MAIN ROADS

1979-1980

MAIN ROADS

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(Front Cover) Earthworks during construction of the Bellwood Deviation of the Pacific Highway around Nambucca Heads (see article on pp. 2–6).

(Back Cover) The second section of the Parramatta By-pass, near Lake Parramatta Reserve.

Issued by the Commissioner for Main Roads, B.J. Sexton

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A MESSAGE FROM THE COMMISSIONER FOR MAIN ROADS

It is with great pleasure that I introduce this composite issue of "Main Roads". We've had some production problems but now we're back in full swing . . . setting out to continue to record some of the Department's recent achievements.

The journal was first published back in September 1929, as a monthly statement of the activities of the then Main Roads Board — which was the forerunner of the Department of Main Roads. So this combined 1979-80 issue marks the 50th year of publication of this fine journal.

Over the past 50 years, the journal's standard of presentation has improved progressively, especially with the introduction in 1964 of colour illustrations on the cover and a few years later, on the centre pages. The layout and design of the journal have also been frequently updated to keep pace with contemporary trends. In fact, this issue is the first in a new style which incorporates an international paper size. There is no doubt that the journal justly deserves its reputation as a high quality, attractive and informative publication.

Perhaps the journal's greatest feature is that it provides a sequential record of the varied work undertaken by the Department. Therefore, as the years pass, the growing volumes of "Main Roads" add up to a comprehensive historical document, which is frequently referred to by people involved in quite different fields of research.

Far from being a boring, stodgy publication, "Main Roads" will continue to be a lively presentation of what roads and bridges demand of those who build them and what they mean to those people who use them. It gives a clear insight into the technical *mysteries* of road engineering and vividly portrays the visual appeal of today's bridge designs.

Articles report on works undertaken throughout the State, from Wanaaring to Wentworth, from Dubbo to Deniliquin, from Broken Hill to Bega, and from Narrabri to Nowra. Road improvements and traffic management activities in the urban areas of Sydney, Newcastle and Wollongong are similarly recorded. New and unusual equipment, the latest techniques, and current research projects are documented, while historical reports on early road and bridge works are published.

The coverage in the journal also ranges over such subjects as environmental considerations, funding, property acquisitions and administrative organisation. Consequently, in many ways, it can be regarded as a *window* through which the community can look into the operations of an important Government department and see how it serves them. The journal particularly helps to keep local Councils informed of the Department's policies and activities, in so many of which they work in partnership.

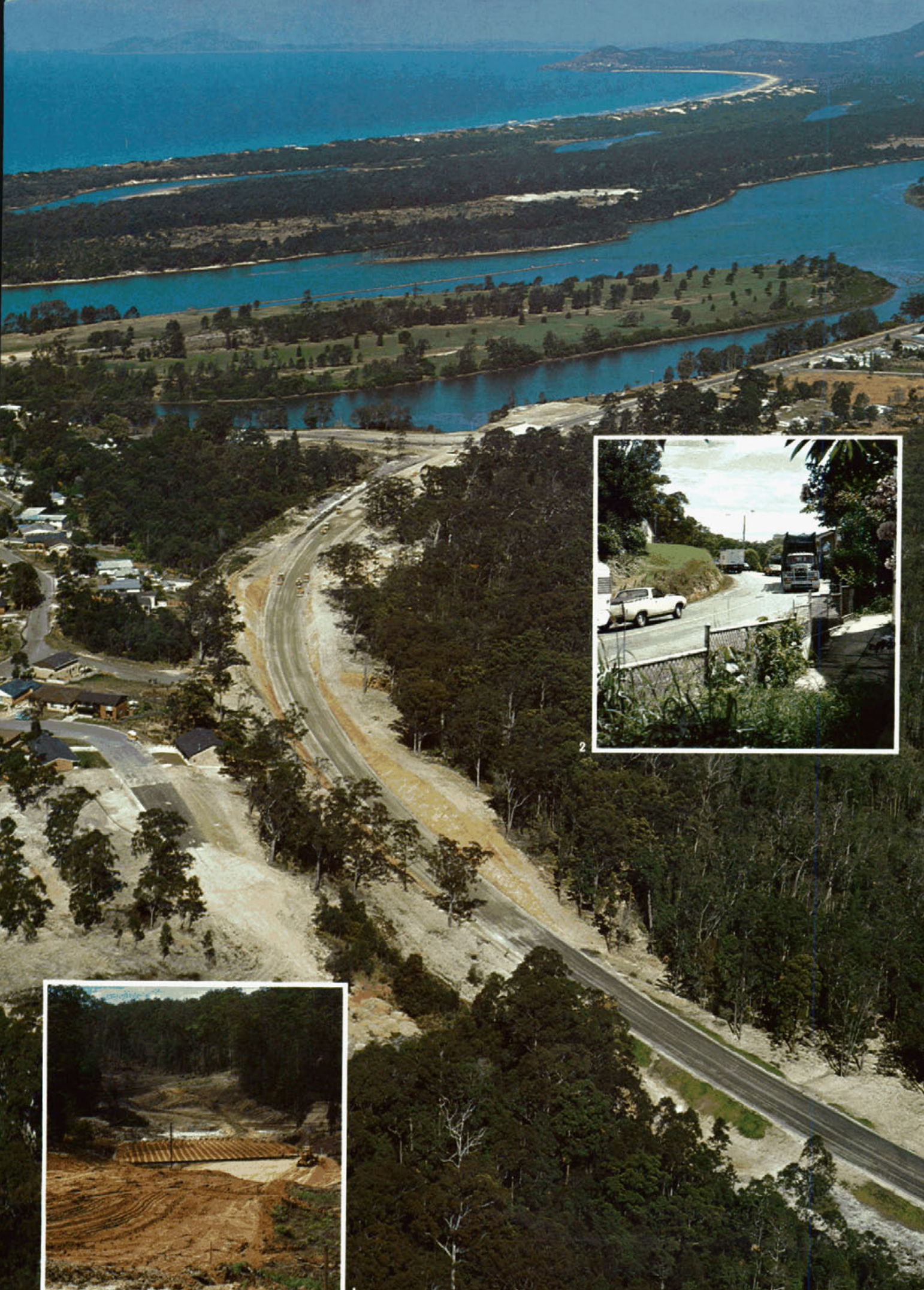
I would like to take this opportunity to publicly congratulate the personnel of the Department on the excellent job they are doing. I also wish to gratefully acknowledge the contribution and co-operation of local Council personnel throughout the State and to thank others from both private enterprise and the Public Service, who, on behalf of contractors and other Government organisations (especially the public utility authorities) have played their part so efficiently.

"Main Roads" is a worthy record of our joint accomplishments. It's a "must" for anyone who wants to know what's being done to give this State the type of good road network it deserves and so vitally needs.

As the eighth Commissioner for Main Roads (since Mr. H.H. Newell was given the title in December 1932), I have much pleasure in commending to you not only this special issue, but also all forthcoming issues of this valuable journal.

B. J. Sexton
Commissioner for Main Roads
New South Wales

Sydney,
January 1981.



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CHANGES AT NAMBUCCA HEADS — BELLWOOD DEVIATION

On 12th December, 1980, the Governor of New South Wales, Sir Roden Cutler, V.C., K.C.M.G., K.C.V.O., C.B.E. officially opened the 5.3 km Bellwood Deviation of the Pacific Highway to by-pass the township of Nambucca Heads.

The roadworks were carried out by the Department's own workforce, administered by the Port Macquarie Works Office, at a total estimated cost of just over $4 million (excluding bridgeworks). The five bridges and one large culvert included in the construction of the deviation have been built by four different contractors at a total of approximately $1.4 million.

The deviation of the Pacific Highway around Nambucca Heads was planned to alleviate many problems. The Highway previously passed through the main shopping and commercial centre of the township and consequently through traffic mixing with local traffic brought congestion for most of the year. During holiday periods, this congestion was particularly heavy as Nambucca Heads is a town of considerable tourist attraction in its own right and the centre of a beautiful district.

Improvements were also needed as the existing Highway was narrow, with a poor alignment and steep grades, as well as with a deteriorated road pavement. The new roadway has a two lane carriageway, each lane being 3.7 m wide, with 3 m wide shoulders.

Construction of this deviation has replaced a narrow and badly aligned timber bridge at Bellwood Creek. It has also eliminated a railway level crossing on poor alignment at Nambucca Heads Railway Station and replaced a timber bridge at Boggy Creek and a narrow culvert at Cedar Creek. The deviation has reduced the distance travelled by almost 2.5 km, and with better alignment and less traffic conflict it substantially reduces travelling times for highway users.

Left: The Bellwood Deviation by-passes Nambucca Heads, eliminating the noise and disruption and danger of through traffic.
1. Earthworks in progress along the Bellwood Deviation early in 1979.
2. A steep and winding section of the Pacific Highway just south of the commercial centre of Nambucca Heads — now by-passed.

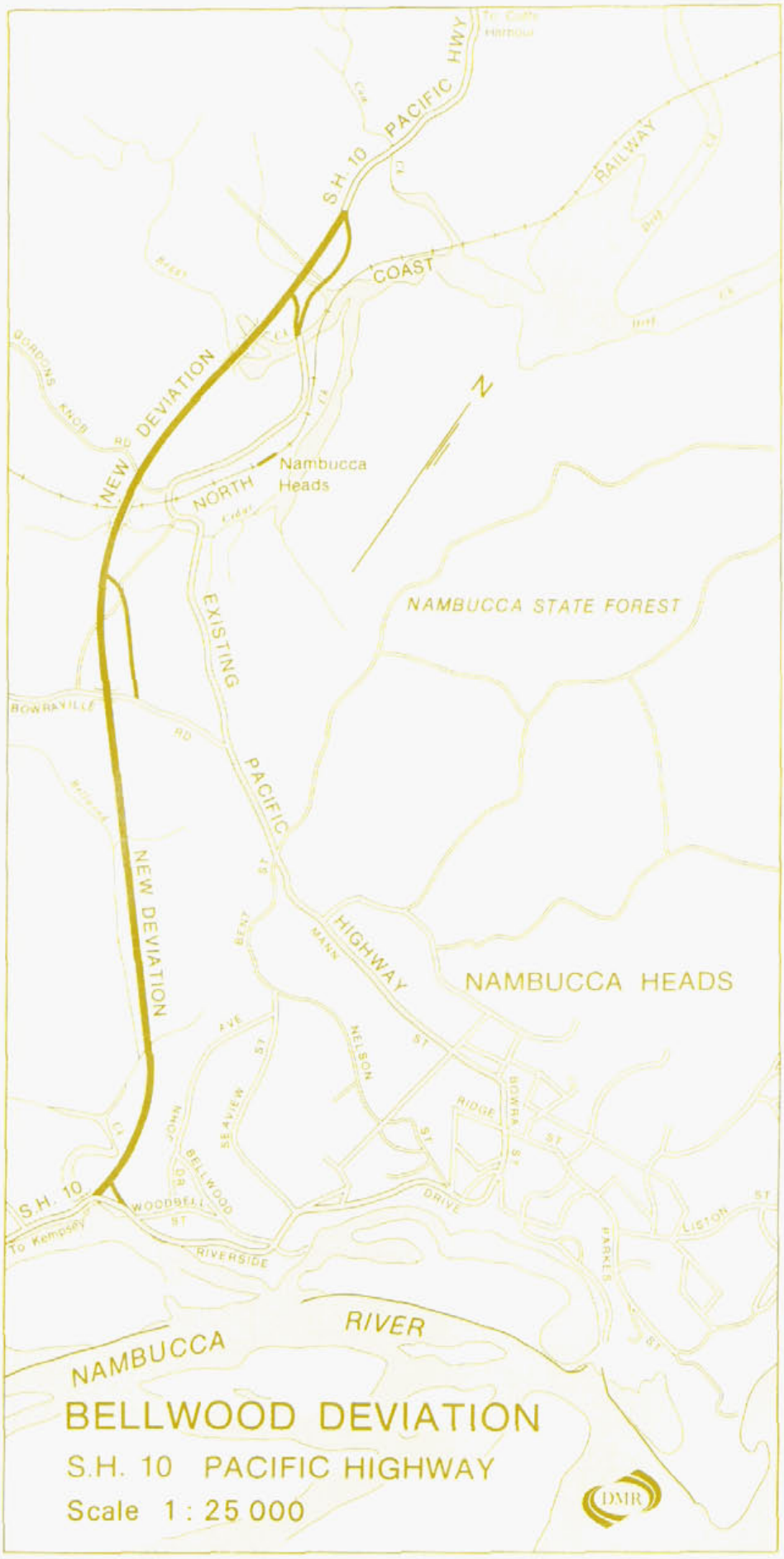
Route investigations

Several routes were considered for the Nambucca Heads by-pass. Back in the late 1930's, consideration was given to a line leaving Macksville near Newee Creek (10 km south of Nambucca Heads) and passing along Bowraville Road (the Old Coast Road) on a high ridge to the west of the existing Highway. However, it was decided to construct shorter deviations to permit better utilisation of the limited funds available.

Another line commencing immediately north of Teagues Creek, 3.5 km south of Nambucca Heads and slightly to the west of the existing Highway and west of the commencement of the present deviation, was also considered but not adopted.

During the late 1950's, a line was designed to the standard of the time (approximately 50 miles per hour). Since that time, however, the standard demanded for the Highway was increased to 60 miles per hour (100 km/h) and a new line was subsequently prepared and was approved in 1976.

The deviation leaves the existing Highway on the southern outskirts of Nambucca Heads at Bellwood Creek, skirts a swamp area on the side of a ridge and passes through a saddle at Bowraville Road (the Old Coast Road). It crosses the Main North Coast Railway Line by means of an overbridge and continues through a saddle at Gordons Knob Road. After completion of the deviation both the railway level crossing and Gordons Knob Road were closed to traffic.



Geological conditions

A preliminary geological survey, followed by seismic investigation and drilling, established that three distinct subgrade types existed within the deviation.

Swamp areas (between Bellwood Creek and the old racecourse east of Bowraville Road) were found to be sand-based with a cover of highly organic topsoil. The water table in this area varied from surface level to one metre below, and was lowered very early in the construction by excavating deep side drains. Despite a few local soft areas, there were no real foundation problems as the sand was firm even where it was submerged. In these local areas, a drainage blanket was placed to sufficient depth to give a dry base for fills.

Low-lying and swampy areas (between the old racecourse and Bowraville Road, as well as at Cedar Creek and Boggy Creek) were underlain by soft silty clays and muds to depths of 1 to 4 metres. These muds were solid but when disturbed turned into a slurry (thixotropic) with extremely low remoulded shear strengths and bearing capacities. Where depths were reasonable (1 to 2 metres), these sections were excavated and backfilled with either sand or non-plastic gravel.

At Boggy Creek, the depth was too great to fully excavate, and two drains were excavated to a depth of 4 metres along each side of the pavement line. These drains then were covered and were backfilled with non-plastic river gravel to form vertical drains across the full formation width with a 1 to 2 metre drainage blanket. The two objectives of this were the acceleration of settlement by consolidation under the load imposed by the fill, and to provide a dry base for fill materials.

Batters were flattened to a slope of 4:1 in an endeavour to reduce localised heavy loading. A settlement monitoring test has also been conducted at this site and the results showed no significant movement.

Elevated areas (where cuts were required and the material was to be used for fill throughout the job) consisted of surface materials of highly weathered phyllite clays with a high water absorption rate and high swelling properties. Seismic surveying and subsequent drilling confirmed that the weathering persisted to the full depth of the cuts and that no hard rock was present. This dashed any hopes of finding, within the cut areas, a convenient source of pavement materials, which were similar to the rock outcrops on the coastal headlands.

To determine how best this material could be used, a long term testing programme began well before construction started. Soil suction and moisture relationships were checked and the equilibrium moisture content determined. Compaction and CBR (California Bearing Ratio) tests were carried out and the optimum moisture was found to lie within the equilibrium moisture content range. This permitted construction at the moisture content where volume changes would be minimised. The cover requirement on top of the subgrade of the new roadway was assessed at 400 mm.

Designing the road pavement

The pavement design decided on was as follows:

- 2% lime stabilisation to a minimum of 100 mm below the subgrade level;
- 2% lime stabilisation of Schist gravel to provide a very stiff layer 200 to 300 mm below the surface;
- two layers, each 100 mm of mixed river gravel-granite soil stabilised with 1% lime, to give moisture stability when wet; and
- reworking of the top 100 mm layer for maximum flexibility.

The addition of the lime modified the pavement materials, increased the CBR and improved the performance of the materials under wet conditions (see articles on "Lime Stabilisation" in the March 1978 (Vol. 43, No. 3, pp. 74-7) and June 1979 (Vol. 44, No. 4, pp. 107-111) issues of "Main Roads".

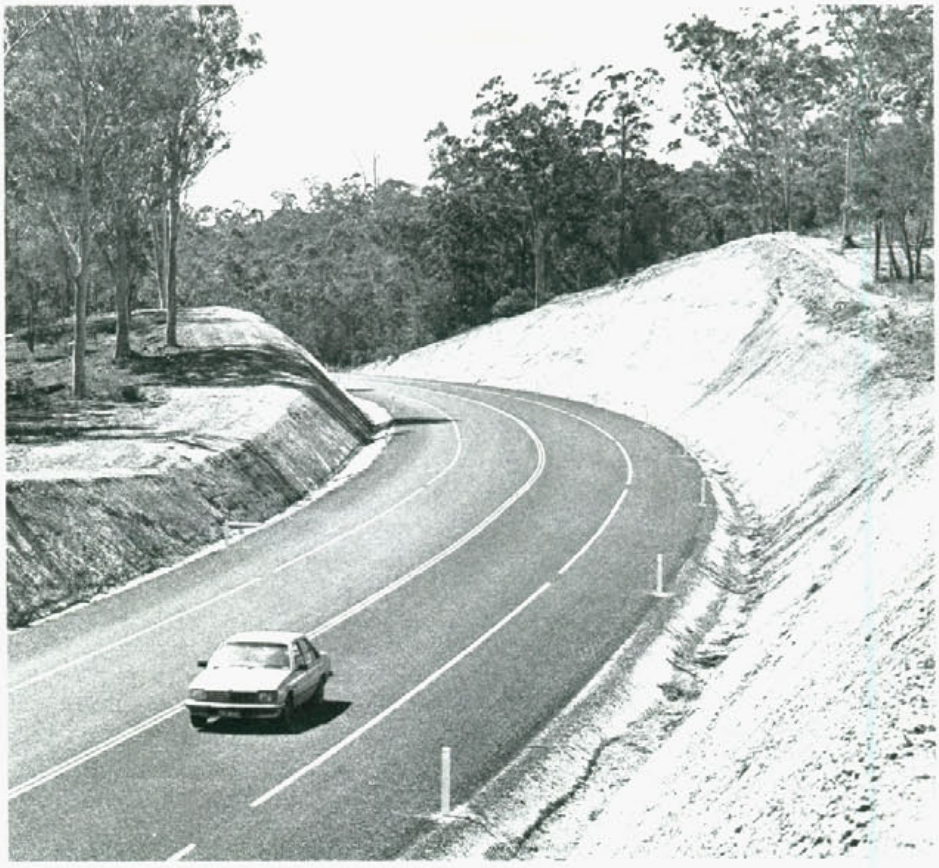
During construction, the quicklime was incorporated by firstly spreading it with a tractor-drawn bulk spreader and then mixing it with the pavement materials using a Departmental pulvimixer.

