "through" traffic and being proclaimed main roads;

(ii) Those which have little or no prospect of ever becoming through roads, *i.e.*, spur roads.

Roads of group (i) clearly should be constructed to appropriate main road standards. Roads of group (ii) need not follow these. The need in either case is to fit the road to the type of traffic which it will be called upon to carry.

So far as class (ii) roads are concerned, the provision of as great a length of road as possible, of a type which the Council responsible will be able to maintain efficiently with the funds likely to be available, renders necessary the selection of construction standards upon a basis somewhat different from that applying to through routes. An indication of the widths of roadway and structures considered suitable for the second group of developmental roads was given in the Annual Report referred to above, and was followed, in September, 1929, by the issue of standard typical cross-sections for feeder roads in hilly country to suit one-way and two-way traffic, respectively. With a view to incorporating the whole of the Board's present practice in regard to these roads, the following summary has been prepared as indicating the general basis recommended for work on developmental roads of the spur or feeder type.

Grading.—The standard diagram showing the variation of allowable maximum grade with distance (Drawing No. A-492, see also Fig. 1) is based upon the heaviest grades which a commercial vehicle of about 4 tons load capacity can negotiate in top gear, one assumption being that the alignment is such as to render a speed of 25 m.p.h. practicable, particularly at the foot of each section of steep grade. The standard is thus applicable, broadly, to all classes of roads.

However, some of the circumstances peculiar to spur roads may warrant modification of the standard. For example, it is physically impossible for vehicles to negotiate a curve of 100-ft. radius at a greater speed than about 25 m.p.h., or 15 m.p.h. for a 50-ft. radius curve, which indicates that alignment—*e.g.*, a sharp curve at the foot of a steep grade,—may interfere with the acquisition of the momentum relied upon for surmounting the grade. On the other hand, teams, and heavy vehicles travelling in other than top gear, have no useful momentum; in this case, ruling grade and allowable maximum have the same meaning. Traffic will be sparse on spur roads—this, in conjunction with the need to improve as great a length of road as possible, will warrant a lesser rate of expenditure per mile upon grade improvement than would be justifiable on through roads; and finally, such vehicles as the heavy truck mentioned above are not favoured for use on pioneer roads—vehicles of about half the capacity and possessing, relatively, much better climbing ability being preferred.

Steep grades tend to scour, but this can be controlled, although not always at slight cost, by giving extra attention to the drainage of the roadway.

Thus, at the initiation of a project, when the matters of route and widths are being settled, the question of grades (in conjunction with alignment) should also be examined. If grades conforming to the standard diagram are not obtainable readily, a steeper scale is permissible. For example, the scale shown dotted in Fig. 1, which gives grades 1 per cent. higher than the standard throughout, would be acceptable on this class

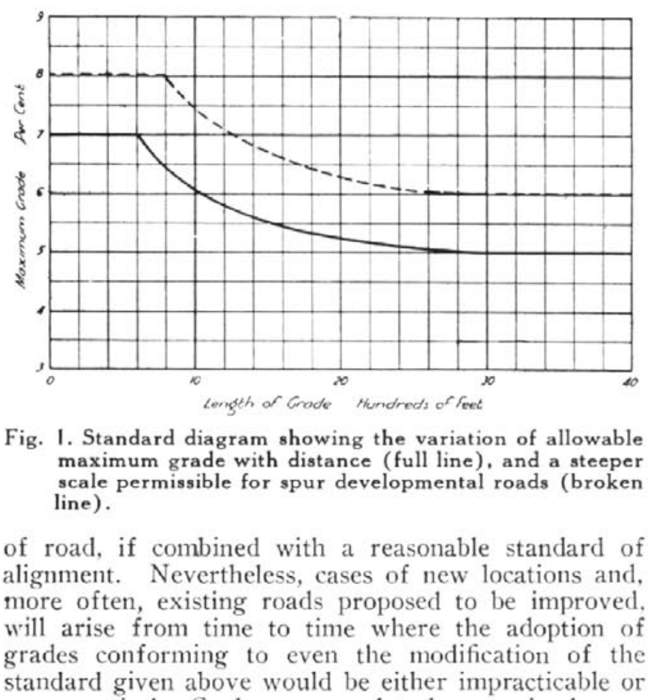


Fig. 1. Standard diagram showing the variation of allowable maximum grade with distance (full line), and a steeper scale permissible for spur developmental roads (broken line).

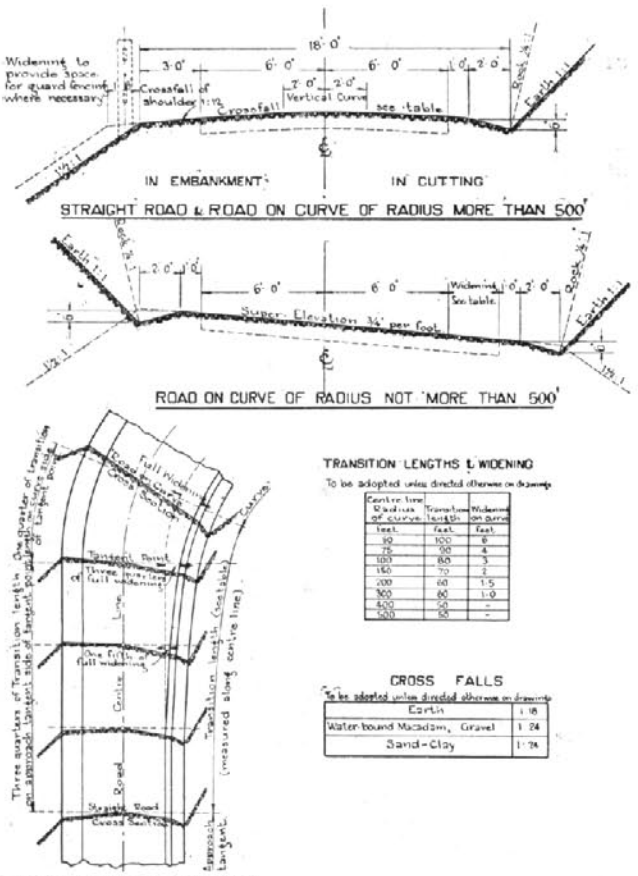
of road, if combined with a reasonable standard of alignment. Nevertheless, cases of new locations and, more often, existing roads proposed to be improved, will arise from time to time where the adoption of grades conforming to even the modification of the standard given above would be either impracticable or uneconomical. Such cases need to be examined carefully from all angles and considered on their merits.

Alignment.—No definite minimum radius of curvature, or minimum sight distance is proposed, since cost must be the determining factor in all cases. A radius of 300 feet and a sight distance of a like amount are necessary to provide facilities on a curve in any way comparable with those on a tangent. When these figures are halved, speeds must be greatly reduced and considerable care be exercised at curves. When they are halved again, a definite element of danger is introduced, unless the particular road abounds in sharp curves which cause special care and watchfulness on the part of drivers. Sharp curves necessitate considerable widening of the formation, benching of cuttings or cutting back of trees and scrub to provide a reasonable sight distance, easing of the grade to ensure that the grade of the inside edge of the formation does not exceed the ruling grade, and suitable warning devices and protection fencing. All these aspects are to be weighed in each case, remembering that where traffic is very light, as on many of the hill roads serving dairying country, considerable sacrifices of alignment are warranted in order to extend the road a maximum distance for a given amount.

The benching of cuttings is relatively inexpensive compared to constructing a curve of equal visibility without benching, and particularly where the alignment is not of a high standard, has the advantage that the effective visibility is still measured around the road centre-line, not across the bench, and is further increased, in effect, by the physical restraint upon speed exercised by the sharper curves.