This design has provided:

- a flexible base immediately under the seal to prevent block cracking.
- a stiffened sub-base and subsequent fill layers selected to give maximum "spreadability" of the loading; and
- a permeability inversion at a depth of 200 mm, with water resistant materials to deflect water into sub-soil drains and away from the sub-grade.

Down to earth

The road construction plans provided for a formation width of 13.4 m, a pavement width of 7.4 m and 239,400 cubic metres of placed earthworks.



Preliminary earthworks (consisting of approaches to bridges and the provision of a sound base for fills) were carried out using a hired Caterpillar 613 elevating scraper. Later, heavier equipment was hired to carry out the bulk of the earthworks. This equipment consisted of two Caterpillar 631 self-propelled, push-loaded scrapers; a Caterpillar D9 bull-dozer and three self-propelled static weight compactors.

Problems were encountered with the earthworks because the in-situ material has been derived from phyllite and is very sensitive to moisture. Even light falls of rain during the construction period caused considerable disruption.

The works were programmed by the use of a link bar chart, which is a combination of a conventional bar chart and a critical path diagram. The link bar diagram was particularly useful in co-ordinating the target dates for earthworks and the contract bridgeworks.

Arrangements have been made for the Soil Conservation Service of N.S.W. to carry out hydromulching along the project in order to stabilise the batters, eliminate erosion and reduce construction scars.

In addition to the construction of the deviation, considerable work was carried out on the side roads. This involved reconstruction of the Bowraville Road as well as the north and south access links to Nambucca Heads.

Crossing roads, rivers and railways

Structures along the new deviation include the following five bridges and one major culvert.

- **The bridge over Bellwood Creek** — constructed by Gervay and Libera Constructions Pty. Ltd. of Lane Cove (Sydney) at a contract price of $280,939.
- **The bridge over Pacific Highway at Bowraville Road** — constructed by Wrightson Contracting Pty. Ltd. of Toronto (Newcastle) at a contract price of $217,270.
- **The bridge over Main North Coast Railway Line** — constructed by C.T.K. Engineering Pty. Ltd. of Wauchope at a contract price of $174,760.
- **The culvert over Cedar Creek** — constructed by C.T.K. Engineering Pty. Ltd. of Wauchope at a contract price of $54,047.
- **The bridge over Boggy Creek** — constructed by Bridge and Civil Pty. Ltd. of Tamworth at a contract price of $187,147.
- **The bridge over Boggy Creek Flood Channel** — constructed by Bridge and Civil Pty. Ltd. of Tamworth at a contract price of $79,747.

Bellwood Creek bridge

The bridge over Bellwood Creek (at 2 km south of Nambucca Heads) is the most southern structure on the deviation and was built in two sections. This staged construction was necessary because of the proximity of the existing bridge which carried Pacific Highway traffic. As soon as the first section (i.e. the western side of the structure) was completed and the approaches finished, traffic was diverted on to this portion. The old bridge was then demolished and the final section of the new bridge built.

The new bridge consists of two 15.2 m spans with a width between kerbs of 21.9 m to provide a turning lane for traffic travelling from the south and wishing to turn right into Nambucca Heads. It also allows for a median and for a merging lane for traffic heading south from Nambucca Heads. A footway, 1.8 m wide, is also included on the downstream side of the bridge for pedestrian traffic.

The deck is composed of inverted "T" shaped precast prestressed concrete girders with a cast-in-situ reinforced concrete deck slab.

Pile driving of the steel casings was carried out using a "bottom driving" method whereby the steel cylinder casings were fitted with a flat plate toe. Impact from a driving hammer was transferred to the casings by a cushion of dry concrete mix at the bottom of the cylinders. After a period of driving, the concrete mix became ineffective in transferring the hammer's impact and casing penetration diminished. Additional concrete mix was then added to enable further driving of the pile.

The "bottom driving" method was generally successful, but at the southern abutment driving was more difficult and two of the piles required so much concrete mix that reinforcement could not be placed. A change in the technique was therefore necessary, and this involved drilling through the layer of sand (approximately 2.5 m thick) which hindered the driving of piles.

The holes were drilled by use of a continuous flight auger to a depth just below the sand layer. After reaching this level the auger was withdrawn without rotation. As the auger was being withdrawn, a polymer compound known as "Revert" was pumped down the centre of the auger to make up for the volume of the extracted auger and the soil retained on the flight. The "Revert" was displaced from the hole by the bottom sealed casing which acted as a piston. "Revert" has the property of "self-destructing" to become water after about three days and this ensured that there was no long term detrimental effect to the pile.

Bowraville Road bridge

The bridge over the Pacific Highway at Bowraville Road is a simply supported prestressed concrete structure having a single span of 30 m and a width of 7.4 m kerb to kerb. A footway 1.6 m wide will be available on the southern side. Provision for a future dual carriageway and allowance for a further span are incorporated in the design. Broad flange girders have been used to give a continuous box appearance and, in an endeavour to present a more pleasing appearance for road users, the fascia slabs were made from compressed asbestos panels with an exposed aggregate finish on the outside girders of the bridge.

To facilitate haulage, the 30 m girders were precast and pretensioned in 10 m segments, weighing approximately 15 tonnes each. Post-tensioning was then used to join the segments longitudinally and also to connect the girders transversely. This tranverse post-tensioning is located at the end beams and at the two cross girders located at the segment connections. Concrete is placed between the flanges after the transfer of stress to the cross girders.

Railway overbridge

The two-lane bridge over the Main North Coast Railway Line consists of three 12.5 m spans of precast, pretensioned units supported on wall type piers. This type of pier was incorporated as a result of the Public Transport Commission's requirements.

The deck of the bridge is made of precast, pretensioned planks held together by a cast-in-situ reinforced concrete slab. The abutment fill was placed prior to the commencement of construction, thus requiring the driving of piles through the fill. In order to ensure that the piles could be driven to contract level, the contractor elected to pre-bore the fill down to the natural ground level. After driving, the spaces around the piles were backfilled with sand.

Bridges at Cedar and Boggy Creeks

The structure at Cedar Creek is a 3-cell 3 m x 2.1 m reinforced concrete box culvert 10 m wide. It is situated in the southern approaches to the new railway overbridge, mentioned earlier. A culvert was chosen for this site because of the depth of fill required.

The bridge over Boggy Creek is a single span structure, 24 m long and 12 m wide, comprising a deck of precast, prestressed "I" girders and a cast-in-situ reinforced concrete slab. Piles were constructed by driving open-ended steel casings which were then cleared from within by the "air lift" procedure. Concrete was then placed in the piles using the tremie system.

The bridge over Boggy Creek Flood Channel was constructed in a similar manner to Boggy Creek Bridge. The single span, however, is 9 m long and 12 m wide consisting of precast, pretensioned concrete girders having the same inverted "T" beam shape as used on the Bellwood Creek Bridge.

* * *

With the opening of the Bellwood Deviation, through travellers on the Pacific Highway between Kempsey and Coffs Harbour have been provided with a safer, shorter and faster route past the township of Nambucca Heads. For the lucky ones, who are holidaying in this lovely coastal location, it means more of a pleasure than usual to stop . . . and shop . . . and sightsee . . . and surf . . . and laze in the sun . . . and fish . . . at Nambucca Heads, now that the noise and disruption and danger of through traffic is gone.

Another major deviation — at Deep Creek

Immediately north of the Bellwood Deviation, an adjoining 4.3 km deviation is being built by the Department to replace another sub-standard section of the Pacific Highway. The Deep Creek Deviation, as it is known, will eliminate several sharp curves from the Highway and will reduce the distance by a further 1.8 km. The existing route has presented problems for some time as it is both prone to flooding and has a high accident record.

The new deviation will remove the first of these problems by providing a flood-free bridge at Deep Creek and will relieve the second problem by providing a very high standard road.

The new 91 m long bridge at Deep Creek will have six 15 m spans constructed of precast prestressed concrete planks, made continuous with cast-in-place concrete cross girders at the piers. The carriageway width will be 9.2 m between kerbs and of great importance is the fact that the bridge deck will be almost 2 m above the highest recorded flood level.

The bridge is being built for the Department under contract by McDougall-Ireland Pty. Ltd. of Carnegie, Victoria, at a contract price of $503,740. The Deep Creek Deviation is expected to be completed in 1983 and will cost in the vicinity of $3 million.

OLD DAYS AND WAYS AT NAMBUCCA HEADS

A sub-tropical climate, together with abundant fresh water, wildlife and edible vegetation, would have made the Nambucca area an idyllic setting for Aborigines who inhabited this region for centuries before European settlement.

White settlers found numerous groups of aborigines, each of about 6 to 10 families. Despite their nomadic nature, these groups basically remained within their own hunting grounds. Occasionally the groups gathered for ceremonies, initiations, to fight a war as allies, or in winter, for the coastal warmth and plentiful seafood.

The Nambucca aborigines are thought to have belonged either to the Dainggatti or the Kumbainggiri tribes. The Kumbainggiri, who generally occupied the area around the lower course of the Nymboida River and eastwards to the coast, had particularly stationary habits. The local abundance of food and the difficult terrain would have tended to discourage travel. Not much is known of the Dainggatti tribe, but they are generally throught to have occupied the area around the Macleay River headwaters, inland to the New England district, and south-west to the Mount Royal Range.

It is believed that from the local dialects, the word "Nambucca" (Ngambugka) means either "crooked river" or "entrance to the waters".

A village by the sea

The river was probably first discovered, by white settlers, in 1818. An extract from the *Journal and Proceedings* of the Royal Australian Historical Society of 1907 (Vol. 11, Part 6, p. 135) states:— "*The seizure of the brig* Trial *in Port Jackson in September, 1816, by a gang of convicts . . . led to the discovery of the Macleay and Nambucca Rivers.*

"*Captain White was sent in February, 1817, in the* Lady Nelson *to investigate statements by blacks that a ship was ashore far up the coast, and he found the wreck of the* Trial *in a bay known as Trial Bay.*" Two days later the vessel sailed northward and hauled inshore where a river corresponding with the Nambucca was discovered.

In 1820, Surveyor-General John Oxley was sent by Governor Macquarie to survey the site of Port Macquarie, in the schooner *Prince Regent*, and to investigate two inlets north of Smokey Cape. An extract from his diary of December 1820 reports:

(Saturday 2nd) "*It was three o'clock before we had approached the inlet* (the mouth of the Nambucca) *sufficiently near to permit me to send the boat under Mr. Kent to examine the entrance . . . The country from the masthead appeared good and pleasingly diversified. At half-past six the boat returned, being unable to find any passage into the inlet . . .*
(Sunday 3rd) . . . *After breakfast we examined the river . . . A good channel at two and a half fathoms continued for about three miles . . . it shortly afterwards spread out into shoal flats, with numerous swampy islands divided by channels . . . Across the narrow channels the natives had constructed weirs for the purpose of fishing*".

Lieutenant Henderson visited the colony in 1838 and later wrote a book called "Excursions and Adventures in New South Wales". In his book, he refers to the *Nana Bucca* as an unexplored river, running parallel to and north of the Macleay. Four years later, when the cedar supply on the nearby Macleay River began to be depleted, the cedar-getters moved north to the forests around the Nambucca district. In the 1860's, settlers were coming north from the Macleay, the Manning and further south. Many engaged in cedar getting, clearing areas already passed by the earlier group, seeking out the timber from the less accessible ranges further upstream.

You have to admit, roads have improved . . . a convoy of vehicles finds the going rough on Nambucca Heads Road in April 1923.

The Village of Nambucca was proclaimed in the Government Gazette of 21 October, 1870. The first survey on the site of the village was made by Surveyor Herborn in July, 1874. It's hard to believe, but an auction sale for the allotments, held on 7 November, 1877, at West Kempsey, received no offers. On 30 July 1879 they were again offered for sale — this time with better results. Lot 3 was sold for £7 5s 0d; Gordon's Hotel was built on it and began operating in the 1880's. The Nambucca township began to grow, but the beginnings were far from easy.

Early conditions

For convenience on the one hand and at times for survival (due to the uncertainty of transport and communications), the early white settlers needed to produce their own food supplies. Agriculture was undertaken, with maize being the earliest cash crop. Food consisted mainly of vegetables grown from seed carried by the pioneers. Paddymelons (brush kangaroos), wallabies, wild pigeons and turkeys added much needed variety to the diet of salt beef, which was transported to the district in casks. The maize, when finely ground, formed the basis of porridge and scones and enabled the fine flour, which was purchased from stores, to go further.

Bullock teams were commonplace, and were originally the only means of cartage. The cottages were either of pitsawn cedar or beech, or split slabs, with bark (and later shingle) roofs and dirt floors. Small lean-to's often provided sleeping room for children and kitchens were also generally separate lean-to structures. Lighting consisted firstly of tins of fat, called slushlamps, and later of home-made tallow candles.

Supplies first came overland to the Macleay River then by sea to Nambucca Heads. Roads were primitive and travel was often hazardous. Locally, the river was the main artery of transport and communication, carrying boats, launches and droghers (coasting vessels), most of which were built in the district. The droghers sometimes served a purpose other than carrying logs, livestock and produce. The decks were washed and flags were strung around in order to make the vessels look as bright and festive as possible. In this transformed state, they would ferry people around on moonlight excursions, or carry them to a nearby crossing for a picnic or sports day.

Timber milling and mining

Timber brought the first white people to the area, and, with mills in virtually every locality, timber developed into one of the greatest sources of income.

A team of eight bullocks was required to drag the Robinson Bros' Passenger Service Car out of trouble on Nambucca Heads Road in April 1923.

The first timber mill on the Nambucca River was probably that of Nicholas Christensen. Known as the *Copenhagen Mill*, it began operations around 1874. A number of good shipwrights soon made use of the local timber, much of which was pit-sawn on the eastern slope of McClungs Hill.

Mining also played a part in the early days of the district, with molybdenite, antimony and arsenic concentrates being the main mineral deposits. A gold bearing reef was reported to have been discovered in 1874, though investigations showed the amount of gold present to be almost negligible.

Living off the Land

After the land was cleared, dairying usually followed as a means of making a living. The lack of natural grasses, poor financial resources and transport problems made this a difficult proposition. A species of grass called paspalum was introduced to the area from South America in the early 1890's as fodder for the dairy herds. It was suited to the local soils and warm climate of the Nambucca district, and gave the dairying industry a much needed boost.

Separators were soon introduced, varying in size from large power machines to the smaller horse-driven versions. The first butter factory came into operation at nearby Macksville in 1902.

But soil depletion, the depression years and an increased emphasis on beef cattle, all had adverse effects on the dairying industry. In 1941, a co-operative meat society was formed and in the first year of operation, 60,000 head of stock were slaughtered.

Meanwhile, fruit and vegetable production had grown into a viable industry. Tomatoes were being sent to Sydney markets by 1923, and bananas by 1926. Carrots were grown successfully in the district, thousands of tonnes being grown during World War II, for supply to the Department of Defence. In one season, 5,000 bags of carrots were harvested from a 5-hectare paddock.

The road ahead

Agriculture depends on getting produce to markets as quickly as possible, and so roads have more often than not, played a crucial role in the development of farming districts.

With the changes from bullock teams to high powered semi-trailers, and with the decline in coastal shipping, roads have increased in importance in the life of North Coast towns. They have also increased in quality — thank goodness — from those early earth formations which were dust bowls in dry weather and quagmires in wet.

In our more affluent times, we look to roads to get us to and from our holiday resorts and tourist centres with ease and safety. So, for all the local people involved in primary industries and commercial activities in the Nambucca region, as well as for all those lucky people who come to holiday or visit, roads are one of the most important assets they have.

RE-ORGANISED FUNCTIONS FOR DEPARTMENT'S CHIEF ENGINEERS

A two-part article dealing with the structure, function and operation of the Department's Engineer-in-Chief's Branch appeared in the June and September 1976 issues of the "Main Roads" Journal (Vol. 41, No. 4, pp. 121-4 and Vol. 42, No. 1, pp. 19-23). The following article outlines the changes to the Branch's top management since 1950, particularly those introduced in mid-1979.

The need for change

Large organisations in both the public and private sectors of our community are continually subject to change. This Department is no exception. Pressure to change can come from outside the organisation (from Government or the general public) or it can come from within (from staff or from activities generated by the organisation itself).

Changes to higher levels of organisational structure within the Engineer-in-Chief's Branch have generally occurred in order to improve efficiency where organisational and technological developments have meant a build up and even overload of responsibilities in certain areas. The changes have lessened excessive work loads on senior officers through the delegation of responsibility to newly formed positions. This has also meant shorter lines of command and has given those officers time to initiate new proposals as well as fulfil existing commitments.

Past changes

Up to 1953, the Branch was managed by the Chief Engineer as Branch Head with an Assistant Chief Engineer for support. Divisional Engineers and the relevant Section heads reported to these officers.

In 1953 the Assistant Chief Engineer was elevated to the status of Deputy and the new position of Assistant was formed to take charge of operational matters. The need for an additional Assistant was foreshadowed and five years later, 1958 saw the appointment of the second Assistant Chief Engineer and a re-allocation of duties. The Chief Engineer retained his responsibility for Divisional Engineers and the Deputy assumed responsibility for operational matters. The two Assistants assumed responsibility for the areas of planning and design.

In 1961 the duties of the four senior officers were again re-organised. Changes for the Chief Engineer were minimal as they were for the Deputy Chief Engineer who retained the basic responsibility for operational matters. But the division of duties between the Assistants was no longer on a functional basis and the planning and design designations disappeared.

A comparatively major change took place in 1968, when new positions were created, duties re-allocated and titles changed. The Chief Engineer was given the title of Engineer-in-Chief, while the two Assistants were elevated to the status of Chief Engineers. Two new Chief Engineers were also appointed making four positions responsible for the oversight of the Urban, Rural, Roadworks and Bridges functions. This situation remained the same until mid-1979. The responsibilities of each of the six senior officers were outlined in the September 1976 issue of "Main Roads".

All of these changes were significant as they resulted from a recognition of the need to re-allocate duties in response to changing emphases, as well as the need to delegate authority. This was made necessary by the increasing size and overall responsibility of the branch.

Developments in the 1970's

The 1960's saw a large growth in construction activity by the Department. This growth was in the Department's traditional areas of work and many major projects, such as the Sydney-Newcastle Freeway and large bridges at Gladesville, Taren Point, Roseville and Harwood, were completed. The 1968 organisational restructuring, mentioned above, was a response to this development.

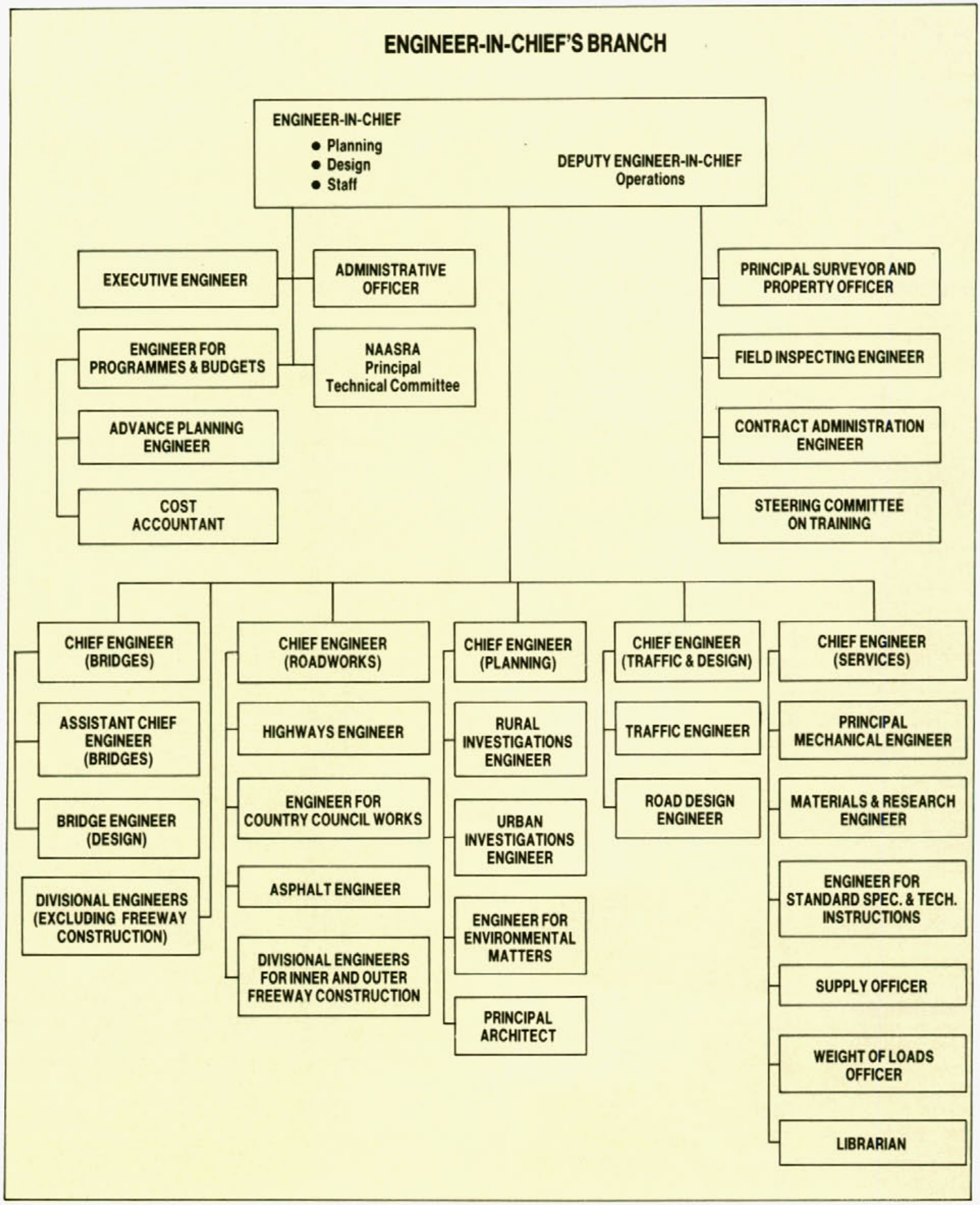
The 1970's, however, saw a levelling-off in construction growth. Major works, of course, continued to be undertaken and completed, but there has been little growth in the real value of funds available. Nevertheless, the volume of work to be performed continued to increase significantly because of changing functions and the allocation to the Department of additional responsibilities.

The following factors have brought the biggest changes to the overall workload of the Department.

As from 1 July 1974, a new classification of Urban Local Roads was created as part of new legislation for Federal funding. Under this legislation the Department became responsible for administering Commonwealth Grants to councils for works on this type of road throughout New South Wales.

As from 1 February 1975, this Department also took over from the Department of Public Works the task of administering Commonwealth Grants to councils for the construction and maintenance of Rural Local Roads

The Traffic Authority Act 1976 established the Traffic Authority of New South Wales which assumed full responsibility for road traffic control throughout the State as from 1 June 1976. Certain traffic management activities formerly undertaken by the Department of Motor


ENGINEER-IN-CHIEF'S BRANCH
ENGINEER-IN-CHIEF
• Planning
• Design
• Staff
DEPUTY ENGINEER-IN-CHIEF
Operations
EXECUTIVE ENGINEER
ADMINISTRATIVE OFFICER
ENGINEER FOR PROGRAMMES & BUDGETS
NAASRA Principal Technical Committee
ADVANCE PLANNING ENGINEER
COST ACCOUNTANT
PRINCIPAL SURVEYOR AND PROPERTY OFFICER
FIELD INSPECTING ENGINEER
CONTRACT ADMINISTRATION ENGINEER
STEERING COMMITTEE ON TRAINING
CHIEF ENGINEER (BRIDGES)
ASSISTANT CHIEF ENGINEER (BRIDGES)
BRIDGE ENGINEER (DESIGN)
DIVISIONAL ENGINEERS (EXCLUDING FREEWAY CONSTRUCTION)
CHIEF ENGINEER (ROADWORKS)
HIGHWAYS ENGINEER
ENGINEER FOR COUNTRY COUNCIL WORKS
ASPHALT ENGINEER
DIVISIONAL ENGINEERS FOR INNER AND OUTER FREEWAY CONSTRUCTION
CHIEF ENGINEER (PLANNING)
RURAL INVESTIGATIONS ENGINEER
URBAN INVESTIGATIONS ENGINEER
ENGINEER FOR ENVIRONMENTAL MATTERS
PRINCIPAL ARCHITECT
CHIEF ENGINEER (TRAFFIC & DESIGN)
TRAFFIC ENGINEER
ROAD DESIGN ENGINEER
CHIEF ENGINEER (SERVICES)
PRINCIPAL MECHANICAL ENGINEER
MATERIALS & RESEARCH ENGINEER
ENGINEER FOR STANDARD SPEC. & TECH. INSTRUCTIONS
SUPPLY OFFICER
WEIGHT OF LOADS OFFICER
LIBRARIAN

Transport and the Traffic Branch of the Police Department were transferred to the Department of Main Roads, which became the Authority's principal construction agency. Under this legislation, the Department became responsible for the planning, installation and maintenance of traffic signals and other traffic facilities on all roads throughout the State (see Article "New Traffic Authority" in the September 1976 issue of "Main Roads", Vol. 42, No. 1, pp. 8-10).

Associated with this transfer of responsibilities, there has been a greater emphasis by the Government on traffic management measures and on local participation in decisions on traffic matters. This has led, for example, to the extension of the transit lane system on the one hand, and to the establishment of local Traffic Committees on the other. These Committees provide a forum for discussions by representatives of the council, the Police Department and the DMR. They have allowed for the delegation and decentralisation of decision-making on the provision of traffic control facilities to a local level.

- A general shortage of funds has required a more detailed examination of the cost-effectiveness of project alternatives, particularly when it is not possible to fund the most desirable option.

- The desire for the preservation of more of our physical environment and other areas of community concern (including those relating to the social implications of project alternatives) have grown dramatically in recent years. The Department has always been sensitive to the total needs of the community environment, but recent developments have meant a considerable increase in the Department's work load. For example the increasing desire for greater public participation and more Government involvement — both commendable worldwide trends — have required the presentation of much more material for *external* consumption, (that is, outside the Department) and the production of reports on studies (such as Environmental Impact Studies) for projects which previously attracted little public interest.

MANAGEMENT AND STRATEGY REVIEW

During 1978, as part of the Review of N.S.W. Government Administration, a Management and Strategy Review of the Department was conducted by a firm of management consultants. One area considered by the consultants concerned a restructuring of the Engineer-in-Chief's Branch.

In their report on the Branch structure, the consultants recognised the work overload on the senior officers. To assist in overcoming this and other difficulties faced by the Branch, the report suggested —

- clearer delineation of staff and line responsibilities and decision-making authorities;

- better focussing of responsibilities for technical and geographical functions;

- a more participative style of management, with greater delegation and more autonomy within operating units, and

- a greater emphasis on the operations function of the Branch.

The consultants made no recommendations regarding a defined Branch structure, but envisaged that the Branch should move towards a structure which would, in outline, comprise the four key performance groups of

- Operations,
- Operations Support,
- Consultant Services (such as design)
- and Corporate Support.

The determination of the actual structure which would best meet the Branch's needs at any particular time was deliberately left as a Departmental responsibility.

ADDITIONAL CHIEF ENGINEER APPOINTED

In May 1979 the structure of the Branch was altered to provide for an additional Chief Engineer. The five positions of Chief Engineer then became
Chief Engineer (Traffic and Design),
Chief Engineer (Bridges),
Chief Engineer (Roadworks),
Chief Engineer (Planning), and
Chief Engineer (Services).

At the same time, the opportunity was taken to re-allocate duties between all senior Branch officers except the Chief Engineer (Bridges). These changes occurred after a detailed examination of the needs of the Branch. The inability of the previous ten year old organisational structure to adequately meet these needs was apparent. Some specific deficiencies of the old structure were as follows.

- There was too great a workload for the Chief Engineer (Urban).

- The duties of the Chief Engineer (Roadworks) did not include responsibility for freeway construction, an activity closely allied to highway construction.

- The Chief Engineers (Urban) and (Rural) had a mixture of duties, some of which required a Statewide approach, and others which were restricted to a geographical area.

- The Road Design Engineer reported to both the Chief Engineer (Rural) and the Chief Engineer (Urban), an arrangement which was considered to detract from the effectiveness of the Section.

- The Deputy Engineer-in-Chief had too many responsibilities of a continuing nature.

- The Engineer-in-Chief was being required to spend an increasing proportion of his time on personnel and National Association of Australian State Road Authorities related matters.

The new Branch structure and allocation of responsibilities is as shown in the diagram on page 10. Two points about the new structure are of particular interest.

- The Engineer-in-Chief has prime responsibility for planning, design and staff matters while the Deputy Engineer-in-Chief oversees operational matters. However, a team philosophy applies to the relationship between the Engineer-in-Chief and his Deputy and the traditional "one on one" management arrangement as shown in previous structures is no longer valid.

- The additional position created, that of Chief Engineer (Services), provides a deliberate focus on the service or support functions.

The current occupants of the seven senior positions in the Branch, with details of their positions before the change, are:

Mr. D.C. Jacob
Engineer-in-Chief
Mr. E.M. Brown
Deputy Engineer-in-Chief
Mr. L.R. Browne
Chief Engineer (Traffic & Design), formerly Chief Engineer (Rural)
Mr. L.H. Evans
Chief Engineer (Bridges)
Mr. E.W. King
Chief Engineer (Roadworks), formerly Highways Engineer who succeeded Mr. V.R. Minus who retired in August, 1980.
Mr. V.P. O'Grady
Chief Engineer (Planning), formerly Road Design Engineer
Mr. K. Edgar
Chief Engineer (Services), formerly Divisional Engineer, Inner Freeway Construction.

A group photograph of the Department's Chief Engineers, viewing a model of the F3 over Darling Harbour in the Head Office Model Room. From left to right: Mr. Lyn Evans, Chief Engineer (Bridges); Mr. Laurie Browne, Chief Engineer (Traffic and Design); Mr. Kel Edgar, Chief Engineer (Services); Mr. Ed Brown, Deputy Engineer-in-Chief; Mr. Vic Minus, retired Chief Engineer (Roadworks); Mr. Doug Jacob, Engineer-in-Chief; and Mr. Vince O'Grady, Chief Engineer (Planning). Inset photograph shows Mr. Eric King, formerly Highways Engineer, who succeeded Mr. Minus as Chief Engineer (Roadworks) in August 1980.

OPENING OF F3 AT DARLING HARBOUR

After 24 May 1980, the North Western Freeway over Darling Harbour became a functional part of our premier city. Inset shows mid-morning traffic on the westbound viaduct.

OPENING OF NEW SECTION OF NORTH WESTERN FREEWAY

On Saturday 24 May, 1980 the first section of the F3 – North Western Freeway across Darling Harbour was opened.

The opening of the viaduct for west bound traffic represented the first stage of a two stage project to provide motorists with an alternative crossing of Darling Harbour. As significant changes to traditional traffic movements were entailed, the occasion was the subject of one of the most intensive publicity drives yet mounted by the Department of Main Roads. When the final stage of the project opens in mid 1981, the ageing and inadequate Pyrmont Bridge will be closed completely to vehicular traffic.

Dual elevated roadways will then provide access between Sydney's central business district (and the Harbour Bridge) and the connecting links for the western and north western suburbs (in the Ultimo-Pyrmont area).

The new traffic arrangements required the reconstruction of existing roadways, intersections and traffic signals to tie in with the new roadway. Works were carried out jointly by the Department and the Council of the City of Sydney.

The publicity campaign included the distribution of two brochures explaining short and long term traffic changes, the placing of half page advertisements in the daily morning newspapers, plus extensive press, radio and television coverage.

The Commissioner for Main Roads, Mr. Brian Sexton, held a press conference on Monday 19 May using maps and a scale model of the area to explain the changes to newsmen. The model and maps were also displayed in city locations and at the Department's Royal Easter Show exhibit. The brochures were distributed beforehand to local residents and businesses, and drivers of vehicles using Pyrmont Bridge. They were also made available to the general public.

The success of the campaign can be measured by the general free flow of traffic on opening day, a flow which further improved in the following days. Considering the extent of the changes, road-users handled the changes very well.

The main change for motorists was the closing of Pyrmont Bridge to westbound traffic. The bridge became one way eastbound into the city. Traffic coming from either the city or the Sydney Harbour Bridge and heading through the Pyrmont area was directed onto the Freeway's new elevated roadway, over the railway yards on the southern side of Darling Harbour.

Traffic entering the city

The eastern, or city side, abutment of Pyrmont Bridge has since been demolished to allow permanent connections to the Freeway to be built at the end of Market Street. This work has prevented traffic from continuing straight on from Pyrmont Bridge to Market Street, and vice versa.

Traffic coming off Pyrmont Bridge now has to negotiate one of two sharp left hand turns. The first turn provides entry to the central business district via a ramp to King Street. The second turn provides access to the Sydney Harbour Bridge or to the city north (via Hickson Road).

Traffic leaving the city

Traffic moving from either the city or the Sydney Harbour Bridge towards the Ultimo-Pyrmont area and Victoria Road now travels on the Freeway's new elevated roadway.

Market Street traffic leaving the city now approaches the Freeway via Sussex Street and Day Place.

Changes in city street flow

To assist these traffic changes other alterations occurred in the city. Traffic flow in Sussex Street between King Street and Day Place was reversed to become southbound. Sussex Street between Erskine Street and King Street, and between Day Place and Bathurst Street became two way.

On 27 July, Sussex Street became completely one way southbound between King and Hay Streets. At the same time, Kent Street was reversed to become one way northbound between Liverpool and Erskine Streets.

Changes in the Ultimo and Pyrmont areas

The western end of the Freeway's elevated roadway ends at Harris Street. Harris Street became one way northbound from the intersection of the Freeway to Union Street. The southern section of Harris Street remained two way.

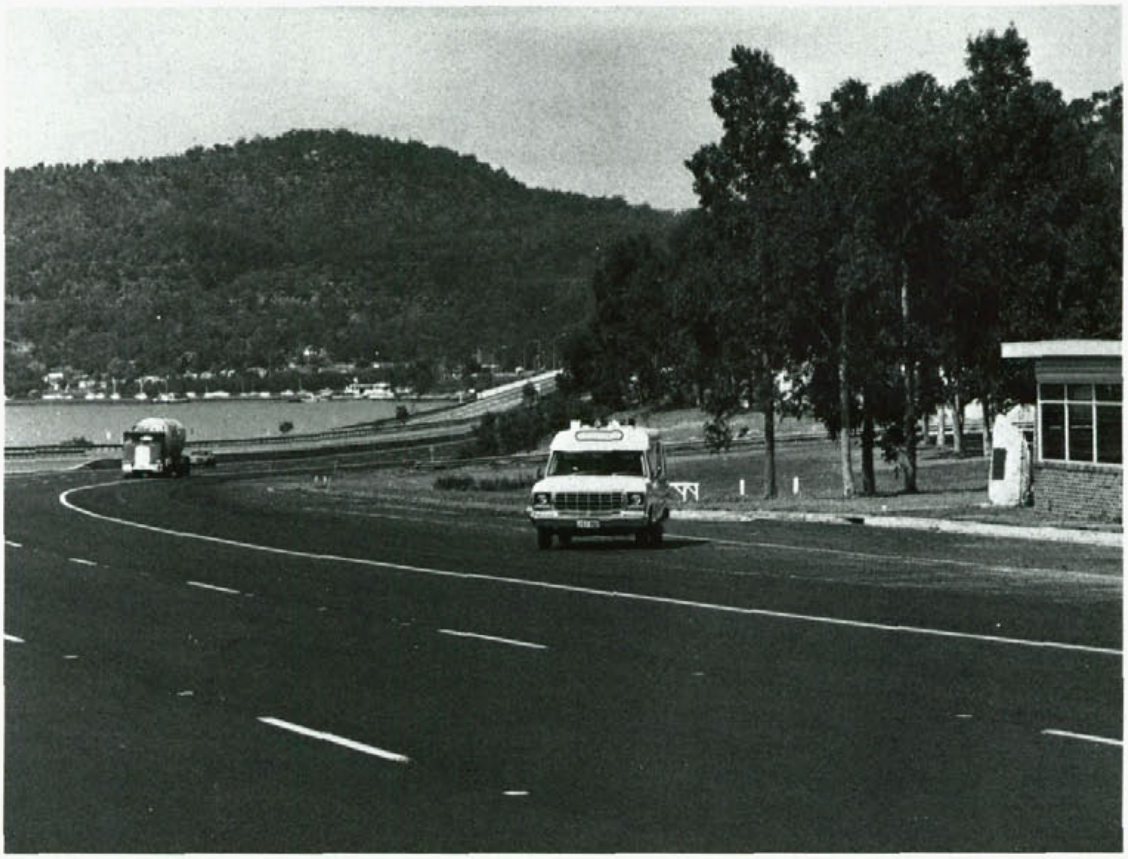
Pyrmont Street became one way southbound from Union to Quarry Streets.

Traffic heading for Pyrmont and Victoria Road must therefore turn right on reaching Harris Street, whereas traffic heading for Ultimo and Parramatta Road must turn left.

1

1. The opening of Stage 1 of the F3 — North Western Freeway on Saturday, 24 May 1980. The first vehicles stream across the new elevated roadway following the removal of the barriers.
2. Many of the Department's senior officers who were involved in the project were on hand to witness the opening of the Freeway.
From left to right: Jim Kelly, Divisional Engineer, Inner Freeway Construction Division; Reg Roughan, Supervising Engineer, Inner Freeway Construction Division; Brian Korff, former Divisional Engineer, Inner Freeway Construction Division and Chief Engineer (Rural), now retired; John Neeson, Metropolitan Engineer; Brian Sexton, Commissioner for Main Roads; Laurie Browne, Chief Engineer (Traffic and Design); Kel Edgar, Chief Engineer (Services) and former Divisional Engineer, Inner Freeway Construction Division; and Bob Leece, Works Engineer, North Western Freeway Construction Office.