Formation and Pavement Widths.—In other than flat country, formation widths should be based upon the minimum requirements for two-way and one-way traffic, respectively. Allowing sufficient width for the table-drains, and for one or two vehicles of moderate size, these widths are 18 feet and 12 feet respectively. Passing places should be provided, however, by widening to the two-way cross-section for a short distance at points within sight of each other.

Pavement widths are of less moment than formation widths, as, in many cases, the natural formation will also be the running surface, and in the remainder, the surfacing will consist of such materials as loam, sand-clay and local gravel. Thus, there will be no sharp differentiation between pavement and shoulders, and the two will, in a short time, be blended by natural agencies and maintenance operations. The minimum width of pavement should be 12 feet; lesser widths encourage tracking and consequent difficulty in maintaining smoothness, while any greater width possible on the formation widths mentioned is still too narrow to permit two-way traffic without one vehicle, at least, leaving the pavement when passing occurs.



TRANSITION LENGTHS & WIDENING

To be adopted unless directed otherwise on drawings

Centre line Radius of curve	Transition length	Widening on curve
feet	feet	feet
50	100	6
75	90	4
100	80	3
150	70	2
200	60	1·5
300	60	1·0
400	50	-
500	50	-

CROSS FALLS

To be adopted unless directed otherwise on drawings

Earth	1:18
Water-bound Macadam, Gravel	1:24
Sand-Clay	1:24

Fig. 2. Standard cross-section for two-way traffic feeder road in hilly country.

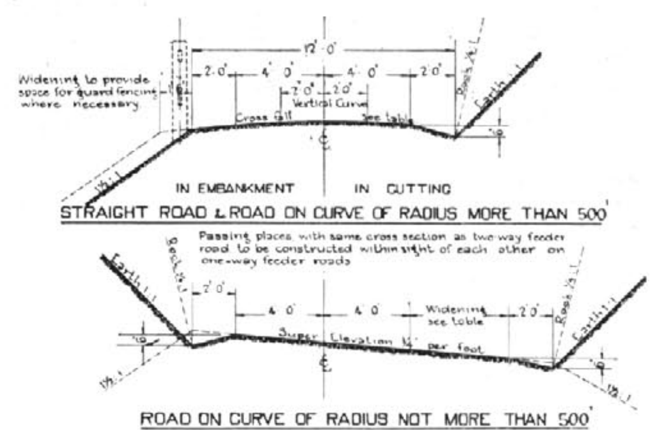
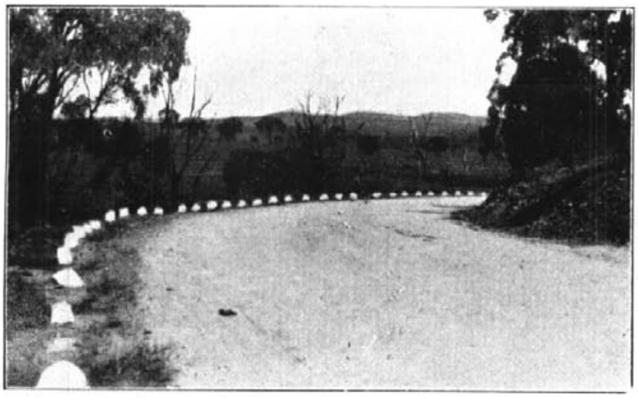


Fig. 3. Standard cross-section for one-way traffic feeder road in hilly country (curve details are as shown in Fig. 2).

The details of the two-way and one-way cross-sections are shown in Figs. 2 and 3. Where traffic is very light, or the location is particularly difficult, the one-way type is suitable; it may be very appropriate to that part of a spur road remote from its connection with the railway or the main road system, where traffic would be at a minimum.

Where the standard flat country cross-sections would apply to main roads, these are to be used for spur roads also, but modified to conform to a pavement width of 12 feet only.

Super-elevation and Widening.—Roads of the feeder or spur type will seldom be improved beyond the earth or gravel pavement stage, indicating that the maximum values of super-elevation prescribed for main roads, if adopted for spur roads, might lead to either scour of the super-elevated section, or unduly costly maintenance. Heavy vehicles are not to be expected in any numbers, and speeds would doubtless be restricted by numerous curves and restricted visibility. It is logical, therefore, to reduce curve-widening and super-elevation to a degree compatible with the requirements of the traffic expected. Super-elevation is to be provided only for curves of radius not more than 500 feet and only to a maximum extent of ¾-inch per foot. Widening is to be provided only for curves of radius not more than 300 feet and ranges up to 6 feet for a curve of 50 feet radius. These standards are set out in detail in Fig. 2, and apply equally to one-way and two-way roads, *Protection Fencing.*—Application of the standards adopted for main roads would lead, on the tortuous locations of many feeder roads, to costs for this item out of proportion to the service required. Except in very special cases, *e.g.*, at an isolated sharp or blind curve, fencing will not be required, but attention is drawn to the possibility of giving a substantial measure of protection at low cost by means of such devices as placing large stones carrying a patch of white paint in similar situations, or erecting isolated posts capped with white paint where guidance is desirable.



Example of use of whitened stones to guide traffic on a curve (Hume Highway in Southern division).

White portland cement has been found suitable for marking guide stones. Posts should be short, so as not to be confused with culvert fender posts.

Pavement Types.—Future maintenance requirements bulk largely in the choice of pavement types for feeder roads. First consideration will be given to the use of the natural soil as a running surface, formed up or not, as may be necessary. Selected material from cuttings, if any, may be regarded as the next field to be exploited. Failing these, surfacing with sand-clay (either natural, *e.g.*, top-soil, or an artificial mixture), shale, gravel, traffic-bound fine-crushed rock, or occasionally under specially favourable conditions of climate and traffic, water-bound macadam are the alternatives. Pavement thicknesses will be kept to the minimum and local deposits of materials, even those of doubtful quality, judged by main road standards, are to receive full consideration.

West of the Dividing Range, wool is hauled during July, August, September, and October, and wheat in December, January, and February—mainly dry months. Also, these products are not perishable and do not deteriorate if haulage is delayed by road conditions. Traffic actually prefers a smooth, dry, earth surface to gravel; therefore, on spur roads in western areas, a well-drained formation, possibly stabilised with top-soil, loam, or sand-clay, should meet all requirements. Proposals to haul gravel should receive close examination.

East of the Dividing Range, the produce traffic, except fruit, is not seasonal. Milk, cream, and live-stock must all be transported on fixed days right throughout the year. On the North Coast, there is a definite wet season, from February to May, but heavy rains are not confined to this period. Thus, an all-weather road surface, with all-weather stream crossings, is the first consideration in this area. As the sub-grades are generally poor, paving is more important than grading or alignment.

Causeways.—In all cases, as an alternative to a bridge or culvert, causeways constructed to the standard profile* (Form No. 269) are to be considered, the lengths of road subject to submergence to be specially constructed to withstand water action. Where a bridge, culvert or causeway cannot be arranged economically to take the full flow of the stream, the possibility of building a structure to take the normal flow and arranging the adjoining sections of roadway to withstand submergence during floods, is to be fully explored.

Causeways are generally more useful in the western than in the coastal areas, where this type of structure carrying permanent streams should be avoided unless the flood waters do not exceed a depth of 1 foot 6 inches. In side-cuttings, even the cheapest timber culvert is preferable to an open V-gutter crossing for intercepting catch and table drains.

Bridge Loading.—Although a road carries few vehicles these are not necessarily individually of light weight. Also, the reduction of the loading from the standard unit of 18 tons to, say, 10 tons affects only slightly the costs of structures other than those of long span, since requirements as to durability, in general, would limit the reductions otherwise possible in the dimensions of most parts of small span bridges. It will be sufficient if large span structures are designed to carry a 10 tons moving load, or a distributed load of 60 lb. per square foot for spans up to 100 feet, and

Gravel construction on the Muronbung-Gollan-Goolma road, —a through developmental road which connects a wheat growing district with the Merrygoen-Dubbo railway, and also links the Dubbo-Dunedoo and Wellington-Gulgong main roads. Eight miles of construction have been completed.