2



1

WHEN MINUTES COUNT!

New ambulance service based at Mooney Mooney

In crises such as heart attacks or serious traffic accidents, survival often depends on how quickly the victim(s) can be taken to hospital for skilled medical attention. There he or she can be treated by teams of specialists backed up by extensive life-support equipment and services.

On the route from Hornsby (about 26 km north of Sydney) to Gosford, an ambulance could take as long as 30 minutes to reach an accident site on the Berowra-Calga Tollwork or the Pacific Highway. At busy times, the delay could be much longer. Until recently, the nearest ambulance stations were at Waitara and Point Clare.

The midway point

Roughly halfway between Hornsby and Gosford is Mooney Mooney, just north of the Hawkesbury River. At this point there used to be a complete toll collection complex.

It was opened on 15 December 1965 when the first section of the Tollwork from Hawkesbury River at Mt. White was completed (see March 1966 issue of "Main Roads", Vol. 31, No. 3, pp. 66-9). This toll collection point covered the extension of the Tollwork to Calga (opened on 28 October 1966) but when the section south of the Hawkesbury River was opened on 12 December 1968, tolls were collected both at Berowra and at Mooney Mooney.

This situation applied until the new Hawkesbury River bridge was completed in October 1973. The new bridge linked the Tollwork sections north and south of the River and allowed Tollwork traffic to have an uninterrupted 26 km run from Berowra to Calga. Consequently only one set of toll gates at Berowra was necessary and the facilities at Mooney Mooney became redundant.

The old Peats Ferry bridge, parallel to the new one, remained as part of the Pacific Highway. The two roadways (i.e. freeway

2

1. 2. The ambulance station at Mooney Mooney, just north of the Hawkesbury River . . . halfway between Hornsby and Gosford.

and highway) now have mutual direct access only at Berowra and Calga.

Same site — different service

Following the changes outlined above, the Mooney Mooney tollgates were no longer needed and so they were removed. The toll office itself and some ancillary structures were retained for a time when they might be useful in some other role.

That time came in mid-1979 when the remaining structures at Mooney Mooney were converted into a much needed midpoint ambulance station. Central District Ambulance, which comes under control of the Health Commission of New South Wales, and the Department combined their efforts in planning this venture. The original suggestion for the disused buildings to be converted into an ambulance station came from Mr. M. Meares, a former Tollway Manager, and his staff at Berowra.

The old toll office is now leased to the Health Commission which has undertaken renovations to adapt the building to its new use.

In commission since 13 July 1979, the Mooney Mooney ambulance base is able to respond in a minimum of time to calls, not just along the Tollwork or the Highway, but to other emergencies in the district. At this location it is possible for the ambulances (as emergency vehicles) to gain direct access to both the Tollwork and the Highway.

Round the clock

At present, three ambulances are stationed at Mooney Mooney and these are manned by ten ambulance officers who work overlapping shifts on a 24-hour basis. Provision will eventually be made to extend this to a standing fleet of six ambulances. With both the base station and vehicles fully equipped with two-way radio, the ambulances are able to respond to calls relayed from a variety of sources.

Calls may originate from private telephones, emergency telephones on the Tollwork, mobile Citizens Band radio operators contacting through CREST (Citizens' Radio Emergency Service Teams), police patrol cars, or the Department's own Tollwork patrol vehicles based at Berowra.

The crews of the latter, while not qualified as ambulance attendants, have enough first-aid training to decide when it is desirable to call for an ambulance. They also carry comprehensive first-aid kits. Their direct radio links with the Tollwork Office at Berowra permit an almost immediate relay of messages to the ambulance station at Mooney Mooney.

This is another example of the co-operation between personnel of this Department and other Government bodies. In this case, it has resulted in a valuable contribution towards safer travelling conditions for the community we all serve.

CARING FOR KIDS

ON THE ROAD AND IN OR NEAR CARS

When people and machinery come into conflict, the people involved usually suffer most. On our roads, those most at risk are the ones who are handicapped in any way. They may be handicapped in their sensory capacities (blind, deaf, or partially so), motor abilities (the "halt and the lame" as the Bible puts it) or their mental functions.

The handicapped . . .

Compared to the ordinary healthy adult, every child can be considered to be handicapped, as far as physical and mental abilities are concerned. Being smaller, they often cannot move or respond as quickly. With less experience they cannot judge traffic movements as well. And naturally, the younger the child, the less likely it is to appreciate the massive danger of moving metal opposed to fragile flesh. Along with the elderly and obviously handicapped, children are at a special disadvantage wherever their paths cross those of motor vehicles.

. . . and the hazards

In the year ending 1 June 1980, 32 pedestrians under eight years of age were killed on the State's roads, and 659 were injured, many scarred or crippled for life.

It takes years of experience and patient teaching to turn a toddler into a trained pedestrian. Responsibility for this training lies mainly with parents and guardians, although schools and other organisations have their parts to play.

Drivers have a deep duty to care for all pedestrians, especially these young ones. Young children lack the experience to judge how fast a vehicle is approaching or how far away is a "safe stopping distance" for a truck. They tend to be impulsive, erratic and unpredictable in their behaviour . . . and more often than not they are preoccupied with their games or just day-dreaming.

Playing your part

A small child can often be hidden by the bulk of a parked vehicle as he or she steps off the kerb. So we should all be aware of the need to always obey the regulation that forbids parking within six metres on the approach side to a marked pedestrian crossing. The excuse that you parked there "just to slip into the paper shop" would sound rather weak and pathetic at a coroner's inquest.

We should also approach all foot-crossings with care. The young pedestrian may often place too much faith in the security of a "walking legs" sign and white stripes on the road, and dart out unexpectedly. If a child stands hesitantly on the kerb, stop well clear and wait until he or she is fully and safely across. A few seconds is little to pay for someone else's life and limb.

We should all take extra care near schools and playgrounds — and remember that for a toddler, the front lawn or nature strip can often be an unfenced "playground", just a step or two from tragedy. It may be a cliché, but it's still true — a rolling ball is often followed by a running child. If you ignore the first you might hit the second. Any child playing on a footpath may dash out quickly onto the street — and caring drivers keep a constant look-out for any indication that this might happen.

"High-rise" bicycles (with their poor control compared to the traditional design), skate-boards and roller skates have added to the risks that youngsters run . . . and drivers approaching children riding on such popular wheels should make allowances for sudden and unexpected movements.

See and be seen

More than half of the under-eight casualties noted above happened between 3.00 p.m. and 6.00 p.m. After-school high spirits, perhaps, making young children a little less cautious than usual? Possibly those hours are the ones when kindergarten and school children are free and relatively uncontrolled. Perhaps drivers are more likely to be tired and/or impatient at this time of day.

Turn on your lights as soon as it becomes dusk, and in heavy overcast conditions or whenever rain dims the sky. Not only will you see better, you'll be *seen* better. In some light and weather conditions, even a bright-coloured vehicle can become virtually invisible. Leaving your lights off won't cut down your vehicle's "electricity" bill. Turning them on won't make any noticeable difference to the lives of the globes and won't shorten battery life either.

A deadly danger . . . even stopped

Although moving cars and trucks are of greatest concern in averting road accidents involving children, they are still at risk when the vehicles are stopped. Yes, even when parked, a motor vehicle can be dangerous. It is, after all, a fairly complicated mass of machinery. Just as is the case with power tools and factory machinery, it contains many traps for the unwary. And children *are* usually unwary of the dangers. Highly flammable fuel, sulphuric acid and corrosive deposits around batteries, as well as low voltage but high-amperage electricity from the same source, are but some of the problem items and areas.

There are, of course, other hazards associated with any parked vehicle. Propped-open or even counter-balanced boot and bonnet lids can slam shut and even lock shut on small fingers. Doors can do the same. Hot exhaust systems can inflict crippling and disfiguring burns. Children playing near the exhaust pipe of an idling car can inhale lethal fumes.

Leaving kiddies alone in cars

Under this heading, the best advice is "DON'T", if it can possibly be avoided. If you must, then take sensible precautions.

In sunny, warm weather, leave windows at least half-open. The average car (especially later models with large areas of glass windows) is a very efficient "greenhouse" or "hothouse" for trapping heat, and the younger the child, the more susceptible it is to heat exhaustion (once termed "sunstroke"). As news reports have too often mentioned, this is particularly liable to be fatal for babies.

As also too often reported, the interior of a car is a very flammable environment. Don't leave matches in the car — anywhere. *Do* take out the cigarette lighter. It is a little "branding iron" that only needs a casual push to activate, and it pops out invitingly when it's red-hot.

Safer parking

Whether you regularly carry children in your car or not, it is good to get into the habit of always parking so that gravity can't take over if the parking brake, gear lever or auto-transmission selector is accidentally moved. On a slope, always park so that the vehicle can only butt up against the kerb should anything give way. This is a good "fail-safe" procedure if the car has a steering lock — as long as you turn the key to the "LOCK" position before taking it out.

It should hardly need mentioning that a child should *never* be left in a parked car with the engine running, especially not in the front seat, close to the controls.

Never even leave children in a car with an ignition key available. When using the parking brake, if possible pull it on so tightly that a child can't release it.

If you are a parent, it is wise to train your children, by regular reminders, not to touch the handbrake or gearstick or any of the buttons or switches on the dashboard. Children should also be encouraged not to lean out of the windows of parked cars, especially on the driver's side — and not to get in or out of the car on that side if access is available at the kerbside.

No matter how secure mother's arms may feel, a baby is at high risk unless travelling in the back of the car and wearing some approved form of safety restraint.

CROSSING ROADS

ISN'T CHILD'S PLAY

1. "What they pick up from you is deadlier than any disease".
2. "Sometimes he's more worried about being late for school than crossing the road to get there".
3. "Sometimes she's more worried about being late home than crossing the road to get there".
4. "What he can't see can hurt him".

4

3

Acknowledgement: Reproduced with permission of Traffic Accident Research Unit (Department of Motor Transport), and S.S.C. & B. Lintas Australia.

A maze of dangers

If a driver is carrying out adjustments that require the engine to be running, such as "tuning" the carburettor or ignition system, he or she should never leave it unattended and running. Besides the hot exhaust system there are other severe hazards for little hands. A spinning cooling fan can be practically invisible. Generator (or alternator), fan and air conditioning drive belts can all snatch and mangle an inquisitive hand in a split second. The high-voltage jolt from a spark plug or lead is enough to make anyone react in an uncontrolled manner. With so much moving machinery nearby, this reflex action can be disastrous.

A natural trap

Going off and leaving a boot unlocked, even if not open, is another hazard for young ones. Whether caused accidentally or as the result of a prank, a closed boot carries the dangers of heat exhaustion, suffocation or asphyxiation by petrol or exhaust fumes for anyone trapped inside.

Getting under way

It is always good practice before driving off, especially from a private driveway, to have a quick glance around the car. Make sure there are no children, pets, bicycles, scooters, toys, etc. in the way of a wheel. This is especially important in reversing, when your vision is so restricted.

In passing, it should be mentioned that a careful watch should be kept when reversing into a parking spot. It's surprising how many adult pedestrians, as well as children, tend to ignore a vehicle they see from the rear, even though it may be moving backwards towards them.

If you carry children in your car, small ones travel safest in the back, wearing some approved form of safety restraint, correctly adjusted. Get into the habit of pausing, just before moving off, to ensure that everyone in the car has a safety belt on and properly adjusted. Seat belts are of no value if they're not worn . . . and children tend to "forget" to put them on unless reminded regularly by Mum *or* Dad.

If your car has "childproof" locks (an optimistic definition as nothing is ever truly childproof), put them on to keep fiddling fingers from accidentally opening a door, while the car is moving. If they're dozing off to sleep, arrange for them to lean backwards or inwards and don't prop them up with pillows against the side doors in case they are accidentally knocked or jolted open.

Some things change but . . .

The modern car has better steering control and better braking than its predecessors; tyres today are better than ever. But there are a lot of "oldies" still around. If you drive one of these older vehicles, remember its limitations — and your own.

. . . some don't

Although new vehicle designs are released every year, children still come in the same basic model, which hasn't changed for many millennia.

Children of today, like those of yesterday, are still impulsive, erratic, unpredictable and, most of all, *full of life. Let's do our part to keep them that way.*

Information about child safety, particularly about child restraints in motor vehicles, may be obtained by contacting the Department of Motor Transport's Traffic Accident Research Unit on (02) 662 0111 Ext 671.

1

1. An open bonnet . . . and a maze of machinery that can burn, cut, mangle and mutilate.
2. It is always good practice before driving off to have a quick glance around the car.

2

STATEMENT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 30 JUNE 1979

	County of Cumberland Fund $
RECEIPTS	
State	
Motor Vehicle Taxation Act, 1976	35,422,658.91
Road Maintenance Contribution Act, 1958	3,915,604.94
General Loan Account	10,400,000.00
Loans raised under Section 42A of the Main Roads Act, 1924	10,000,000.00
Grant for Relief of Unemployment	122,216.55Dr.
Contributions by Other Departments for Special Projects	2,856,868.67
Road Transport and Traffic Fund and Public Vehicles Fund	
Ministry of Transport Vote	
Road Tolls (Net)	5,628,332.88
Interest — On Sinking Fund Investment	1,504,854.22
— On Treasury Fund Balances	406,931.94
Commonwealth	
States Grants (Roads) Act, 1977	30,694,000.00
Transport Planning and Research (Financial Assistance) Act, 1977	
Other	
Levy on Councils under Section 11 of the Main Roads Act, 1924	8,052.52
Contributions by Councils for works carried out in conjunction with works on Main Roads	305,597.49
Contributions from Other Sources for Specified Works	161,106.43
Natural Disasters — State/Commonwealth Grant for Restoration of Works	
Rents from Properties Acquired for Works	2,011,449.03
Miscellaneous	316,342.13
Receipts — 1978/79	103,509,582.61
Cash at Treasury as at 1 July 1978	10,776,083.00
Total Funds Available, 1978/79	114,285,665.61
PAYMENTS	
State Road System	
— Construction and Reconstruction	56,155,528.96
— Property Acquisitions	12,847,587.37
— Maintenance and Minor Improvements	18,693,688.46
— Natural Disasters — Restoration of Works	172,113.94
Local Roads	
— Construction and Maintenance	
— Natural Disasters — Restoration of Works	
Traffic Facilities — All Roads	
— Construction and Reconstruction	
— Maintenance and Operations	
Land and Buildings	
— For Works Operations	1,053,213.74
— For Administration	7,291.16Cr.
General Administrative Expenses	4,100,592.40
Planning and Research	1,073,454.18
Miscellaneous	451,571.28
Debt Charges	
— General Loan Account — Interest and Management Expenses	4,168,913.01
— Loans raised under Section 42A of the Main Roads Act, 1924 — Interest	4,758,373.73
Sub-Total	103,467,745.91
Capital Debt Repayments	
— General Loan Account — Sinking Fund	552,800.00
— Loans raised under Section 42A of the Main Roads Act, 1924 — Principal	1,117,153.20
— Investments for Loan Repayments	3,590,800.00
TOTAL	108,728,499.11
Net Transactions of Operating and Suspense Accounts and Inter Fund Transfers	613,547.32Cr.
	108,114,951.29
Cash at Treasury as at 30 June 1979 (a)	6,170,714.32
	114,285,665.61

Country Fund	Commonwealth Fund	Sub-Total Main Roads Funds	Traffic Facilities Fund	Sydney Harbour Bridge Account	Total 1978/79
$	$	$	$	$	$
88,273,097.53		123,695,756.44	6,500,000.00		130,195,756.44
15,662,413.83		19,578,018.77			19,578,018.77
3,000,000.00		13,400,000.00			13,400,000.00
28,000,000.00		38,000,000.00			38,000,000.00
122,216.55		—			—
		2,856,868.67			2,856,868.67
			14,544,594.72		14,544,594.72
			2,500,000.00		2,500,000.00
		5,628,332.88	1,632,102.19	3,074,985.64	10,335,420.71
473,177.49		1,978,031.71		409,018.48	2,387,050.19
1,067,374.65		1,474,306.59		285,000.00	1,759,306.59
19,251,000.00	109,691,000.00	159,636,000.00	4,849,000.00		164,485,000.00
	1,200,741.00	1,200,741.00			1,200,741.00
		8,052.52			8,052.52
365,168.02		670,765.51			670,765.51
1,256,578.48		1,417,684.91	279,017.29		1,696,702.20
5,438,293.00		5,438,293.00			5,438,293.00
430,847.99		2,442,297.02		274,755.61	2,717,052.63
1,193,151.23		1,509,493.36			1,509,493.36
164,533,318.77	110,891,741.00	378,934,642.38	30,304,714.20	4,043,759.73	413,283,116.31
18,114,279.31	1,468,196.00	30,358,558.31		4,368,288.23	34,726,846.54
182,647,598.08	112,359,937.00	409,293,200.69	30,304,714.20	8,412,047.96	448,009,962.85
72,184,166.34	60,895,357.34	189,235,052.64			189,235,052.64
3,097,975.03	1,792,158.24	17,737,720.64			17,737,720.64
57,857,137.26	8,644,215.18	85,195,040.90		1,637,533.21	86,832,574.11
2,464,856.87		2,636,970.81			2,636,970.81
	35,788,972.71	35,788,972.71			35,788,972.71
3,167,555.08		3,167,555.08			3,167,555.08
			8,043,827.30		8,043,827.30
			19,500,467.20		19,500,467.20
584,874.95		1,638,088.69	493,856.14		2,131,944.83
38,996.56		31,705.40			31,705.40
6,105,139.12	3,224,469.24	13,430,200.76	1,630,261.59	175,464.00	15,235,926.35
1,562,809.56	1,068,522.00	3,704,785.74			3,704,785.74
1,963,958.39		2,415,529.67			2,415,529.67
3,040,803.09		7,209,716.10		775,000.00	7,984,716.10
3,638,480.81		8,396,854.54		519,949.88	8,916,804.42
155,706,753.06	111,413,694.71	370,588,193.68	29,668,412.23	3,107,947.09	403,364,553.00
354,183.22		906,983.22			906,983.22
768,038.45		1,885,191.65		108,293.88	1,993,485.53
1,256,500.00		4,847,300.00		650,500.00	5,497,800.00
158,085,474.73	111,413,694.71	378,227,668.55	29,668,412.23	3,866,740.97	411,762,821.75
4,511,676.57		3,898,128.75	636,301.97		4,534,430.72
162,597,151.30	111,413,694.71	382,125,797.30	30,304,714.20	3,866,740.97	416,297,252.47
20,050,446.78	946,242.29	27,167,403.39		4,545,306.99	31,712,710.38(a)
182,647,598.08	112,359,937.00	409,293,200.69	30,304,714.20	8,412,047.96	448,009,962.85

(a) The Department expends about $2 million per day. As no income will be received before mid July 1979 the cash balances at the Treasury will be required to finance operations during the early part of the month and to meet outstanding commitments to Councils in respect of the 1978/79 construction programme.

QUANTITIES OF ROADMAKING MATERIALS

Statistics are indeed a wonderful "invention" and the computerisation of information has allowed a whole new range of statistics to be obtained quickly and precisely. Take, for example, the amount of roadmaking materials used by the Department in its operations.

Once the appropriate recording methods have been introduced and data is fed regularly into the computer — all we have to do at the end of the financial year is to press the right buttons and "hey presto" out comes a print-out showing annual statistics in their various categories.

Both for the industries concerned (that is, the private companies which extract and supply these materials) and for the Departmental officers who are responsible for obtaining them for use in a multitude of statewide jobs, it is increasingly important to know the total levels of usage and where the consumption is occurring. In a world of diminishing resources it is also extremely important to know what our basic physical ("material") needs are likely to be in the years ahead.

The following figures indicate that the Department's activities in 1978-79 accounted for the purchase from commercial quarries of over 1.25 million tonnes of raw mineral materials for road pavement construction purposes. In addition, we used 100,000 cubic metres of ready-mixed concrete and there are other basic resources which are not included in this schedule. As recorded in the Department's 1978-79 Annual Report (pages 36-7) the Department used a total of 38,171,249 litres of bitumen on its direct control works. Of this, 11,536,649 litres were sprayed and 26,635,600 litres were used in the manufacture of asphalt.

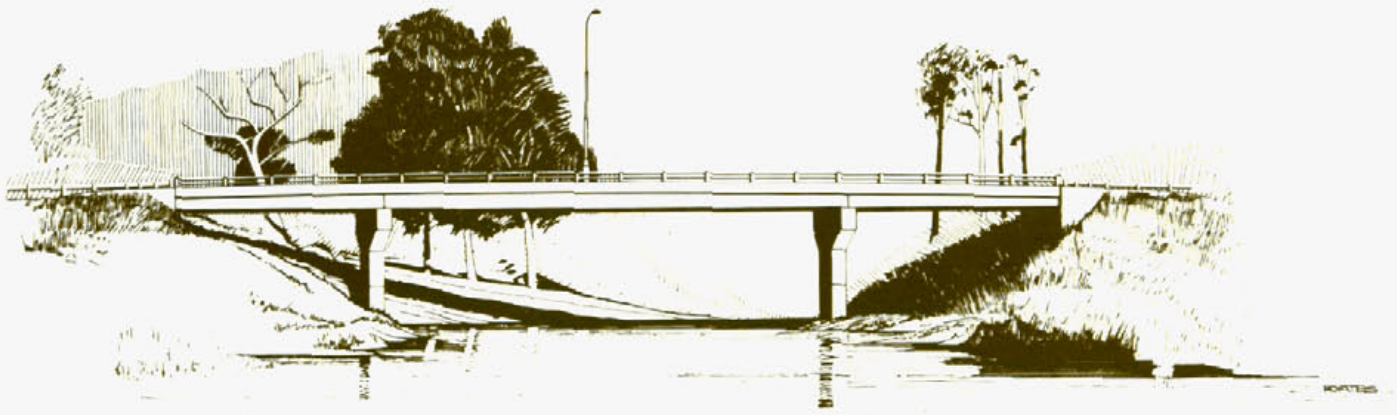
The total quantity of asphaltic concrete used by the Department on direct control works in 1978-79 was 532-712 tonnes, an increase of 63,948 tonnes over the previous years' usage. Of this total, 403,632 tonnes were produced by the Department's Central Asphalt Depot at Granville, 36,259 tonnes by the Mobile Asphalt Unit, 26,144 tonnes by the asphalt unit at Bellambi and 66,677 tonnes by contractors.

Whichever way you look at it, roadmaking in New South Wales needs a lot of materials — and a lot of money.

Road Making Material 1978/79
Quantities used on Departmental Works

Division	Aggregate Slag Fine Crushed Rock, etc. Tonnes	Ready Mixed Concrete Cubic Metres
Metropolitan (Milsons Point)	112755	39750
Parramatta (Parramatta)	134241	31100
Central Mountains (Lithgow)	77516	1150
Illawarra (Wollongong)	234578	4955
Hunter Valley (Newcastle)	18750	542
Lower North Coast (Port Macquarie)	7381	1417
North Eastern (Grafton)	47505	2190
Upper Northern (Glen Innes)	11832	—
North Western (Tamworth)	8446	620
Central Western (Parkes)	11000	727
Central Northern (Bourke)	4800	45
Murray Darling (Broken Hill)	15400	400
Central Murray (Deniliquin)	8500	100
South Western (Wagga Wagga)	20600	745
South Coast (Bega)	7700	520
Southern (Goulburn)	21573	1790
Inner Freeway Construction	51340	7605
Outer Freeway Construction	172955	7107
Central Asphalt Depot	286450	—
	1 253 322	100 763

DESIGN OF NEW BRIDGE AT CONDOBOLIN



The Lachlan River at Condobolin is a pleasant treelined river threading its way through a rural setting. The old bridge which crossed this river as part of the West Wyalong–Nyngan Road (Trunk Road No. 57) was a timber truss bridge which matched the charm of its surroundings.

In July 1976 a traffic accident on the bridge resulted in the collapse of two of the four spans of the bridge, including the main span. The bridge was beyond repair and temporary bridging was erected pending the construction of a new bridge.

The challenge to the bridge designers was to design a bridge which did not visually impose upon the river's natural charm, but at the same time contained the sturdy engineering features needed in a bridge across a flood prone river.

The old bridge

The old bridge was built in 1900 at a cost of £2,033. Designed by the Department of Public Works, it consisted of four timber spans of 10.7 m, 10.7 m, 21.3 m and 10.7 m. The main span was supported by a timber truss and the three approach spans were supported on timber beams. The two approach spans remaining after the accident are being used as part of the temporary crossing of the river.

"Crunch, groan, splash"

At 10.00 a.m. on 23 July 1976, a large bulldozer was being carried northwards over the bridge on a semi-trailer when the 3.6 m wide blade of the dozer (which protruded beyond the side of the vehicle) struck and lodged in the principal diagonal member at the end of the truss. The damaged truss, on the downstream side of the bridge, was partially severed. The driver managed to dislodge the bulldozer blade from the truss and attempted to proceed with his truck and load across the bridge.

The bridge structure had been considerably weakened by the accident and the weight of the truck and its load as it reached the centre of the main span caused the damaged truss to fail. Bridge, truck and bulldozer then fell into the river.

The damaged bridge rests serenely, with the end panels of the lower chords still attached to Pier 2.

Viewed from the south-west, the collapsed third (main) and fourth span, watched by the townspeople during recovery operations.

The main span and the single approach span on the Condobolin side had collapsed and they sat propped against the pier between them. The remaining two approach spans were found to be structurally sound and were later incorporated into the temporary bridging.

The truck and bulldozer were recovered by towing them up the sloping portion of the collapsed main span and onto the collapsed approach span. From there they were finally recovered using a crane.

Fortunately and somewhat remarkably (as there were a number of other vehicles and pedestrians on the bridge at the time) no-one was killed or seriously injured by the accident or the subsequent collapse.

Under Section 40 of the Main Roads Act any person who causes damage or injury to a road (including bridges and ferries) under the control of the Commissioner for Main Roads shall pay the cost of repairs. Consequently, the Department is pursuing a claim of over $100,000 for costs incurred by this accident.

Temporary structure

The collapsed deck spans and pier were demolished after which some repair work was carried out on the remaining portion of the bridge.

A temporary crossing was constructed by launching a Bailey bridge span across the gap left by the collapsed portion of the bridge. Problems were encountered with the Bailey bridging as the earth abutment at the Condobolin end failed under the bearing loads. This was overcome by extending the length of the span and moving the bearings well back from the face of the abutment. The temporary Bailey bridging was opened to traffic on 5 August 1976. A footway for pedestrians was provided on the upstream side of the Bailey bridging shortly afterwards.

1. The D6 Bulldozer on the approach span on the Condobolin side (span 4), prior to being lifted off by crane.
2. Part of the deck of the main span resting against Pier 2.

Design of new bridge

The design of the new bridge features a 55 m long concrete deck supported by five steel welded plate web girders which are continuous over three spans of 13 m, 29 m and 13 m. It will be supported on two piers, each a single wide concrete column with cantilevered headstocks, and on retaining wall type concrete abutments. The piers and abutments will be supported on steel piles driven to refusal into the underlying shale strata.

The deck will be 12.4 m wide overall, comprising two traffic lanes 4.6 m wide and a 2.0 m footway on the upstream side. Barriers will be provided on both sides of the carriageway and will prevent vehicles from mounting the footway.

Forward planning for floods

The flood plain at the bridge site is approximately 800 m wide, and in times of major flood the entire flood plain (including the southern road approach of the bridge) is covered to a depth of approximately 0.8 m by flood waters. As the main channel is only about 50 m wide, it was decided to make the bridge structure long enough (55 m) to span the main channel only. Flood-free access to the bridge was not practical considering

the restriction to the river flow which would result from an elevated roadway embankment. On the other hand, a full flood plain width structure was not warranted because of the relatively low frequency of major floods.

It is generally desirable to prevent flood waters from reaching the deck of a bridge in order to reduce the possibility of damage to the structure by debris. Consequently, this bridge will have a 0.9 m clearance above the maximum recorded flood level (of 1952). The bridge will, therefore, be higher than its approaches, and to maintain an attractive appearance the bridge deck is designed on a crest vertical curve with approaches sloping down to natural surface level on both sides.

A main span length of 29 m was chosen to maintain an unobstructed waterway at normal flow levels.

Construction considerations

Continuous steel girders were chosen to support the deck as these could be launched across the river and would not require falsework to support them. The overall depth of the deck was a critical factor in maintaining reasonable approach grades and adequate clearance above high flood level. The depth of the girders was reduced to a minimum by the use of "hybrid" design. This involves the use of higher strength steel for the girder flanges where stresses are high and lower strength steel for the webs. This results in a more efficient use of materials.

The top flange of the girders has been designed curved to comply with the vertical curve in the road alignment at the bridge site. The soffit of the girders has been made level to maintain uniform clearance, over the length of the bridge, above the design high flood. The level soffit also facilitates launching of the girders which is described below.

The end spans on each side of the main span will be 13 m long. These are relatively short for a continuous three span bridge where the end span length is generally 70%-80% of the main span length. The 13 m span was chosen as it was the minimum span for which no dead load uplift would be experienced at the abutments with the main span 29 m long. Although some uplift at the abutments might have been experienced under live load conditions, this has been overcome by the use of a heavy concrete cross girder at the abutments, to counterbalance any tendency for the deck to lift off its bearings.

The launching procedure involves the assembly of girder segments to the correct profile on the approach embankment and splicing by full penetration butt welds. The girders will then be winched across the river on rollers mounted on the piers and abutments. It is proposed to launch the girders in two groups (one of two girders, the other of three), with the cross frames in place to maintain the stability of the girders during launching.

After the drama. Pier 3 remains sound and upright.

Relief in sight

The new bridge, construction of which commenced in December 1979, is being built approximately 10 m upstream of the damaged bridge. This coincides with the site of the original bridge which was in service prior to the bridge now being replaced. Remnants of the original timber piles were uncovered during recent piling operations for the new bridge.

The Tamworth-based company, Bridge and Civil Pty. Ltd., is the contractor for the construction of the bridge and the contract price is $430,186. The work is under the supervision of the Department's Central Western Divisional Office at Parkes.

The new bridge is expected to be opened to traffic early in 1981. Residents of Condobolin and the surrounding districts will, no doubt, welcome its completion with well-founded relief as they will no longer have to negotiate the "temporary" replacement structure, which by then will have served as their most direct link over the Lachlan River for over four years.

SAD LOSS OF SECRETARY

Obituary — Mr. N.B. Herrick

Mr. Neville Herrick, Secretary of the Department of Main Roads, died suddenly at his home on Friday, 20 July 1979. The skills, integrity and courtesy he brought to his position will be long remembered. To Mrs. Gwen Herrick, to his daughter Jennifer, and to other members of his family, his death was a great personal loss and he is still greatly missed by his many friends in the Department and the many organisations he was associated with.

Mr. Herrick's career with the Department spanned a period of more than 42 years, commencing with his appointment as a junior clerk on 30 November 1936. After service in Head Office and the Kiama, Metropolitan and Petersham offices, he served for approximately 12 months in the Australian Army, later transferring to the R.A.A.F., where he served for almost 4½ years.

Following his return from war duties in November 1945, Mr. Herrick gained experience in a number of clerical positions in Head Office. From 1949 to 1954 he worked as a Cost Clerk, principally at Yass. He returned to the Sydney Metropolitan Area in 1954, and subsequently moved into a number of senior positions. These included the position of Senior Clerk at the Department's Central Workshop, Granville and similar positions in the Costs Section, the Metropolitan Divisional Office and the Correspondence Section.

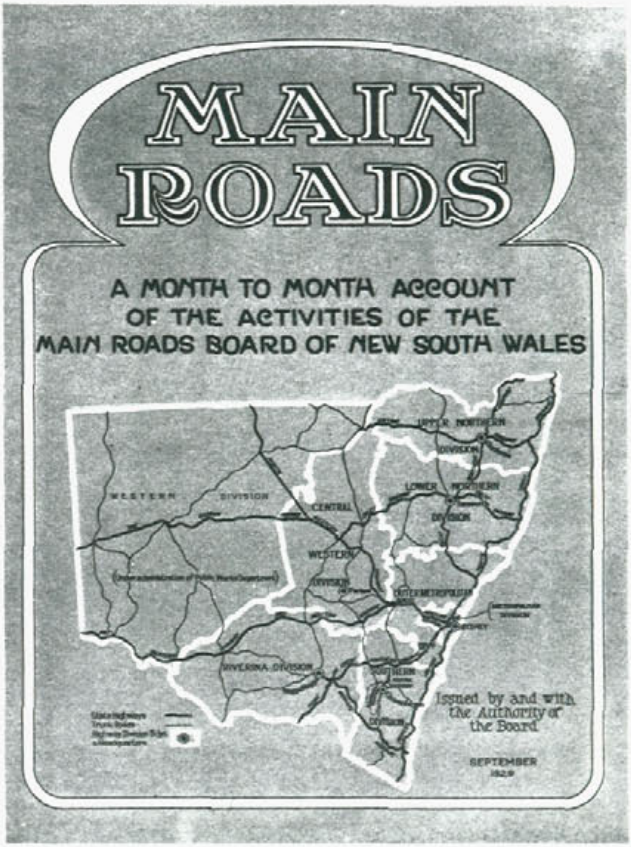
Mr. Herrick also spent four years as an Accounts Inspector for the Department's country offices. He was transferred to the position of Officer-in-Charge, Weight of Loads Section in 1964, and appointed Senior Examiner of Claims in 1968. He became Industrial Officer in 1970, before being appointed Assistant Secretary in February 1974.

Mr. Herrick, who was an Associate of the Australian Society of Accountants, was appointed Secretary of the Department on 28 September 1976, following the retirement of Mr. C.A. Gittoes.

A man of sound judgement, Mr. Herrick did much to enhance the reputation of the Department which he served so capably and for so long.

THE *MAIN ROADS* JOURNAL

PAST, PRESENT AND FUTURE



The cover of the Journal's first issue, showing the then Divisional boundaries.

As mentioned in the foreword of this issue, "Main Roads" was first published in September 1929 as a monthly statement of the activities of the then Main Roads Board. How the Journal originated is best described by an extract from Volume 1, No. 1, (pages 1-2).

The purpose of the journal

From year to year, an annual report, reviewing the operations of the Board during the preceding year, is submitted to Parliament. This is necessarily a comprehensive work. Its objective is primarily to account for the expenditure of the funds voted by Parliament for main and developmental roads, to explain the policy that has guided the Board in the application of the principles of the Main Roads Act, and to direct the notice of Parliament to any matters affecting main or developmental roads which, in the opinion of the Board, need attention. Incidentally, some review of the many issues affecting the problem of roads is attempted, with a view to informing Councils and their engineers of the Board's experience, so that the standards of work shall be improved not only on the main roads, but on roads generally throughout the State. The variety of the work, and the many subjects which call for comment, involve that an annual report shall deal generally with basic principles. It is not possible to describe in any detail many of the individual works that are undertaken from time to time, and which are most interesting in themselves, nor to indicate how a particular local problem of, perhaps, high technical interest, but not of State-wide concern, is being dealt with, and the reasons for this. While the value of an annual report is enhanced by the breadth of its outlook, it loses by that very broadness the intimate touch which is so valued by many readers, who are more anxious to know what is being done in their areas, or what is involved in a particular work, than they are to comprehend the general problems of highway administration. The conviction has been growing upon the Board for some months that something more than a series of annual reports is required in so large a State as New South Wales to keep the community adequately informed as to the activities of the Board and the Councils on main and developmental roads. Information at more frequent intervals and in more acceptable form than an annual report is required.

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

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

A favourable reception

The 1929-30 Annual Report of the Main Roads Board refers to the need for a formal authority.

"As under the Main Roads Act, 1924-29, the Board had not the authority to publish and issue a journal of the type necessary to fulfil the needs that have been indicated, legislative authority for the purpose was sought, and was granted by Parliament during the passage of the Transport Act, 1930."

The Report then comments on the response to the new publication.

"It is of interest to record that the issue of the journal — which has been given the name of "Main Roads" — has met with a

most favourable reception. It has helped to bring under the notice of the Board and its officers, and to make available for general use, valuable information which might otherwise have been lost. It has stimulated an interest in the technical side of road maintenance, improvement and organisation and has more than fulfilled the Board's expectations in this respect. Insofar as its compilation is effected in the course of the work of the various officers of either Board or Councils who have contributed, the only expense involved has been in printing and distribution and this cost is offset to some extent by the reduced price of publishing the annual report, and by the elimination of the publication of the bulletins previously found necessary."

Quotable quotes . . .

In his foreword in the first issue, the then Minister for Local Government, Lt. Col. The Hon. M.F. Bruxner, D.S.O., M.L.A., quoted some of Hilaire Belloc's thoughts about roads and added some equally impressive comments of his own.

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

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

. . . and other quotations from the past

In the editorial of our last issue (June 1979, Vol. 44, No. 4, p. 97), mention was made of the *"rather dull, unattractive lists of tenders . . . not a very appealing feature but nonetheless . . . a very helpful and informative reference"*. In the first volume of "Main Roads", some of the items and prices from the lists of "Quotations" are quite fascinating. A few samples are included in the box below.

Now for the commercial

From its second issue in November 1929 through to June 1931, the Journal featured, on the outside back cover, the only advertisements published in its long history. They were all placed by the N.S.W. Government Tourist Bureau, Challis House, Martin Place and urged readers to holiday — summer and winter — at the Hotel Kosciusko or The Chalet at Charlotte Pass. In August 1930 the cover proclaimed that "Snow Sports, Ski-running, Tobogganing and Ice Skating" could be enjoyed for as little as £15.18.0 early in August down to £9.3.6 in mid-September. And this included all expenses paid for ten days!