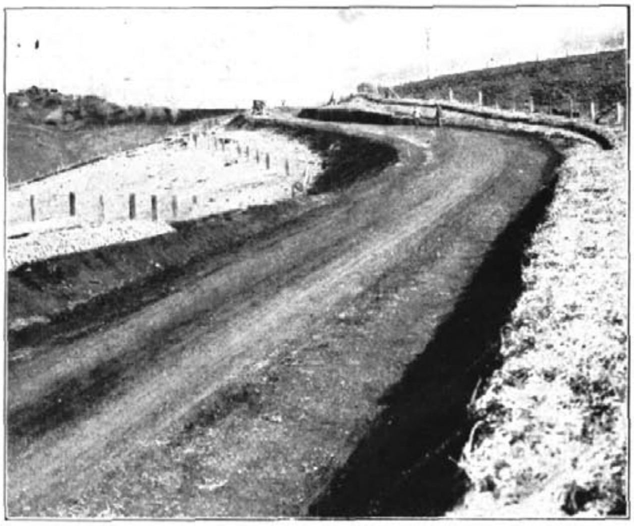
* See *Main Roads*, October, 1930, p. 28.

50 lb. per square foot for spans in excess of 100 feet, the loading in other respects to be the same as for main roads, provided suitable load limit notices are erected at either end of such bridges.

Bridge Widths.—The widths to be adopted for bridges on spur roads are given in the article setting out the general standards for bridge widths on main and developmental roads, to be found on page 60 of this issue.

Bridge Materials.—All bridges are to be of timber unless the cost of concrete or steel exceeds the cost of timber by less than 20 per cent., or the risk of damage by fire is unusually great, as in heavily timbered, steep country, where burning debris may possibly roll down the hillsides and lodge against the structures. Of the timber listed in the standard timber beam bridge specification (Form No. 164), Classes "A," "B" and "C" timber will be acceptable for beam bridges.

Pipe Culverts.—Economy can be introduced by omitting headwalls or substituting aprons for headwalls at outlets, where possible. Stone set in mortar, timber, or concrete are all acceptable for headwalls or aprons, or stone pitching on the batter may be used in lieu of headwalls, the selection depending mainly upon cost. Consideration should be given to using plain joints, faced and pointed with cement mortar, in preference to the standard bandage joint where the embankments are not of light or friable material. Where large size pipes are required, the possibility of erecting, at less cost, a timber culvert of sufficient size to permit the construction within it, at a later date, of the necessary size of pipe culvert is to be fully considered.



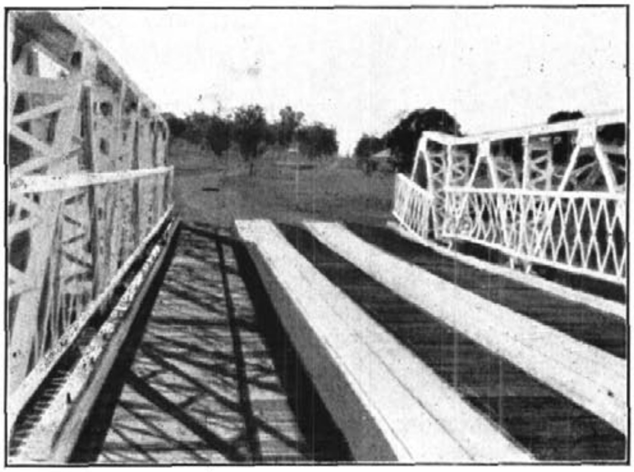
Gravel construction on the Yarrum Creek developmental road, which connects a dairying area with the railhead at Dorrigo.

Box Culverts.—Timber is to be used unless the price of a concrete structure is less than 20 per cent. in excess of the price of a timber structure. Concrete culverts will be necessary where the height of fill over the culvert exceeds 6 feet, unless the device referred to above, of providing a timber structure of excess size, inside which a concrete culvert can be constructed when the timber has reached the end of its useful life, is applicable.

Sheep-station Creek Bridge, Barraba.

A heavily-laden wool waggon caused the failure recently of a member of the steel truss bridge over Sheep-station Creek, on the Tamworth-Barraba trunk road (No. 63) in the Shire of Barraba. The bridge is at present closed to traffic, an adjacent causeway being in use as a temporary crossing.

The bridge consists of a single 70-feet steel truss span, with timber deck, supported upon concrete abutments. It was erected by the council in 1913. The trusses were fabricated by the American Bridge Company and are departures from the usual practice in



Sheep-station Creek Bridge.

this State in two respects: There is no external lateral bracing, the width of the lattice diagonals and posts being relied upon to support the top chord, and the field connections are all bolted. In 1921, the bridge was carried away by a flood, but the trusses were recovered, repaired, and re-erected 4 feet higher than their original level.

An examination of the broken member (the diagonal in the first panel of the downstream truss) disclosed that of the two 3 in. x 2½ in. x 5/16 in. angles comprising it, one had been broken previously, probably in 1921, leaving insufficient sound metal in the remaining angle to withstand the strain of the heavy vehicle which caused the failure. The latter weighed about 11 tons, and all the ten horses drawing it were on the bridge when the member broke. A new member is being fabricated and will be inserted after the bent members have been straightened by the use of jacks.

Nambucca River Bridge, Macksville.

The bridge over the Nambucca River, on the Pacific Highway at Macksville, is complete. Work is now proceeding on the gravel roads in approach to the bridge, and it is expected that this portion of the work will be ready for traffic early in December, so that the ferry will not have to carry the Christmas traffic.

Highway Work in the United States.

By H. M. Sherrard, M.C.E., Assoc. M.Inst. C.E.

Assistant Chief Engineer.

Maintenance.

(Continued from page 32, October.)

South Carolina.—The State is divided into divisions, each under an engineer. Each division, which includes about 1,500 miles of road, is subdivided into districts containing about 500 miles, the maintenance of which is under a supervisor. Each district comprises two to four counties (*i.e., shires*), and a superintendent controls the maintenance work in each county, each of which has a maintenance depot. Lengths of patrol sections are—

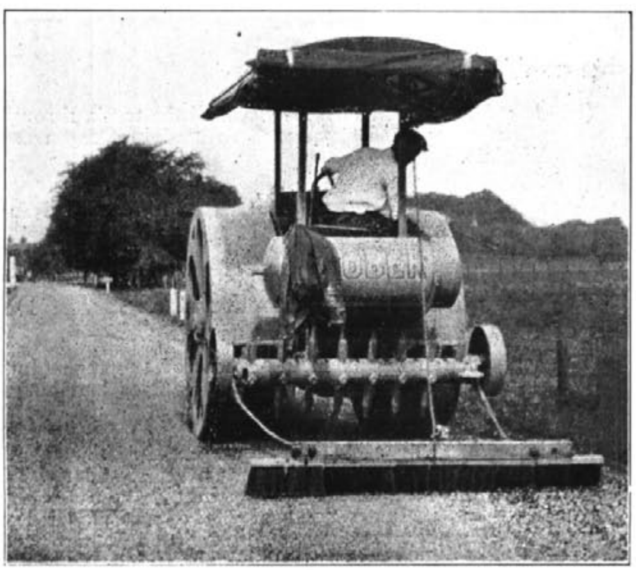
	Miles.
Hard-surfaced pavement	40
Surface-treated pavement	10-15
Sand-clay, top-soil, and dirt	18-25
Unimproved (carrying, say, 50-100 cars per day)	40-50

The patrol unit usually comprises:—

Patrolman.	One (or more) 1½-ton dump trucks.
Tractor-driver.	One tractor (usually crawler type).
Two labourers.	
Drag.	
Grader, 8 ft.	

Plant.

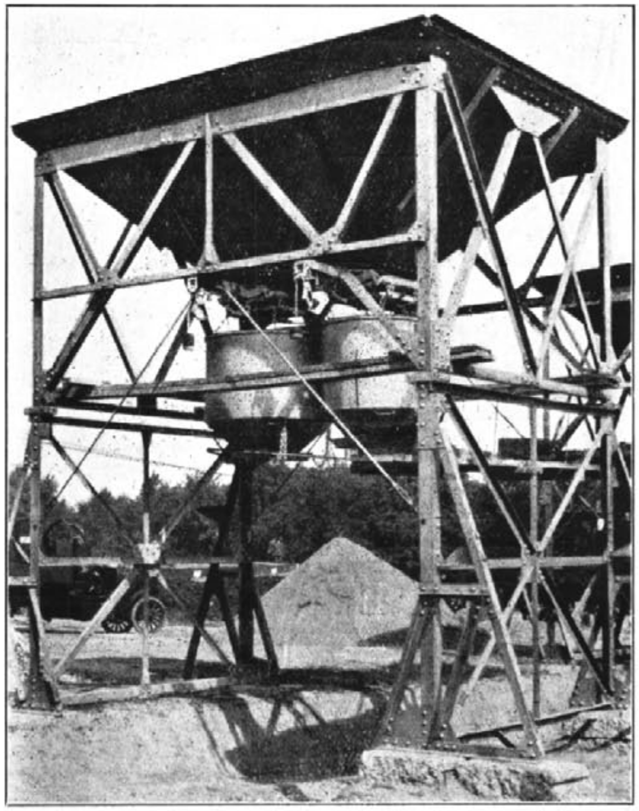
Concrete Paving Plant.—Concrete paving machines with loading-hopper, bucket discharge, and automatic water tank are standard on all works. Some have devices whereby an interlocking of gears enables the operator, by one foot movement, to carry out an entire



A motor roller equipped with brooms for distributing screenings in surfacing and macadam work.

sequence of operations. The bucket also spreads the concrete instead of dumping it as in older models. Mixers mounted on trucks are used by sellers of ready-mixed concrete, and by organisations having many small works. These cost (without truck) about £400 in U.S.A.

Portable steel bins are used generally for storing aggregates, as being cheaper than erecting wooden bins. The bins are usually loaded by a grab bucket,



Typical portable steel bin installation, with weighing equipment, for batching concrete aggregates.

and are high enough to accommodate weighing hoppers. The cost of 20-40 cubic yard bins in U.S.A. is £150-£200. Weighing hoppers are suspended below the bins by a system of levers, and weighed on a lever arm or by spring scales. The former type is the cheaper, costing about £220 f.o.b. New York.

The use of truck turntables on concrete and mixed asphaltic pavement construction is general.

Subgrade trimmers have been on the market for some time. One type cuts off bumps, distributes material to fill hollows, and lifts the excess material and deposits it outside the forms.

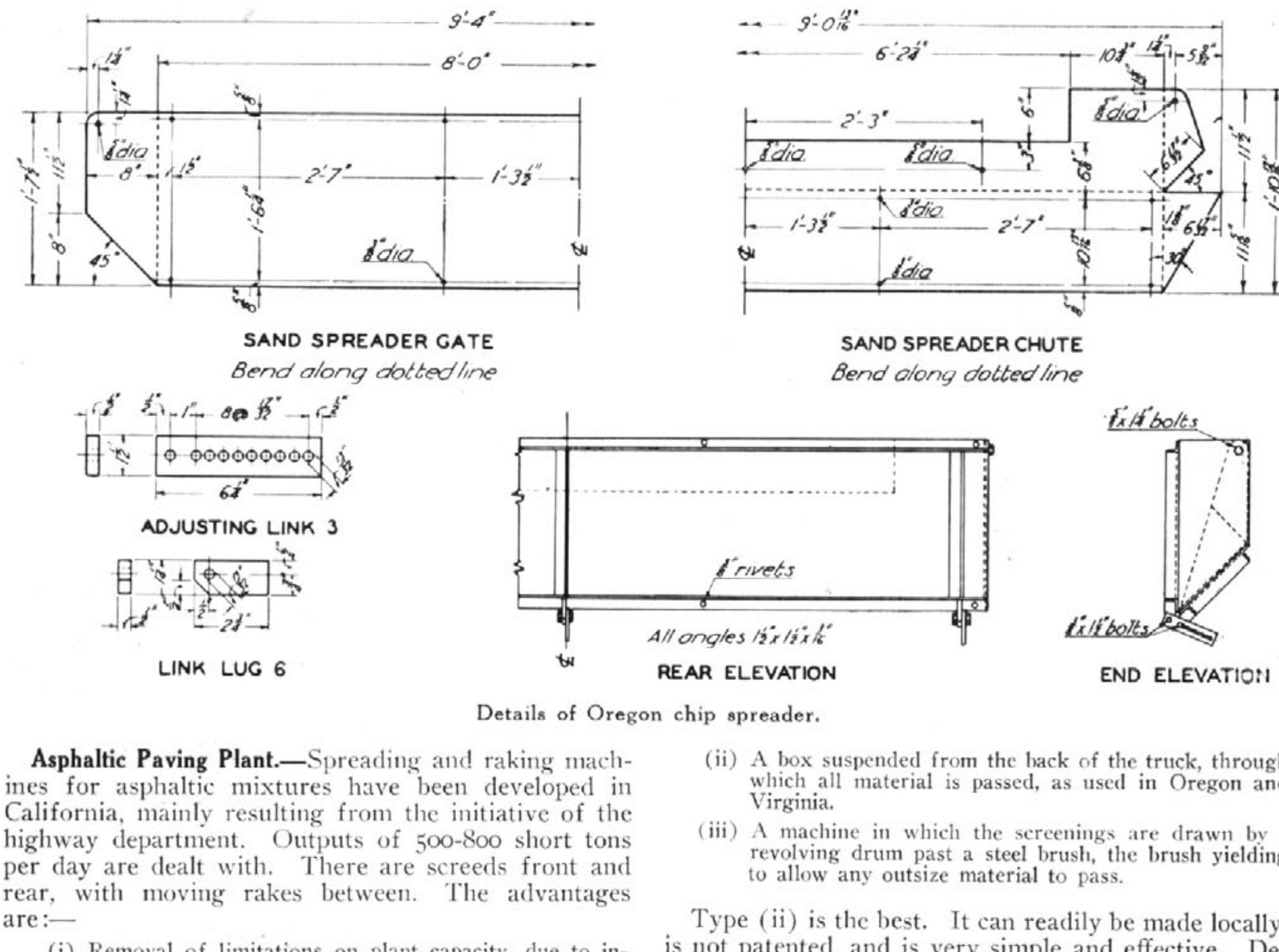
Finishing machines are very effective, especially on a long length of uniform width pavement. One type has two screeds (which move laterally) and a belt; another has a tamper also. Steel forms are essential with finishing machines to esure rigidity and, thereby, smoothness. Their durability also commends them to contractors. Transverse contraction and longitudinal grooves can be installed by a device attached to finishing machines, the machine merely forcing in a metal plate which, when withdrawn, leaves a groove. Grooves are formed by hand by hammering a T-iron into the concrete, or by placing a collapsible joint plate before the concrete is poured. Travelling bridges, running on wheels on the forms, are used for finishing edges and joints. Burlap (hessian) may be carried rolled on a spindle on a wheeled bridge, and let out or re-rolled as required.

Lighter grades of asphaltic materials are usually shipped in tank cars. Oil burners are used for heating kettles or distributors. For hauls from rail exceeding 6 miles, separate tank trucks are used to supply distributors.