Just for the record

Following the first issue of "Main Roads" in September 1929, publication continued generally at monthly intervals until August 1933 and thereafter at quarterly intervals (November, February, May and August) up to August 1940 when as a result of the war, production was suspended. Publication was resumed in September 1946, on a quarterly basis but the months of issue were altered to September, December, March and June.

Half a century later

The Journal "Main Roads" is produced by the Department's Public Relations Section, which oversees the typesetting and printing by commercial companies. Each quarter just over 6,000 copies are published and it therefore has a readership of probably well in excess of 12,000.

The Journal is distributed free to all Members of State Parliament; State Members of Commonwealth Parliament; appropriate State and Commonwealth Government Departments and Instrumentalities; all Local Government Authorities in New South Wales (including copies for all Council libraries); Technical College, College of Advanced Education and University libraries; all media outlets (press, radio and television); and appropriate organisations, institutions and associations including over 130 overseas. In addition, it is distributed to Departmental officers and is forwarded to over 500 subscribers, both individuals and commercial companies, throughout Australia and overseas.

Half a century later, the Journal is still fulfilling the aims outlined in its very first issue, providing people with technical information on the work of our Department, giving *"intelligent insight into the problems of road construction, maintenance, administration and finance"*.

P.S. The Department's Public Relations Section has in stock a reasonable supply of back numbers of the Journal. Most early issues (and some recent ones) are, of course, out of print or in short supply. Nevertheless, if you are trying to fill the gaps in your collection to make up sets of recent year's issues, it would certainly be worth while contacting us (tel. 20933 Ext. 536) to see if we can help you with your missing issues.

And, please remember us if, for any reason, you feel you have to dispose of the old issues you currently hold. We'll always be glad to take them off your hands in order to replenish our own stocks and to help someone else who wants to obtain back issues.

Road ploughs (6): British Standard Machinery Coy:	£66.4.0
Firewood, 200 tons, F.O.R. Board's Siding, Rosehill: E.T. Walker:	£175.0.0
2 road planers: Meadowbank Manufacturing Co:	£40.0.0
Turntable: Armstrong Holland Ltd:	£317.0.0
Maple Map Cabinet: H.E.C. Robinson, Ltd:	£8.0.0
12×7 cubic foot scoops, 48 wooden handles: Gibson Battle and Co.	£32.16.5
Boat, double tuck, Clinker built: White and Co:	£26.10.0
1,200 tons bitumen, 60/70 penetration: Shell Co. of Australia:	£9,000.0.0
20,000 sets of 6 Order Forms: Lamson Paragon, Ltd:	£58.0.0
1 pavement breaker: Noyes Bros. (Syd.), Ltd.	£47.14.0
500 tons 1½ in. blue metal: State Metal Quarries:	£129.3.4
3 pairs of water cart wheels: Geo. E. Fortescue and Sons:	£34.7.0
36 bitumen pouring cans: Malleys Ltd:	£27.0.0
Motor truck: J. McGrath Ltd:	£251.13.3

Once the wheeled outrigger is braced against the mainframe, the boom array can unfold to swing the platform over the side of the bridge.

SUPER SNOOPER

Mobile bridge inspection platform

By its very nature and purpose, a bridge must be a raised structure. It is built to carry one stream of traffic over another, or over an obstacle, such as a river.

And, like all man-made structures, a bridge starts to age as soon as it is built. Only a planned program of inspection and maintenance can keep a bridge serviceable and safe over many years. Decks and above-deck parts are comparatively easy to inspect and maintain. However, the undersides and such parts as bearings can be more difficult to check.

"Underneath the arches"

Not being rain-washed, the undersides of bridges often collect corrosive pollutants from the atmosphere. Any signs of possible structural deterioration must be detected early, so that suitable corrective measures can be taken.

If a bridge is not too high, and road access is available under it, either a "cherry-picker" or a "tower-truck" can be used. The latter is preferable as it gives a large and stable working platform.

To get at the undersides of the higher bridges (beyond the reach of the equipment mentioned above) or bridges over water, underslung scaffolding has commonly been used. But this is a clumsy method, especially if the bridge is long and the scaffolding has to be moved. Sometimes dismantling and reassembling are required, such as at pier positions. It is also a decidedly uneconomic procedure, if access for inspection or work is needed for only a short time.

Some larger structures, such as the main span of Sydney Harbour Bridge, have long uninterrupted runs under their decks. Thus they can be equipped with electrically-powered moving gantries for inspection, painting and other maintenance work. But smaller bridges do not warrant such comparatively expensive installations.

Enter the Super Snooper

In February 1978, the Department acquired its "Super Snooper", a unit which can usually solve the problem of gaining access under bridges more economically and efficiently.

This unusual machine consists basically of a Ford LNT 8000 truck with automatic transmission, fitted with a Paxton-Mitchell boom-type inspection platform on a traversing mount. In effect, in action it resembles a somewhat upside-down "cherry-picker". When the "Super Snooper" is in its working position, the platform can move vertically and also rotate. The movements of the entire boom system are hydraulically powered.

For travelling between jobs the "Super Snooper's" boom system partly telescopes and jack-knifes to reduce its dimensions. The platform is carried in a lengthwise position on the truck.

Setting the scene

Before the actual setting up process can begin, certain safety precautions must be taken. Since the "Super Snooper" occupies slightly more than one traffic lane when in action, two lanes are required and are unfortunately therefore unavailable to road-users. If the bridge is wide enough, such simple devices as warning signs, barriers and "witches' hats" may suffice to divert traffic around the affected lanes.

With a narrower bridge, it may be necessary to convert the traffic from normal two-way flow to an alternating one-way movement. This, of course, can be achieved in various ways, depending on the traffic density, sight distances and other factors. Flagmen can be stationed at each end with either visual or radio contact. Remote-controlled signal bats and radio-linked, radar-controlled traffic signals are other possibilities.

For getting the "Super Snooper" into action the truck is parked in an appropriate position adjacent to the initial section

Final positioning is made by the operator, using a set of controls on the working platform.

of bridge to be inspected. A retractable wheeled outrigger is then extended and braced against the main frame. This is necessary to counteract any tendency for the mass of the extended boom to overbalance the truck. Drag chains are then attached to the outrigger. In addition, the truck's rear springs are "locked" to give added stability.

Next, an operator, using controls located behind the truck cabin, unfolds the boom array and swings the platform over the side of the bridge. An assistant at the edge of the bridge gives instructions to the operator to avoid any chance of the platform being fouled by the structure. This setting up procedure can usually be accomplished in about 15 minutes.

Remote control

When the platform is approximately in the desired position, with a section of it extending under the deck of the bridge, the engineer who will undertake the inspection gains access to the platform by a ladder. The final positioning can then be made using a set of controls on the working platform itself.

The entire assembly (truck and positioned platform) is then ready to move slowly along the bridge structure for inspection purposes. The driver must be particularly careful to avoid sudden movement. An intercom system keeps the person on the platform in contact with the driver of the truck. The platform is also fitted with an emergency "cut-out" button which allows the operator to apply the brakes and to stop the engine of the truck. When the unit comes to obstacles, such as lighting poles and some bridge piers, the man (or men) on the platform must "disembark" while the boom assembly is retracted and then repositioned beyond the obstacle.

Safety foremost

Operator safety is an extremely important factor in every aspect of the machine's design and use. Safety belts and lines must be worn by anyone on either the access ladder or the platform. The importance of this can be appreciated when it is considered that the bridge deck may be 50 metres or more above ground or water level and that the whole unit is often moving slowly along the structure.

Normally the unit's hydraulic fluid is pumped by means of a power take-off from the truck's main engine. In case of a failure in this power source, an electrically-driven back-up pump can take over. This can be powered by the truck's main electricity supply or from a portable alternator carried on the truck.

In the unlikely event of a complete electrical failure, the equipment can be operated manually by levers. All hydraulic rams are fitted with "non-return" safety valves, which retain pressure in the event of pump failure or rupture of the hoses. Consequently, in the ultimate case of all control systems failing, all components will "freeze" in position.

Some dimensional data

The basic working platform is 0.8 of a metre wide and 4.3 metres long, but with extensions this length can be increased to 8.3 metres. By using the platform extensions, and working from both sides of the deck, most bridges can be closely examined across their full width. The maximum permissible live loading is 270 kg (two men plus some equipment).

The geometry of the boom structure and its mounting allows it to be employed on bridges with superstructures up to three metres deep.

The "Super Snooper" is a versatile unit and has accessory attachments which allow it to be used as a small crane or as a tow truck. However, it has been so busy as a bridge inspection aid that it has never yet been used by the Department in those other roles.

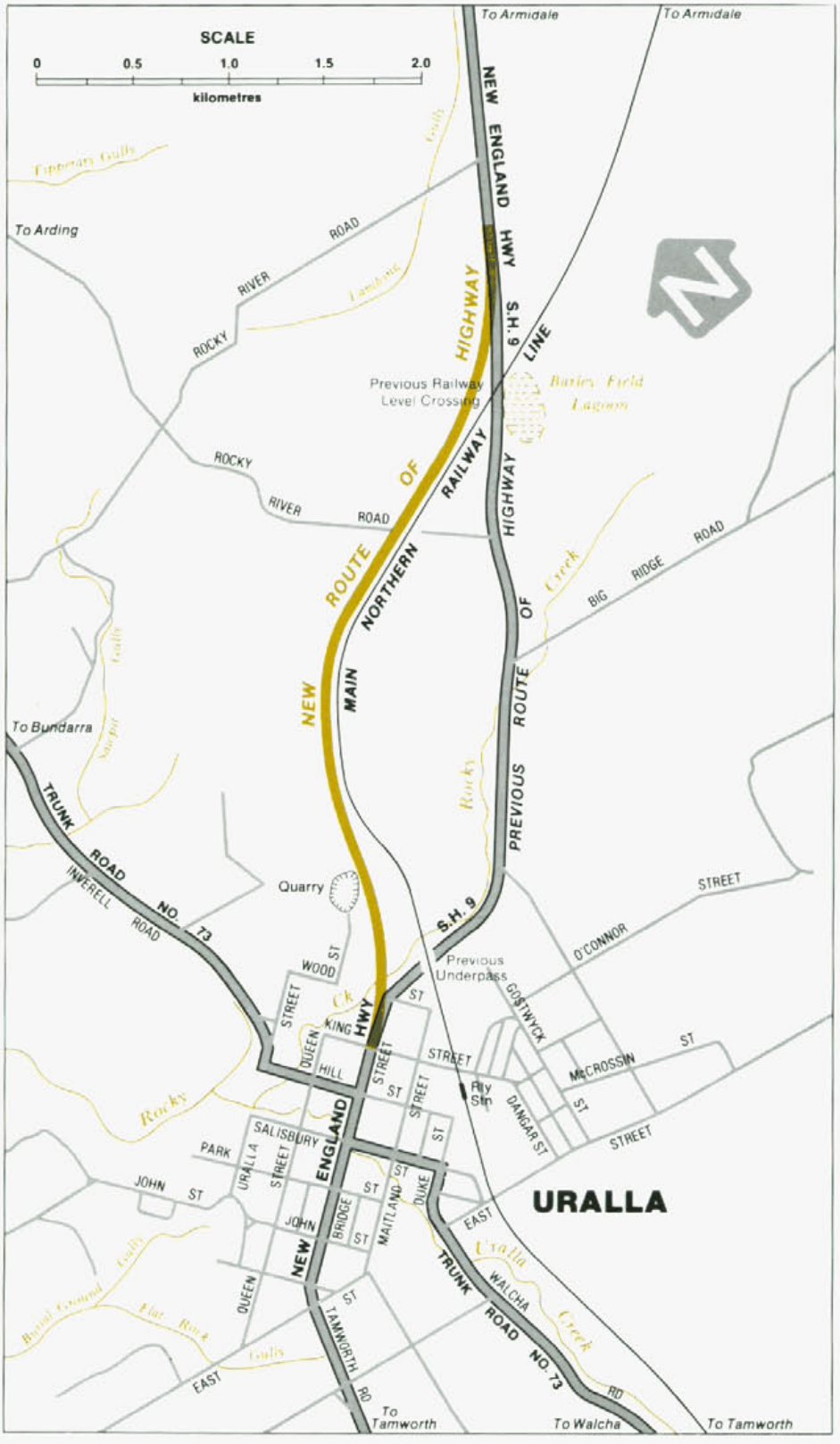
Proven value

The Department's "Super Snooper" is based at the Metropolitan Bridge Maintenance Works Office at Annandale, an inner Sydney suburb. Although much of its work is centred within the Sydney Metropolitan area, it is available for use in divisions outside this area, allowing its potential to be fully developed and utilised. Costing about $91,000 the "Super Snooper" has proved on all accounts to be a valuable investment by the Department, providing a whole new standard of ease and efficiency in bridge inspection and maintenance.

The Department's mobile bridge inspection platform enables the inspection of the undersides of bridges to be an economical and efficient operation. The unit is seen here on the bridge over Middle Harbour at Roseville.
(Inset) The operator uses the controls located behind the truck cabin to position the platform.

URALLA — BARLEYFIELDS DEVIATION

ON THE NEW ENGLAND HIGHWAY



NEW ROUTE OF THE NEW ENGLAND HIGHWAY S.H. 9

The New England district of New South Wales, bounded on the east by the Great Dividing Range, and on the south by the Liverpool Range, extends north to Queensland and west to the union of the Barwon and Gwydir Rivers. It is a land of sprawling mountain ranges, vast tablelands and clear mountain streams in the east, and to the west, blacksoil plain pasturelands, wheatfields and cottonfields.

The name "New England" appeared in 1836, probably because the district was *"chiefly, or entirely, occupied by young gentlemen of respectability and education, who . . . emigrated from Great Britain"* (from "Excursions and Adventures in New South Wales", by John Henderson, 1851) . . . the rich pastureland and cooler climate reminding them of their homeland.

There are a number of important communities throughout the district's tablelands and slopes. The New England Highway, by traversing the whole region, is a link to the important cities of Tamworth and Armidale, as well as to the towns of Wallabadah, Uralla, Guyra, Glen Innes and Tenterfield.

The New England Highway was declared part of the National Road from Sydney to Brisbane by the Commonwealth Government in 1974, and all road and bridge works on it are now financed under Commonwealth grants. It has been designated National Route No. 15 from Hexham to the Queensland border at Wallangarra.

The Uralla to Barleyfields deviation is one of the many improvements to the Highway made over the years and it was opened to traffic during February, 1980. Commencing north of King Street, Uralla, it is built to motorway conditions for its entire length. Access to the highway is therefore restricted, which means greater safety for through travellers and local traffic alike. The deviation has also eliminated from the route of the Highway a railway level crossing and a railway underpass on poor alignment. The old section of Highway also had a narrow pavement and had been the site of many accidents in previous years.

The project is 3.9 km in length, with a formation width of 13.4 m, including a two-lane 7.4 m carriageway and a 3.7 m wide climbing lane 2.9 km long for northbound traffic. The improved grades for northbound traffic will pass on a cost saving to all road users and particularly truck traffic. The gravel shoulders of decomposed granite were sealed because of the high regional rainfall.

The Department's own forces, under the control of Armidale Works Office, undertook the construction work, except for some culverts which were built by private contractors. Work commenced in January 1977 and was completed in February 1980. The deviation cost approximately $2.5 million. Allowance had to be made for above average problems due to very wet conditions and their effect on the maintenance of the "haul track" (that is, the route used by earthmoving machinery and other vehicles during construction).

Great interest was aroused by the discovery, during earthwork operations, of an early goldminers' tunnel. The tunnel was uncovered in March 1979, when excavation for a major cutting was nearing completion. Details of this discovery follow in the article commencing on this page.

The total project has been landscaped, including the planting of grasses, trees and shrubs, to provide for revegetation and erosion control as well as to make the route an attractive one for road-users.

The completion of this work, together with the major Moonbi Ranges project (see article "New Road Through Rugged Moonbi Ranges" — March 1978, Vol. 43, No. 3, pp. 82-87), will provide greatly improved conditions for travellers using the New England Highway.

HISTORICAL NOTES

Uralla

Uralla was gazetted as a village in 1855, having come into being during a goldrush in 1852. In 1856 another and more considerable goldrush took place, but did not lead to any lasting development.

Uralla was proclaimed a municipal district in 1882 and in 1948 became the administrative centre of Uralla Shire, in which was incorporated the previous shire of Gostwyck.

The bushranger Frederick Ward ("Captain Thunderbolt"), who operated in the district, is buried in Uralla cemetery.

The district is given principally to the production of fine Merino wool, but cold-climate fruits, oats, and potatoes are grown. Granite of high quality is quarried nearby.

"Uralla" is an Aboriginal word said to mean "in a little while", "big hill" and "red wood".

DISCOVERY OF GOLDMINERS' TUNNEL

Unearthing the past

A reminder of our early miners' energy and workmanship was unearthed in March, 1979 near Uralla during construction of a deviation of the New England Highway between Uralla and Barleyfields (see preceding article).

In a cut at Mount Beef, about 1 km north of Uralla, a grader operated by Mr. Viv. Partridge was trimming a batter when it uncovered the entrance to a tunnel, which had been blocked by a rockslide. It was first noticed as a 0.5 m hole but further careful examination revealed its full height (1.75 m). The entrance is now approximately 2 m above the finished level of the roadway.

After Departmental officers checked the tunnel, arrangements were made for historians and archaeologists from the University of New England at Armidale to inspect it. Professor A.T. Yarwood, Associate Professor of History at the University subsequently wrote this interesting report.

Although the existence of the tunnel was known to the property owner who had sold the land to the Department, and no doubt to generations of small boys in the locality, its re-discovery caused quite a stir in the local press and radio, and within days, a group of academics, led by archaeologist Graham Connah (Associate Professor at the University of New England), had made a brief investigation. We did some measuring, posed for some photographs by Shirley Dawson of the University's photographic department, marvelled at the neatness and symmetry of the pick-hewn tunnel, and quietly left it to the engineers.

The tunnel's entrance has now been securely walled in, because the attraction of its availability was matched by the danger of cave-ins. Indeed, the brief investigations by journalists and academics were limited by a major fall of rock, about 100 metres from the entrance. Although the ground is surprisingly dry, the walls are of extremely soft granite, which yielded to the picks of last century's miners as readily as a Queensland cheese. It had been constructed, probably by Chinese miners, using a horizontal mining technique that was described by an article in the Armidale Express *of 23 July 1875. This new system offered an easier mode of gaining access to the deep leads of gold than the earlier method of driving vertical shafts, at least in cases where the gold deposits and the soft granite had been covered with a cap of hard basalt.*

Measurements of the passage, which probably gave access to an interior maze of mine workings, showed an average height of 1.75 metres (5'8") and an average width of one metre. It ran into the hill to the major rock fall for about 95 metres without a turn. No human artifacts now remain; there are not even marks on the roof resulting from the use of fire for illumination. Perhaps, as Dr. Lionel Gilbert suggests, miners' spiders were used, that is, special candle-holders fastened onto the rock wall. (Dr. Gilbert is Director of the New England Historical Resources Centre at the College of Advanced Education, Armidale.)