The spreaders for bituminous mixtures and broken stone are drawn on skids or rollers.

The spreaders for chips may be—

(i) A machine pushed behind a truck, which drops the screenings through a hopper on to a revolving disc, which spreads them over the road surface.



Details of Oregon chip spreader.

Asphaltic Paving Plant.—Spreading and raking machines for asphaltic mixtures have been developed in California, mainly resulting from the initiative of the highway department. Outputs of 500-800 short tons per day are dealt with. There are screeds front and rear, with moving rakes between. The advantages are:—

(i) Removal of limitations on plant capacity, due to inability to handle large tonnages on narrow highways.

(ii) Decrease in costs due to quantity production and quantity handling on the street, and speed of operations as a whole.

(iii) Greater uniformity in the structure of the asphaltic paving base and surface.

(iv) Decrease in surface roughness to a point where there is now little difference in this respect between the best laid asphaltic type and any other type of pavement.

(v) Production of a uniformly smooth non-skid surface which will be safe in any weather for a number of years.

(vi) Elimination of poor workmanship through the substitution of machinery for hand labour on all of the more important phases of the work.

(vii) Reduction in rolling due to the particular arrangement of the paving mixture previous to rolling.

(ii) A box suspended from the back of the truck, through which all material is passed, as used in Oregon and Virginia.

(iii) A machine in which the screenings are drawn by a revolving drum past a steel brush, the brush yielding to allow any outsize material to pass.

Type (ii) is the best. It can readily be made locally, is not patented, and is very simple and effective. Details of the Oregon spreader are as follows:—

The spreader is made from two pieces of 14-gauge (Imp. S.W.G.) sheet steel, stiffened with light angles and hinged together at the top, with an adjustable opening at the bottom (see sketch on this page). The dimensions of each piece of steel, before bending, are given in the sketch. The angles are attached by rivets or by spot welding. Similarly, the lugs for adjusting the opening are planned for attachment by welding, but, if this is not available, can be modified to suit other means of attachment. In addition to the parts shown in the sketch, means are necessary to suspend the spreader from the rear of the truck and to brace the lower portion of the spreader to the truck body. These details will depend upon the type of truck body. The weight of the spreader box complete is about 170 lb.

Tractors and Rollers.—Crawler tractors are usually used, even for maintenance, as the faster wheeled tractors have little grip on a wet road if of earth or sand-clay. Trailers are used for transporting quickly all classes of construction plant, including pavers, excavators, &c.

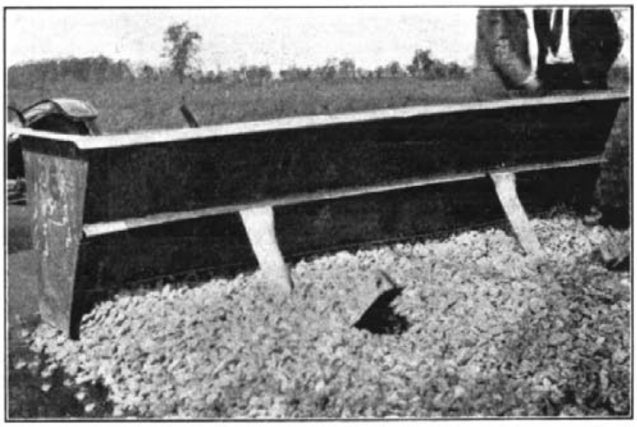
Tractor fitted with power broom and blower for preparing roads for surface treatment.

Three-wheel rollers weighing 10 short tons are commonly used on all pavements. Tandem rollers are confined to "ironing-out" work. Some States use rollers as light as 3 short tons on subgrades. On types of work where screenings are to be forced in, the roller always has a broom (sometimes with steel bristles) attached to distribute the screenings. Such brooms have a central flexible joint to enable conformity with the profile of the pavement, and can be pushed or pulled. To prevent the roller wheels "lifting" an asphaltic pavement and to keep the wheels clean, hot water jets are played on to coir mats resting on the wheels.

Sheeps' foot rollers are used for consolidating embankments, and are sometimes seen attached behind a tractor-drawn scoop.

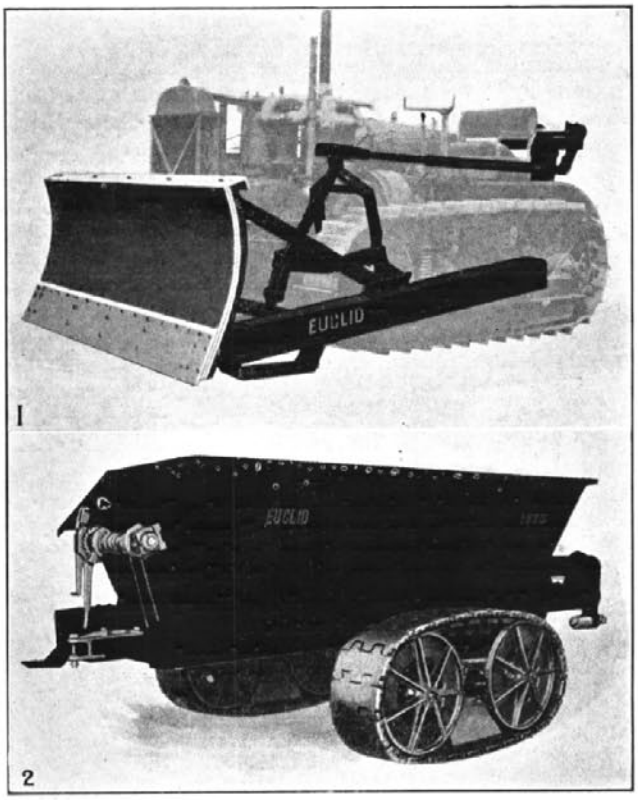
Excavating Machinery.—An interesting development is the use of ¼ cubic yard power shovels for maintenance work, such as removing slips, loading, and loading from stock piles. In some cases these shovels are built on to tractors. While mules drawing 2 cubic yard waggons are still used, three-way tipping, tractor-drawn waggons, built in sizes up to 8 cubic yards, have been developed for large jobs.

The wheeled scoop is still used with mules or horses, but most scoop work is now done by tractor haulage. Rotary (fresno) scoops of up to 2 cubic yard capacity, one scoop to a tractor, are operated by the tractor driver without stopping. There is a larger scoop, with an internal belt loader, also entirely operated by the



Typical spreader-box for bituminous mixtures and broken stone.

tractor driver. The 5½ cubic yard size of this type costs £675 in U.S.A., and the 2 cubic yard size £350. Another type of large scoop used in California (4 cubic yard capacity, hauled by 60-h.p. tractor) is tipped hydraulically, and can be adjusted to spread the earth in thin layers. There is also a type which can be



1. Tractor with heavy bulldozer.
2. Seven cubic yards bottom dump crawler wagon.

operated, in chains of three, by the unaided tractor driver. Yet another type has two bowls, one behind the other, giving a total capacity of 3 cubic yards.

Bulldozers consist of a straight pushing blade (as opposed to the inclined blade of the backfiller) attached to a tractor, the height of the blade above ground being adjusted hydraulically. They have extensive use, especially for spreading on earthwork dumps. The bulldozer is a most useful piece of plant, for not only can it spread, but it can also push material along.

Graders.—Several novel varieties of drive for combined tractor-graders were noted, viz.:—

(i) Dual drive (*i.e.*, two driven rear wheels in tandem on each side), solid rubber tyres.
(ii) Dual drive, pneumatic tyres.
(iii) Dual drive, double pneumatic tyres (*i.e.*, ten tyres per machine).
(iv) Rubber crawler track. (This is said to reduce vibration and permit higher speeds.)

Pneumatic tyres are said to be easier on the machine and driver, easier to replace, and to have a life at least equal to that of solid tyres. On one make, a "false" blade acts as a cutting edge. As it is worn, it is moved down into another set of bolt holes, reducing the waste of blade ends.

(*To be continued.*)

Widths of Bridges.

A SURVEY of existing pavement and formation widths on the three classes of country main roads was made during 1930, and considered in conjunction with the probable future traffic and the further construction required on each section. The decisions as to the pavement and formation widths for future construction made as a result of this review, have already been published.* The requirements of developmental roads have also been published in the Board's Third Annual Report, and a revised and somewhat more comprehensive statement, bringing this information up to date, appears elsewhere in this issue.† The series of standard widths for pavements on all classes of roads which concern the Board is thus complete. In a similar manner, the standards of width for bridges, which were laid down in Circular No. 78, issued to country councils in August, 1928, have been reviewed, and adjusted where necessary, to bring them into line with the revised standards for roads. The decisions consequent upon that review were embodied in Circular No. 284, issued to country councils during August, 1931, and are as follows:—

Except in special situations where the Board may decide that greater widths are necessary, all new bridges constructed on main and developmental roads shall provide widths of carriageway in accordance with the following scale:—

1. State highways, trunk roads, ordinary main roads and through developmental roads.

(i) Bridges of steel or reinforced concrete, timber bridges within municipalities and exceptionally long timber bridges elsewhere .. 20 feet.
(ii) Timber truss bridges not included in (i) .... 18 feet.
(iii) Timber beam bridges not included in (i) .... Same width as pavement in approach, but not less than 16 feet.

2. Developmental roads not of through type:—

(i) Where the width of pavement in approach is in excess of 12 feet .... 16 feet.
(ii) Where the width of pavement in approach is 12 feet or less .. 10 feet, or in wheat-growing areas, 12 feet.

3. Culverts:—

(i) Any culvert having a clear waterway opening of 20 feet or more, and having its deck at road level, should be constructed in accordance with the scale for bridges.
(ii) Any culvert having a clear waterway opening of less than 20 feet, and having its deck at road level, should be constructed equal in width to the standard formation width for the road in approach, *i.e.*, if the formation is not of standard width, the culvert should be built to conform to any future widening to that width.
(iii) Any culvert supporting an embankment above the deck should be built so that the upper part of each of its headwalls supports the sloping side of the embankment, built to standard width, through which the culvert passes.

It will be noted that the objective aimed at has been that the bridge should supply the same facilities for movement as the road in approach. This is, of course, as it should be, as a bridge is only a part of a road. The standards laid down for main roads, and for the more important developmental roads, aim at provision for two-way traffic, and consequently the widths of the bridges have been fixed at from 16 to 20 feet. For the minor spur type of developmental road, where provision for one-way traffic is ample, *i.e.*, the roads where the width of pavement in approach is 12 feet or less, a width of 10 feet, or, in the case of bridges in wheat-growing areas which may need to transport heavy and wide agricultural machinery, 12 feet, has been adopted.

It will be noted, too, that the degree of permanence and the ease or difficulty of alteration of the structure have been factors in influencing width. Clearly, the more readily a bridge can be widened, the more reason there is for constructing it to suit only present-day requirements, leaving the additions required by subsequent developments to be made as occasion warrants. If, however, substantial alterations cannot be made without large reconstruction, greater allowance must be made for the future in the initial construction.

In one case also, viz., timber truss bridges of type 1 (i), the width has been fixed at 18 feet rather than 20 feet because of the disproportionate increase in expense involved in any greater width.

There are a considerable number—possibly the majority—of existing bridges on main roads which have lesser widths than the standards now required. It is improbable that it will be necessary (as it is also impracticable from the point of view of finance) to attempt to bring more than a few of these into conformity with the present standards during their lifetime. In any case, however, where, on account of the growth of the traffic, this appears desirable, the problem will be dealt with on its merits; but as each bridge wears out and is replaced the new bridge will be built to the standard, and thus in the course of years the requisite change effected

* See *Main Roads*, February, 1930 (State Highways)
June, 1930 (Trunk Roads).
October, 1930 (Ordinary Main Roads).

† See page 56.

Traffic Regulation in the United States.

BY S. L. LUKER, B.SC., ASSOC. M.INST.C.E.

Metropolitan Maintenance Engineer.

(A Report prepared as a result of a visit to U.S.A. in 1930.)

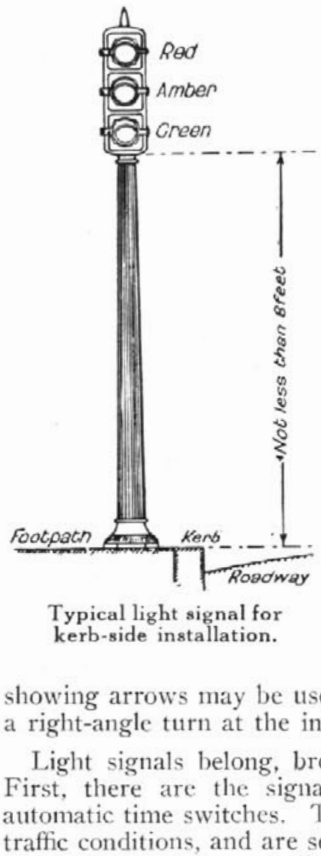
THERE are in the United States 27,000,000 motor vehicles and 3,000,000 miles of road; in Australia there are 500,000 vehicles and 230,000 miles of road. Thus, the number of vehicles per mile of road, or average traffic density, is more than four times greater in the United States than in Australia. This is largely because the cost of owning and operating a vehicle in the United States is approximately half the corresponding cost in Australia. Comparing similar metropolitan areas, we see the same contrast. Boston, for instance, is of somewhat the same size as Sydney, and is somewhat similarly situated in relation to the sea-coast; but in Boston there are at least three radial traffic arteries carrying in excess of 10,000 vehicles daily at points 10 miles from the centre of the city, and about ten additional radial routes carrying traffic of the order of 5,000 vehicles daily; while in Sydney, the Parramatta-road, which carries 2,000 to 3,000 vehicles daily in the vicinity of Lidcombe, is the only route carrying more than 2,000 vehicles at a similar radius from the centre of the city. In each case the Sunday traffic is approximately double that on week-days.

These figures are quoted to indicate that traffic problems are relatively more acute in the United States. As a result, correspondingly greater efforts have been made to deal with the difficulties, and, in the great wealth of experience and information available, there is much of value as bearing on conditions in Australian cities. The features of American traffic regulation which are of interest to Australia are:—

(i) Use of light signals (red-amber-green) at urban intersections.
(ii) Regulation requiring traffic to stop when entering a main road from an intersecting road of lesser importance.
(iii) Logical and effective use of shape and colour in the standard system of traffic signs.
(iv) Use of lines for regulating the paths and, particularly, the overtaking of vehicles.
(v) Movement towards the enforcement of a minimum standard of efficiency of the brakes, lights, and warning signals of vehicles.
(vi) The high degree of respect paid by drivers to the various signs and signals.

Light Signals.—The methods of regulating the flow of traffic in the central regions of cities were not studied, but light signals are used universally, within city limits, and beyond, on many important routes, and are having an important effect on driver-psychology. The obvious benefit of its use and the ease (and rigidity) of enforcement of its observance in cities ensures for the light signal the almost inviolate respect of drivers. This respect is naturally extended to signals used under rural conditions, but the defects of certain types of equipment tend towards a measure of abuse.

Light signals consist of a group of lamps having lenses coloured red, amber, and green. The lenses of each group are hooded so that the signals are clearly visible and conspicuous in daylight; each group is visible to one only of the streams of traffic approaching the intersection. The signals are placed on the kerb line at the intersection (on the right-hand kerb in America, but would be on the left-hand kerb in Australia, where traffic is required to keep to the left), or are concentrated within a unit supported by suspension wires or a lattice tower at the centre of the intersection.