Mr. Viv Partridge trimming the batter in the vicinity of the tunnel opening. (University of New England photograph.)

URALLA-BARLEYFIELDS DEVI

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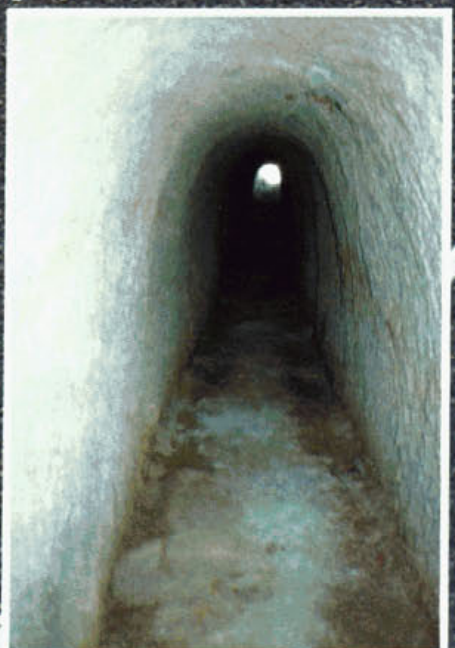


3

ATION

The newly completed Uralla—Barleyfields deviation, looking south towards Uralla.

1. The entrance of the gold miner's tunnel, which was uncovered by a grader trimming a batter on a section of the Uralla—Barleyfields deviation.

2. Looking towards the entrance, the symmetry of the tunnel walls is remarkable.

3. Noel Bloxsome of the Department's Armidale Works Office at the rockfall about 100 m from the entrance.

The local "diggings"

Mount Beef was a relatively unimportant part of the Rocky River gold field, but the nearby Mount Jones was, and is, a veritable honeycomb of shafts and tunnels. Alluvial mining began on the river in 1852, and attracted a population of from 300 to 500 miners till 1856, when a Mr. Thomas Jones noticed flecks of gold in the tracks left by the wheels of his dray. Quickly, the numbers rose to about 5,000, producing in its best year 40,000 ounces of gold, or 22 per cent of the total for the colony of New South Wales. At this time, Chinese miners were greatly outnumbered by Europeans, though this did not prevent the latter from petitioning parliament for their removal or exclusion . . .

After 1858, the great proportion of the European miners withdrew from the area, leaving Chinese in the majority. By this time the mining population was more stabilized, living in huts and shanties rather than tents, with settled families giving an impetus to the local production of foodstuffs and necessitating the creation of such facilities as the Rocky River National School, which was built at the northern extremity of Mount Jones in 1861.

The studies in the region by soils expert Professor John McGarity, have turned up great numbers of broken pots and utensils of Chinese manufacture. Like the tunnels and the water races, these are the only relics remaining to show that gold mining was so important here.

To return to the Mount Beef tunnel. Situated as the entrance is, a metre or two above the level of the climbing lane on the Uralla-Armidale section of the highway, it can be understood that the Works Engineer, Mr. John Booth, had little alternative but to close it securely. It may be that another entrance will be found, and rendered safe for inspection by tourists at some future time."

Rocky River gold

The following potted history of activities on the Rocky River goldfields is taken from the Australian Encyclopaedia, published by Angus and Robertson in 1958 (Volume 4, page 32).

"Alluvial gold discovered September 1851 by W.F. Buchanan and J. Lucas;

first payable gold, October 1852, by the Windeyer brothers;

major rush followed discovery of important deep-lead deposits by J. Jones in February 1856;

4000 miners on field by September, and output for 1856 about 40,000 oz.;

main workings at Mount Jones and Mount Welsh;

some tunnels were cut into deep leads which caused several fatalities — five men killed in tunnel collapse, 29th October 1856;

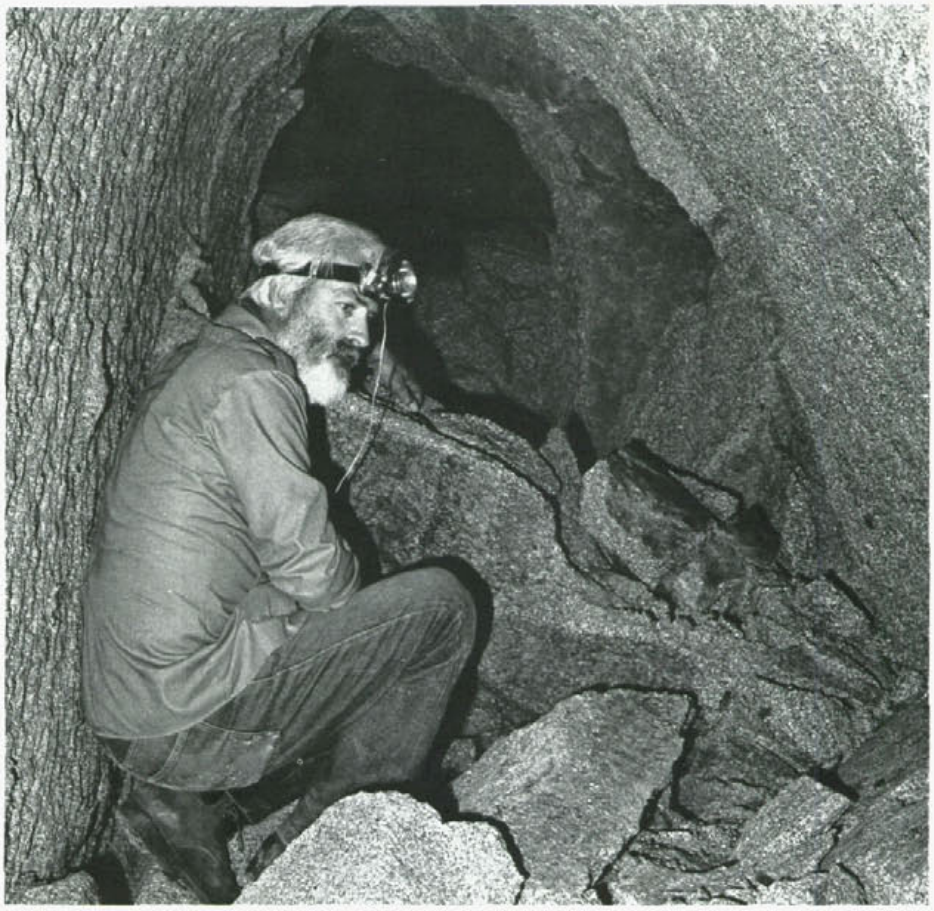
population fell to 2000 in 1857 but annual production high till early 1860s, declining to 4000 oz. by 1867.

Chinese influx began April 1856 and reached 1000 in 1858, greatly outnumbering the European miners;

resentment shown in petitions seeking Chinese immigration restriction;

a few skirmishes between Europeans and Chinese occurred.

The gold rush was the direct cause of development of Uralla at McCrossin's Inn, and also led to marked business expansion in Armidale."



Archaeologist, Associate Professor Graham Connah at the rockfall at the end of the tunnel. (University of New England photograph.)

Other mining tunnels

From a local newspaper report some additional information is available concerning mining tunnels in the Uralla region.

"Many efforts were made to open up the lead under Doherty's Hill, but the inflow of water rendered the work expensive.

In 1877 the Long Tunnel Company was formed with the object of piercing Sydney Flat from a point under Mt. Jones but, after tunnelling for 1800 feet, the company closed down operation in 1881.

This tunnel was favoured by many of the old and experienced miners of the field, but no serious attempt was made to raise sufficient capital to carry the scheme through to its completion.

Almost all the gold won from the field was from alluvial sources, the few reefs found not proving so favourable. The chief difficulty of the early miners was in counteracting the heavy flow of water.

Water for sluicing was brought by races and among these may be mentioned Messrs Roman and Dawson's running from the Lagoon two miles to Uralla; James Young's, running along the cap of the range; E.J. Francis's carrying water from the east side of the railway line; and R. Robert's traversing a similar distance. Some wonderful work was carried out in an effort to bring back some of the vanished fame attaching to the old field.

A Mr. W. French, working alone, drove a tunnel from one side of Mt. Jones to the other."

To conclude this article, the closing words of Professor Yarwood's report seem most appropriate.

"News of other tunnels continues to come in, because of the recent publicity, and in view of the increasing interest which Australians feel in the past it maybe expected that the more prolific goldfields of Mount Jones may yet yield a new kind of treasure to the curious."

EAST MEETS WEST

Chinese influence in Australia is often thought of mainly in terms of Chinese market gardeners and greengrocers, Chinese laundries, Chinese "crackers" and fireworks at Empire Night Bonfires, and, more recently, Chinese restaurants.

Last century, the Chinese were not so popular especially when thousands of Chinese entered the country to seek their fortunes on the goldfields. The European and colonial-born whites didn't care for the competition and many of them stirred up distrust against "the invading yellow peril".

The Chinese were, as always, an industrious lot, often content to laboriously work over the "tailings" discarded by the white miners. Their diligence and willingness to work long hours probably irritated the others and caused resentment.

Rocky River, near Uralla, was the site of probably the first serious clash between Chinese and whites on New South Wales goldfields in August, 1856. The exact number of Orientals injured or even killed in the Rocky River riot was never officially known. But, about 800 Chinese miners were violently "run-off" the Lambing Flat (now Young) goldfields in 1861 in one of the State's worst anti-Chinese incidents.

In that year (1861) the New South Wales census showed that of 20,365 miners, no fewer than 12,000 were Chinese. But concern at such a large influx was growing and legislation was passed in the same year, severely restricting the entry of the Chinese.

Four years later, a Chinaman named Sam Poo gained brief notoriety and "working along the roads" near Gulgong, wrote his name into the annals of Australian history.

The story of Sam Poo

One January day in 1865, 10 Chinese prospectors left the Talbragar diggings out of Gulgong and set out along the road to Mudgee. Each was carrying a small fortune in gold dust from many months of backbreaking fossicking on the goldfield.

At a lonely spot on the road the line of plodding wayfarers was confronted by another Chinese, also on foot, who stepped out from behind a tree and bailed up his 10 countrymen at pistol point. Sam Poo, the only Chinese bushranger in Australian history, was making his first hold-up.

He knew the Chinese custom of concealing valuables under their pigtails. A search there of each victim produced 10 small calico containers of gold dust and with these the well-satisfied Sam Poo disappeared into the bush.

Sam Poo's activities were short-lived for after a few more robberies, he raped a woman and shot dead a trooper who tried to arrest him. Five white troopers and a half-caste Aborigine black-tracker (named Harry Hughes) hunted, shot and captured Sam Poo in February.

He recovered slowly in Mudgee hospital only to be taken to Bathurst for trial as soon as he was well. Convicted of murder, he was hanged at Bathurst gaol on 19 December, 1865.

Sam Poo's stolen gold was never recovered and the persistent hope of finding his "buried treasure" still endures in the Gulgong District.

NEW SECRETARY

MR. M.A. LLOYD

The Department's new Secretary, Mr. M.A. Lloyd, joined the Metropolitan Division (which then had its headquarters in the Department's Head Office building in Castlereagh Street) as a junior clerk in November 1938 at the age of 16½ years.

Three years later, Max Lloyd took up full time military duties and in September 1942 he enlisted in the A.I.F. He served in Western Australia and New Guinea.

On leaving the Army in July 1946, he rejoined the Department as a clerk, working in the Engineer-in-Chief's Senior Control for almost eight years, mostly as personal assistant to Mr. J.A.L. Shaw. He then served in the Correspondence Section, Costs Section, Relief, Correspondence Section, Financial Control Section, Internal Audit Section as Inspector of Accounts, Correspondence Section (yet again) and Financial Control Section (again).

In April 1966 he was appointed First Clerk in the Financial Control Section, moving in March 1967 to the position of Cost Accountant. He became Assistant Industrial Officer in March 1969, Paymaster in February 1971 and Officer-in-Charge, Correspondence Section in February 1974.

Early in September 1976, Max Lloyd rose to the position of Assistant Secretary and towards the end of that month became Deputy Secretary. Following the sudden death of Mr. Neville Herrick, Mr. Lloyd was appointed Secretary of the Department on 25 July 1979.

Mr. Lloyd is a member of the Chartered Institute of Secretaries, the Society of Accountants, the Computer Society and the Industrial Relations Society.


JOHN DAVIS & SON PRINTERS

PYRMONT BRIDGE

Two Special Occasions from the Past

As mentioned earlier in this issue, the first section of the F3—North Western Freeway was opened to westbound traffic on 24 May 1980 and eastbound traffic only continued to use Pyrmont Bridge. This traffic moves either to King Street, via a new ramp, or to Sydney Harbour Bridge, via the Western Distributor. The eastern approach to Pyrmont Bridge from Market Street has since been closed and dismantled to allow connections to be completed, linking the City street system to the next section of the F3.

When this second freeway section is opened in about mid-1981, Pyrmont Bridge will no longer be required to carry city-bound vehicles. It is expected that Pyrmont Bridge will then be demolished as the Maritime Services Board wishes to develop the southern end of Darling Harbour for port facilities and the bridge structure is a barrier to their proposals.

In a later issue of this journal we will again report on the current situation but for the moment we would like to publish two contemporary reports about the Pyrmont Bridge — one from 1902 when the present bridge was opened and one from 1884 when the previous bridge became toll-free. These reports are an interesting record of two historical occasions in the life of Pyrmont Bridge.

The first report is from the Sydney Morning Herald of Monday, 30 June 1902 and describes the official opening ceremony held on Saturday, 28 June. It presents a fascinating summary of the construction of the bridge and also gives some details of the earlier structure at this site.

"THE NEW PYRMONT BRIDGE
OPENED BY LADY RAWSON
AN INTERESTING CEREMONY
SPEECH BY SIR H.H. RAWSON, K.C.B.
DISAPPEARANCE OF AN OLD LANDMARK
MEMENTOES OF THE OLD STRUCTURE
ADDRESS BY THE MINISTER FOR WORKS

The ceremony of opening the new Pyrmont Bridge was performed on Saturday morning conjointly by his Excellency Sir H.H. Rawson, K.C.B., and Lady Rawson, in the presence of a large gathering of people. It was accompanied by several interesting incidents connected with the life history of the old bridge which has been superseded by the new structure, and will shortly disappear altogether from view. The time fixed for performing the ceremony was midday, and long before that hour a large number of people assembled to witness it. In order to prevent accidents when the central swinging span was set in motion a fence was erected across the bridge about 50 yards from the swinging span, and only those specially invited by ticket were allowed by the police to pass through the gate in the fence. In the centre of the swinging span a temporary platform was erected for the accommodation of the vice-regal party and some 30 guests, who were to enjoy the privilege of being the first to sit on the span whilst it opened and shut for the first time in public.

At noon his Excellency Sir H.H. Rawson, accompanied by Lady Rawson, Miss Rawson, Master Rawson, and Captain Watt, A.D.C., arrived, and was received on the bridge by the Minister for Works (Mr. E.W. O'Sullivan), the Minister for Education (Mr. Perry), the Minister for Mines and Agriculture (Mr. Kidd), Sir George Dibbs, Sir H.N. MacLaurin, M.D., M.L.C., the Mayor of Sydney (Ald. Thomas Hughes) and his colleagues, a number of members of the Legislative Assembly, and public officers. A guard of honour was furnished by the Civil Service Corps. Mr. O'Sullivan, on behalf of the citizens of Sydney, welcomed his Excellency and Lady Rawson on their arrival upon the bridge. Mrs. O'Sullivan then presented Lady Rawson with a handsome bouquet of flowers made up in spray form by Searle Brothers.

His Excellency and Lady Rawson, with the Ministerial Party, having taken seats on the temporary platform erected on the swinging span, that structure was swung open and then closed again. Whilst it was opened, a great crowd of people lined the yawning gap that looked down into the river. It was very fortunate that the people behind, in their eagerness to secure a good position, did not press forward. Had they done so many people would have been tumbled into the river, and perhaps on to the timbers below. It was an anxious moment for the policemen who lined the gap. When the bridge swung back into its place there was a great rush on the part of the public to secure good positions around the platform from whence the speeches were to be delivered, and the ceremony of cutting the ribbon was to be performed by Lady Rawson. The arrangements for preserving anything like order in front of the platform were very bad indeed. The crowd rushed in pell mell, and even the guard of honour with fixed bayonets, a dangerous weapon in a crowd, was completely helpless to keep a clear space.

A CHANGE OF SCENE

When something like order had been secured, Mr. O'Sullivan said he had great pleasure in asking Lady Rawson to cut the blue ribbon stretched across the bridge as a signal that it was open for public traffic. For that purpose Mr. O'Sullivan presented her Ladyship with a beautiful pair of gold scissors from the establishment of Messrs. Hardy Brothers. In consequence of the Minister jocularly remarking that that particular piece of ribbon would, in the course of a few years, be worth £5 a yard as a memento of the occasion, hundreds of hands grasped the ribbon, intent upon securing a piece. For a moment or two there was an unseemly struggle amongst the people, but the ribbon was partially released on Mr. O'Sullivan calling out that Lady Rawson would not cut it unless it was left free. The next instant her Ladyship severed the ribbon, every particle of which disappeared in a moment.