Typical light signal for kerb-side installation.

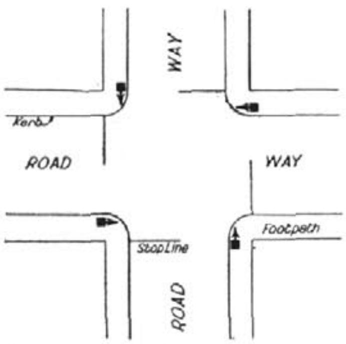
The former locations are preferred where traffic is dense, as the obstruction caused by a tower to the traffic streams making a right-angle turn is objectionable; the latter position is generally adopted where traffic is less dense, and it is desired to simplify the installation, particularly the electrical connections, as much as possible.

The significance of the colours is as follows:—Red means "stop," green means "go," and amber means "prepare to stop," or "prepare to go," according to whether it is shown subsequent to the green or the red. Amber may also be used to guide pedestrians at intersections, and auxiliary lamps showing arrows may be used to guide vehicles making a right-angle turn at the intersection.

Light signals belong, broadly, to two main classes. First, there are the signals which are operated by automatic time switches. These are suitable for heavy traffic conditions, and are set to cause traffic movement in regular cycles—each light is shown for a certain fixed time (not necessarily the same for each colour), which may be changed to take care of varying conditions of traffic at different periods of the day. It is apparent that such signals could easily cause congestion and reduction of average speed if set so as to block intersecting roads for times not appropriate to the relative amounts of traffic; roads blocked when the intersecting road is clear of traffic invite irresponsible drivers to ignore the signal, thus inducing want of respect for the system. This rigidity of operation has led to two developments—on the one hand, the different

State authorities are now controlling (by special legislation, in some cases) the erection of signals by local bodies, and, on the other, the use of signals actuated by approaching traffic has been developed.

The effort by State authorities to introduce uniformity and eliminate the indiscriminate use of signals is part of a wider movement to place the handling of traffic in the hands of qualified persons, such as traffic engineers, and the application of high-grade technical skill to these problems has been of general benefit.



Arrangement of intersection for traffic control by kerb-side automatic light signals.

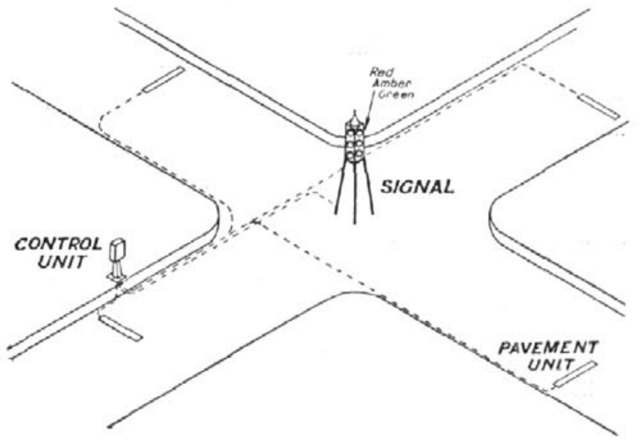
One important advance has been the development of means for the synchronisation of the signals at a series of intersections, enabling the principal streams of traffic to proceed without interruption if the proper speed is maintained. Such a system is best suited to a city having rectangular blocks of approximately uniform size, *e.g.*, Melbourne, where light signals are being used at present with success.

Traffic-operated signals are actuated by contact devices passed over by the vehicles approaching the intersection, subject to an overriding control, similar to that governing the automatic signals described above, which protects traffic in the less important streams from undue delay due to continuous actuation of the signal by vehicles in the main streams, and is also capable of co-ordinating the use of a series of intersections in the same way as the automatic signals. (The mechanical "brain" which performs these involved functions consists of electrical devices similar to those utilised in the ordinary radio receiver.) The signals would, normally, show "go" on the main route, and "stop" on the subsidiary routes leading to the intersection. Should a vehicle approach on a subsidiary route, it would operate the contact mechanism set in the road at a convenient distance back from the intersection and, subject to the supervisory controls regulating the relative use of the several routes (and co-ordinating the series of intersections, if this function were incorporated also), would receive first the amber, then the green signal.

The outstanding advantage of this type of control is that, if traffic is sparse, there is never the difficulty of a route being held blocked if the intersecting routes are clear, as may happen with the automatic type. The apparatus is costly, but the expense would probably be entirely justifiable on economic grounds whenever a pointsman needs to be employed, even if for the peak traffic hours only—apart from the value of the signalling system in promoting safety during the remaining hours when traffic is lighter. Such intersections as those on Parramatta-road at Liverpool-road, Concord-road, Good-street, and Woodville-road, and the intersection of the Great Western Highway and Church-street, Parramatta, could be safeguarded completely by traffic-operated light signals.

Through-route-stop Regulation.—Comparing the New South Wales regulations controlling traffic at intersections with American practice, there is the contrast that, in this State, effort is made to prescribe the *path* of vehicles, by means of traffic domes, but in the United States, the control is directed towards the *time* of negotiating the intersection by ensuring (by means of signals such as those described) that conflicting streams of traffic cannot traverse the intersection simultaneously. In the latter circumstance, the path taken becomes a secondary consideration and traffic domes are unnecessary.

The "giving way" rule of the New South Wales Traffic Regulations (which gives the driver on the right at an intersection the right-of-way) is aimed at coping with somewhat the same situation as that which, in the United States, is regulated by the "through-route-stop" rule. The local rule operates successfully in the city, where speeds are relatively low, but, in the outer suburban areas, where the traffic is fast, observation indicates that the inherent difficulty, on the part of each of a pair of rapidly-approaching drivers, of judging whether they would arrive simultaneously at an intersection greatly reduces the efficacy of the rule. The observed conduct of drivers at such



Arrangement of intersection for traffic control by central traffic-operated signal unit.

intersections indicates that there is recognition of the principle that traffic on the more important route is entitled to an uninterrupted passage, although this is contrary to the present regulations. The principle thus has no official status, and the possibility of occasional careless entry of vehicles from side streets is responsible for the general practice, on the part of drivers on main routes, of slowing down at each intersection, and keeping to the centre of the road rather than as close as practicable to the left.

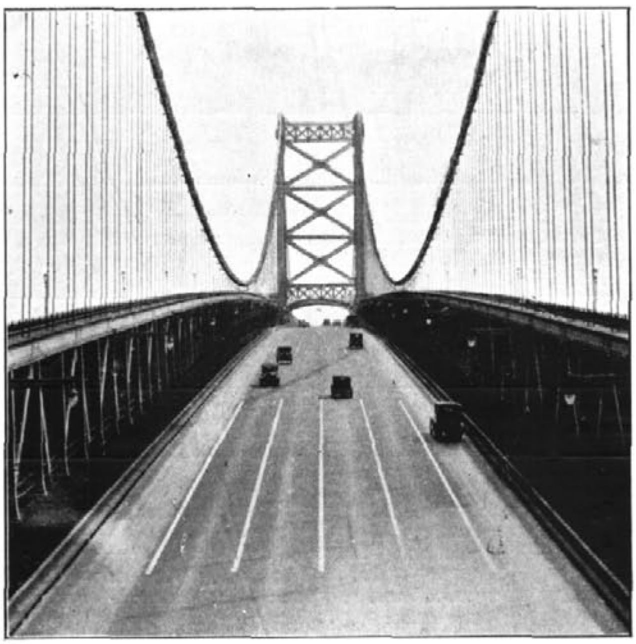
The American "through-route-stop" rule controls traffic at the intersection of a "through" route and a side road in a logical and universally applicable manner by conceding definitely a preference to the traffic in the former, and requiring the side road traffic to come to a stop before entering the more important route. The side road driver thus assumes full responsibility for crossing or joining the main stream without causing interference or danger to the vehicles on the "through" route. This ensures that the minor traffic stream does not enter the principal stream until a favourable opportunity has presented itself and, moreover, entry is made at a low speed, facilitating a short turn to the left when this is necessary and causing a minimum of disturbance to the main road traffic generally.

Sign exhibited to side-road traffic approaching a "through" route.

In Sydney, the traffic at intersections where pointsmen are not employed is generally regulated by domes (prescribing the paths to be taken) and the "giving way" rule (allotting precedence amongst the several traffic streams). The substitution of the "through-route-stop" rule would eliminate the necessity for domes, with consequent benefit in allowing vehicles to adopt a more convenient path when turning, and would benefit the administrative authorities to the extent that the "through-route" signs would be cheaper to establish and maintain than an appropriate set of traffic domes; while, judging from observations of the working of the rule in America, it would undoubtedly add to safety. Subsidiary benefits would accrue from the speeding up of traffic, and its better distribution over the roadway width. The only difficulties associated with the rule appear to be educating the public as to its significance, and preventing its application to intersections not carrying through traffic. In the latter case, the rule would become irksome and tend to be ignored, thus bringing the system into disrepute.

Traffic Lines.—Many American States use lines marked longitudinally upon the pavement to promote the safety and convenience of traffic and to improve the traffic-carrying capacity of the roads. There are, as yet, no common standards established for universal guidance in the use of lines, but the principles actuating the various authorities are clear. The lines mark the boundary of a traffic lane (*i.e.*, the width necessary for a single file stream of vehicles) and are used to achieve two main objects; first, they confine traffic to a definite path, thus giving the fullest utilisation of the roadway width, since "straddling," or driving with a wheel in each of two adjacent lanes, is discouraged by the presence of the line, and may be prohibited by regulation; and, second, a change in the character of the line can be used to indicate where leaving the traffic lane (*e.g.*, for overtaking) is not desirable, as at vertical and horizontal curves, intersections, or similar points of restricted visibility. Occasionally, the character of the line is used to indicate where parking is restricted. Where used, the commendable standard of observance of the restrictions indicated by the traffic line was shown by the location upon the pavement of the oil drippings from vehicles, which are practically all concentrated within a width of 2 feet or so, marking the very close adherence of vehicles to the same path. A subsidiary benefit resulting from the lines was said to be reduced expenditure upon shoulder maintenance wherever the lanes were marked.

The actual marking of a line upon the pavement presents no serious difficulties. For concrete pavement, the almost universal central joint, filled with black material, serves the purpose except where the joint is not exactly in the proper position, as may occur if suitable adjustment in the location of the joint is not made on a widened curve. On black-top pavements, a white or yellow line in a durable paint may be painted cheaply. Some States use a white line even on concrete pavement. To be thoroughly effective, such lines must present a matt surface, to pick up the light from headlights. Such a surface is usually not obtainable with the more durable paints, but ingenuity in securing this, without too great sacrifice of durability, has been shown. Pavement markers, kept polished by traffic, may also be used, but are not greatly favoured.



Traffic lines on a large bridge, Pennsylvania.

When it is desired to use different kinds of line for different purposes, the position is not quite so simple. A broken line painted by machine markers usually needs touching up by hand, and is therefore costly, though effective. A broken line may be indicated effectively by metal markers inset at regular intervals. The line may be widened, but this hardly provides a sharp contrast between the widened sections and those of normal width. One solution is to adopt a white line (or black in the case of a concrete pavement) for guidance, and a yellow line (which is effective against a white as well as a black background) to indicate that leaving the traffic lane (overtaking) is prohibited.

Continuous lane marking would be warranted in few situations in New South Wales, as the roads generally provide a sufficient number of traffic lanes for the traffic, and those lanes are seldom used at or near their maximum capacity. There are isolated points, however (e.g., in approach to some intersections), where the guidance to be derived from lane marking would be advantageous. There are other points, such as horizontal and vertical curves having restricted visibility (e.g., some of the grade junctions on the Great Western Highway between Parramatta and Penrith, and long, narrow bridges), where the elimination of overtaking would be of undoubted benefit. Lines or pavement markings could be used, also, to warn traffic of speed limits, "through-route" stops, and railway level crossings.

General Sign-posting.—The American signs used to give information regarding places, routes, and distances, and those indicating danger, conform generally to a national standard system making logical and striking use of shape and colour. The New South Wales system,* although less elaborate, is based upon similar principles and, by comparison, is considered to be entirely suitable to traffic conditions in this State.

Taking a wide perspective of traffic regulation generally in the United States, one gains an impression of marked progress by the controlling authorities in devising aids to convenience and safety, side by side with the conviction that the orderly use of the roads by relatively large volumes of traffic is due equally to the "traffic mindedness" and discipline of individual drivers; therefore, it seems that improvement of traffic regulation in New South Wales should proceed along the twin paths of better regulatory devices and a higher standard of conduct upon the part of individual drivers.

*See *Main Roads*, July, 1930, and October, 1931.

Tenders and Quotations Accepted.

The following Tenders and Quotations were accepted by the Board during the month of October, 1931:—

Tenders.

Work.	Name of Successful Tenderer.	Amount of Accepted Tender.
Disconnecting 14 miles of 3-inch water pipe and accessories on the Pacific Highway between Hornsby and Peat's Ferry, and removal to and stacking at the Board's depot, Rosehill.	J. Feltis	£120

Quotations.

No. of Quotation.	Description of Article.	Name of Successful Tenderer.	Amount of Accepted Quotation.
			£ s. d.
83	Coal, unscreened, delivered to Raymond Terrace ferry as required, 75 tons.	Beatty Bros.	45 0 0
84	Bridge timber, f.o.r., Gundagai—16 in. dia., 740 ft.; 19 in. dia., 443 ft.; 13 in. x 12 in., 2,635 ft.; 12 in. x 12 in., 56 ft.; 12 in. x 6 in., 1,077 ft.; 4 in. thick x 8–10 in. wide, in 21 ft 8 in lengths, 99,360 ft. sup.; 8 in. x 4 in., in 15–30 ft. lengths 26,000 ft. sup.	Hargense and Sweeney	2,778 12 4
85	Crushed gravel—$\frac{5}{16}$ in., 1,135 tons	Nepean Sand and Gravel Co. Ltd. ...	562 11 6 (1,731 tons).
	$\frac{3}{4}$ in. 2,516 tons	Emu and Prospect Gravel and Road Metal Co.	672 0 0 (1,920 tons).
89	Priming tar, sprayed on Pacific Highway near Wyee, 19,000 gals.	B.H.P. (By-Products) Pty. Ltd.	771 17 6
91	Cast-iron alignment pins, 250	Mascot Engineering Works	39 11 8
93	Mild steel axles, with cast-iron boxes and dust caps, 4	Caldwell Engineering Works	7 10 0

The acceptance by the respective Councils of the following Tenders has been approved by the Board during the month of October, 1931:—

Work.			Name of Recommended Tenderer.	Amount of Recommended Tender.
Shire or Municipality.	Road No.	Description.		
				£ s. d.
Bellingen... ...	1,134	Gravelling, 1 mile 770 feet, and four timber culverts ...	J. W. Dodds	308 9 9
Tenterfield ...	189	Timber beam bridge, 30 feet span, over Acacia Creek ...	A. J. Anderson ...	474 6 0
Nymboida ...	12	Construction of concrete arch culvert over Bruce's Creek...	Bugden and Bugden ...	648 3 11
Lachlan	1,059	Formation and gravelling, 1,240 feet	B. Smith	71 16 0

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