Declaring the bridge open

His Excellency said: Lady Rawson having on behalf of the Government of this State, performed the ceremony which will formally hand over this splendid structure to the people for all time, I desire to briefly refer to some particulars I have procured regarding it and the penny bridge it is to supersede. As to the old structure, I am sure there are many who, although they appreciate to the utmost all the improved facilities this new work will give, still have a feeling of regret when they contemplate the demolition of yet another of what I might term your old landmarks. It is one that has rendered invaluable service for many years to the busy throngs that have daily used it as a means of communication with you western water suburbs; and one upon which the demands from year to year have become greater and greater, for at the outset I do not suppose there were many of those great businesses all along what you call Johnstone's Bay, and the other industries now on your water side in that direction, nor was there required the great accommodation at Darling Harbour and Darling Island for wheat, wool, and coal traffic, which is now such an absolute necessity for your Railway Commissioners. Thus, while it is good to cherish a sentiment of fondness for these old connecting links with the past, present needs push on, and the irresistible march of development demands attention. All that increased knowledge in engineering skill, yea, and in every branch of science and art, must be obtained for the advancement of that great national characteristic that has planted and kept the Britisher and his sons at the head of the world-commerce. And so, as we bid farewell to this old friend, who has served you so faithfully, and bears the highest testimony to the durability of that splendid hardwood of yours, ironbark, we might well give a few historical facts. Constructed by a private company at a cost, it is stated, of £75,830 it was opened for traffic on St. Patrick's Day, 1857 (NB: should be 1858 . . . see footnote), and was retained by the company up till 1884, when it was purchased by the Government under the Pyrmont Bridge Act for the sum of £49,600 and with this acquisition came the boon of free access by the people, for the tolls which had hitherto been charged were then abolished. Seven years later it was feared that the crisis of its life was approaching, and a decision was then arrived at, I understand, to invite competitive designs from every part of the world, for a bridge to be erected upon the site on which this new one now stands. Numerous schemes were received and upon adjudication premiums amounting to £1000 were awarded by the Advising Board of engineers; the first premiated design being one for a steel bridge, estimated to cost £295,700. No further action was taken, however, until early in 1894, when the question of the removal of the old bridge and the construction in its place of certain other means of communication was referred by your Parliament to the Parliamentary Standing Committee on Public Works, for inquiry and report. After two inquiries extending over many weeks, during which time I am informed no less than 26 schemes were under consideration, the committee ultimately decided in favour of the design for the bridge which has just been completed. It should be explained just here, though, that as the first premiated design only allowed for a roadway on the swing span of 38 feet and two fairways for shipping of 60 feet each, it was decided by your Public Works Department to submit the design now carried out, which is entirely different, in that the throttling of the road traffic has been avoided by making the roadway on the swing span the same width as that on the rest of the bridge, namely, 54 feet. Provision was also made for two fairways of 70 feet in order to better meet the tendency nowadays to increase the beam of vessels, and this also gives the additional advantage of allowing all vessels to pass through more quickly; while a further improvement, as com-

The bridge has remained in much the same form for over seven decades, but the form of the city skyline has changed considerably. Of the original landmarks visible, the Queen Victoria Building, Sydney Town Hall and St. Andrew's Cathedral, only a small portion of the Queen Victoria Building can still be seen today from behind the screen of office buildings.

pared with the old structure, is given by the building of the other spans with a headway of 26 feet above high water, as against the 6 feet available previously. Thus your vehicular and pedestrian traffic is retarded but a minimum of time, while the most liberal provision is made for your shipping interest. In passing on I should just like to mention a few facts that have interested me considerably in connection with the swing span. Dealing with its floor space, the area of 12,000 superficial feet compares more than favourably with the 10,600 feet of the Newcastle-on-Tyne bridge swing, the 9400 feet of the swing of the bridge in connection with the Manchester ship canal, and the 8700 feet of the swing in the bridge at Hawarden. As to other matters, whilst I believe there are larger swings in American bridges, yet it is doubtful if at the present time there are any in the world more up-to-date in regard to equipment, for in the case of the bridge we are now opening the slewing of the swing, the lifting of the ends, the operating of the gates, and the lighting of the roadway are all done by electricity controlled by one man stationed in the small conning tower yonder. What a great lesson this teaches us all in progression, when we consider this huge swing, some 223 feet long, and weighing 800 tons, opened or closed in a space, I am given to understand, of 44 seconds, simply by a man pressing a button. Compare it with the cumbersome and tedious method of handpower, as exists in the old bridge alongside, and we are brought face to face with another great example of human progress, and, considered in an economic light, think what a saving it is of what I suppose is counted, certainly by your business men, as perhaps the most precious commodity of the human race today — I mean time. On every hand we turn we see the most strenuous efforts made to save even a little of this most precious thing to man; on our large steamships, the Atlantic liners, for instance, the shortening of the trips by minutes even counts; on our railways, too, where water is picked up while the train flies on at unslackened speed. And so we might enumerate everything that saves even a little time as an achievement, and I would thus congratulate you in this respect on obtaining such a marked improvement on what has hitherto obtained. But all this has only been got by the power of men's brains and their capacity for work, and you must have men in your midst in connection with your public departments who have shown they are possessed of these qualifications to no mean extent, else you could never have the architectural and engineering triumphs which I, but so shortly in Sydney, have seen so many fine examples of since my arrival. In concluding, there is just one other comparison I should like to make. Doubtless many of you have seen the great Tower Bridge of London, and such of you as have not have heard of it; well, the roadway of your bridge away out here in Sydney is 4 feet wider than its roadway, and will, therefore, give more traffic facilities than that celebrated structure. I can only add that I sincerely trust the progress which has rendered the construction of such a bridge as this imperative may be continued to you. (Cheers.) I now declare this bridge open for the use of the public.

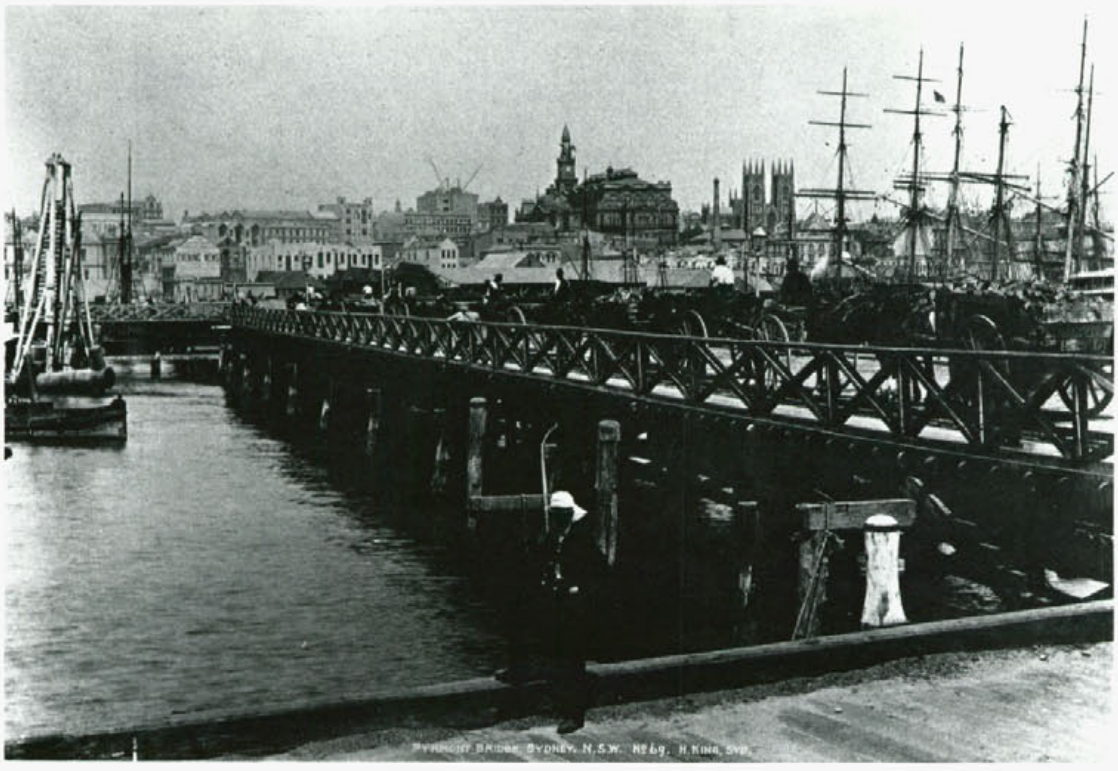
After the cheers of the people had subsided.

His Excellency said he was sure that all present regretted the illness of the King, and he was certain that everyone would join in an earnest prayer for the King's return to health. (Cheers.)

At the call of his Excellency for cheers for the King they were given with great heartiness. Cheers were also given for the architect and engineers who designed and built the bridge; and finally cheers were given for the Governor and Lady Rawson.

Speech by the Minister for Works

The Minister for Works (Mr. E.W. O'Sullivan), on coming forward to address the assemblage, was received with hearty applause. He said: Those of us present who knew the locality under the old conditions, and I suppose most of us did, with the somewhat awkward approaches, the cramped thoroughfare for the continuous stream of vehicles that crossed the old bridge, the dangers pedestrians ran, and the vexatious delays that occurred when the swing had to be opened, will be ready to appreciate to the full all the more expeditious facilities and conveniences modern engineering skill has placed at our disposal. And, as we view the fine broad and direct approaches, we must be reminded of those wise men who effected changes in the configuration of great cities, such as Birmingham, and who thus made themselves benefactors to the dwellers in such places for all time. No wild dream of works simply for decorative purposes, but good solid ones of permanent improvement. These are what we desire to leave behind. Mr. J.H. Young was the Minister who proposed and



Pyrmont Bridge, circa 1890.

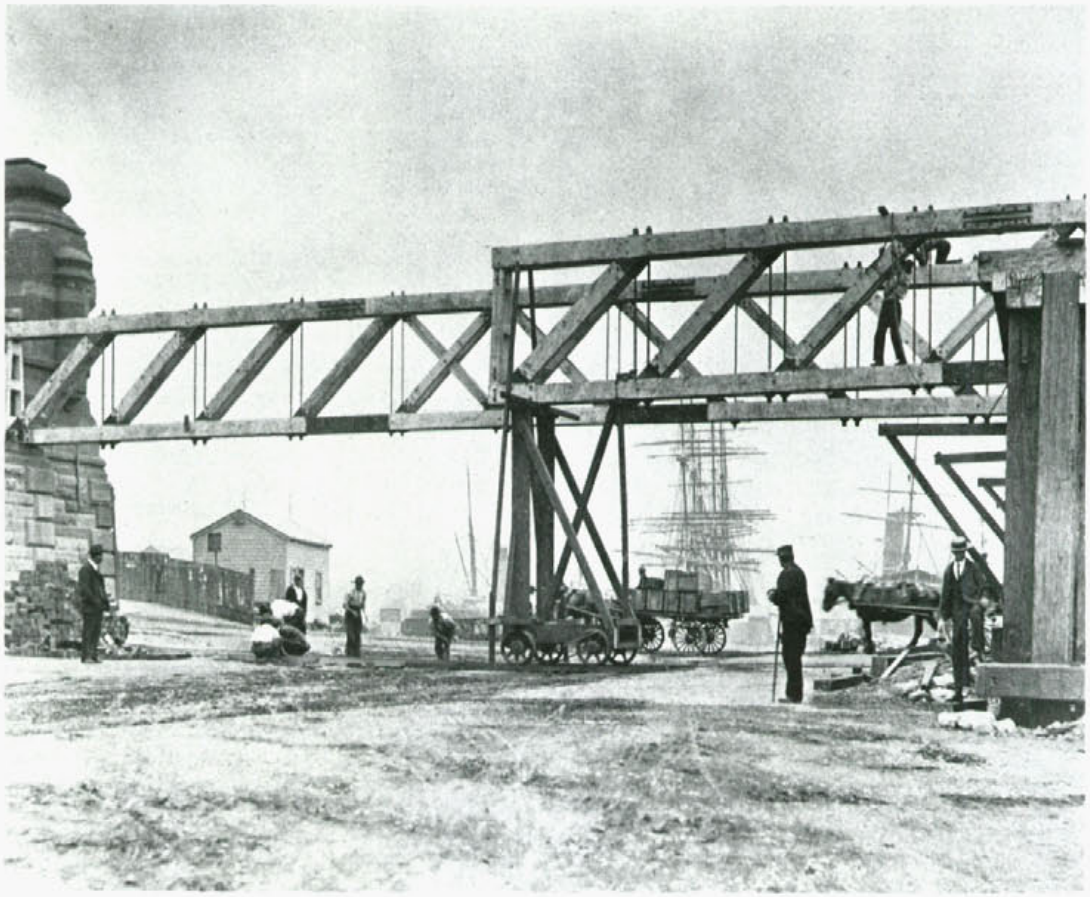
legalised the work, but I carried it out. Turning more particularly to the bridge itself, from press statements I have read from time to time I have learnt that the result we now have before us has not been brought about without considerable anxiety and care on the part of those immediately responsible for the construction. We live in the time of "records", records for everything, even for talking and the duration of our Parliamentary sessions, but in the case I now refer to it is for cylinder sinking. Naturally, the part of the bridge where the mechanism is situated interests us most, and this is in connection with the swing span. A pivot has had to be built for this monster of 800 tons to be sent round on by electricity, which involved the sinking of a caisson, the largest put down in this hemisphere, no less than 42 feet in diameter, with a depth of 62 feet from what is known as the "cutting edge", which goes away down into the bed of the harbour, to the rim from which point the masonry we can see rises. And the total weight of this pivot pier, the cylinder being filled solid with concrete and blocks of stone, is estimated at 6800 tons; so if there are any master mariners present who occasionally come through the bridge span, I would advise them not to attempt to shift the pivot with their vessels, for they will find it pretty tight on its seat. (Laughter.) Apart from the swing span there are 12 other spans each about 82 feet in length, and while the material in the swing span is iron, these others are constructed of what we call the king of woods — our Australian ironbark. Reference has been made often to its marvellous durability, but I would just like to mention an incident that occurred in connection with the old bridge. One of the piles had to be removed, and after it had been drawn up it was sawn in two at the section situated at the spot most liable to destruction, namely, between the tides, when despite the fact that it had been in position for a period of 43 years, it was found to have deteriorated little, if anything, being still serviceable. The total length of bridging is about 400 yards, and, including the approaches, the distance from end to end is 586 yards. Speaking of the old bridge one is reminded of some of the incidents connected with its life, more particularly the one in 1884, when our friend Sir George Dibbs took possession of it from the private company which had previously owned it. A reference to the "Sydney Morning Herald" of August 1 in that year will recall the display that accompanied this taking over, and from that time onward the people have enjoyed the right of free access without any burden of tollage, and the relief that this afforded may to some extent be realised when it is mentioned that for the few years previous the bridge company's secretary stated that tolls had varied between £9000 and £10,000 per annum. Originally competitive designs for the work were invited, and the one which was awarded the first premium, and provided for steel construction throughout, was estimated to cost £295,700. The total cost of the newly completed structure, which was designed entirely in the Works Department and provides, as we can see, for a full width roadway from end to end instead of narrowing it at the swing span as was proposed in the design just alluded to, is set down at £112,500; and it is well to mention that owing to the Darling Harbour resumptions and the necessity for giving a road right round the foreshore, the Sydney approach as designed and as carried out is somewhat different. Provision for the road, however, has been duly made, so that now the bridge will not interfere in any way with the scheme of which this roadway forms a part. The estimated life of the bridge is set down at 50 years, and it is interesting just to conjecture what improvements may take place in and around this portion of the city by the expiry of that time. One can only hope that the progress and development that have taken place here in the past 50 years, and in all the States, despite our bad seasons, and which have made works of this kind necessary, may continue, and as the demands come the men will be found who will carry out the works. I might say the designer in this instance, Mr. Percy Allan, M.Inst. C.E., is an Australian, and his work proves that the native-born are giving evidence of high ability in every department of engineering, as they have already done in science, art, literature, music, vocalisation and sports. (Cheers).

Description of the bridge

The Minister for Works proceeded to give an interesting description of the operations connected with the construction of the bridge. In the course of his speech he said:— The initial operations in connection with the work now completed were performed on September 6, 1899, when I laid the foundation-stone of the abutments, and drove one of the main piles. It was determined at the onset not to let the work in one entire contract, but

to divide it into three sections, mainly with the object of securing wider competition for the respective classes of work, i.e., timber spans pivot and swing span, and masonry & c., in connection with the abutments. The whole, however, has been carried on simultaneously, with the result that considerable expedition has taken place in completion. No. 1 contract was let to Messrs. Farley and McCarthy, and covered the construction of the abutments, the retaining walls, and embanked approaches on the Sydney and Pyrmont sides of the harbour. The abutments and northern retaining walls are built of concrete faced with rock-faced masonry and with pilasters, string courses, weatherings, and balustrades of chiselled and rubbed sandstone, while the southern retaining walls, being little exposed, have been built entirely of concrete. Some 230 piles had to be driven in connection with the Sydney side, the nature of the formation being made ground, and consequently not sufficiently secure, but on the Pyrmont side the foundations have been carried to the rock, although some difficulty has been met with on a portion of the abutments, but this was successfully dealt with. Consequent on the desire of the Harbour Trust to have a roadway round the foreshore, not provided for in the design originally, as the resumptions had not then taken place, some alterations were necessary at the Sydney approach, and these were carried out by day labour. Contract No. 2 which has been carried out by Mr. M'Clure, includes the timber side spans between the abutments and each end of the swing span. These are 12 in number, and are formed of 72 timber trusses, six in each span, 8 feet deep, spaced 9 feet apart between the four central and 10 feet 5 inches apart between the two outer trusses. There are 22 piles driven into the solid bed of the harbour, in some cases to 53 feet below low water mark, in each of the 10 timber piers, and these piles, sheathed with Muntz metal, are rigidly braced and stiffened. Contract No. 3 was in the hands of Messrs. J. M'Cormick and Sons, and provided for the swing span, pivot pier, rest piers, and protecting platforms. It is in connection with this contract that the more intricate part of the whole of the work has been found, the sinking of the caisson, of which particulars have appeared in the press from time to time, being a feat of engineering skill, and reflecting the highest credit alike on the supervising engineer (Mr. Percy Allan) and his staff and the contractors. The huge chamber, for it has a diameter of 42 feet was first started on August 2, 1900 and by October 29, sufficient of it had been completed to permit of its being grounded, by means of girders and wedges, in the position it is to now permanently occupy in the bed of the harbour. Then it had to be gradually worked down to a depth of 46 feet below low water mark, at which point the cutting edge touched rock on one side, when after the necessary damming the chamber was pumped out. Excavation was then carried on in the "dry" until a "blow" occurred, when the tedious process of excavation with the water in the chamber had to be resorted to. Ultimately the work was satisfactorily completed, the caisson being poised with the nicest accuracy. Filling operations then proceeded, and it is now a solid block of concrete and stone. As most of you are aware, the motive power for working the swing span is electricity, supplied from the Ultimo Power-house. This is a very decided improvement on the old method. Both the slewing and the lift motors are carried on a platform inside the drum, the former working through a train of gears a vertical shaft, on the lower end of which is a caststeel pinion meshing, with a caststeel rack secured to the top of a pivot pier, whilst the end lift is effected by means of cones on horizontal shafts worked by a 35-horsepower motor gearing on to a longitudinal shaft running the whole length of the bridge. The total length of the bridging is 1200 feet the swing span is 223 feet while the entire length of the work from the end of the Sydney approach to the end of that of Pyrmont measures some 586 yards. It is anticipated the cost of the work, when everything is fixed, will be about £112,000. The design was one submitted by the Department when the Public Works Committee were inquiring into the proposal, and was selected out of some 26 schemes considered. Originally competitive designs were invited, and the design that secured the first premium was estimated to cost £295,700, but this provided for steel construction throughout. The greatest attention has been paid in every respect to make the work as complete as possible, the shipping interests having been studied by the provision of two 70 feet fairways and a 26 feet headway above high-water mark under the fixed spans, while a full roadway has been provided from end to end, and a quickly opening and closing span for the benefit of vehicular and pedestrian traffic. (Loud Cheers).

Pyrmont Bridge from Darling Harbour Railway Goods Station, 1906.



An early photograph from the 1890's, showing construction of timber truss spans proceeding on the western side of Pyrmont Bridge. Note the masts of the sailing ships in the background.

It only remains to be said that the bridge was designed by and constructed under Mr. Percy Allan, M.Inst. C.E., one of the engineers of the Public Works Department, who had the privilege in the earlier stages of the work of consulting with Mr. C.W. Darley, M.Inst. C.E., then Engineer-in-Chief for Public Works, and Mr. O. Brain, Chief Electric Engineer for Railways. In the construction of the work he had the benefit of the experience of the present Commissioner and Engineer for Roads and Bridges, Mr. W.J. Hanna. Mr. Boswell was the assistant engineer, and Mr. Thackray the inspector on the works. Messrs. Farley and McCarthy were the contractors for the original approaches, the extension of the Sydney approach having been carried out by the department by day labour. The fixed spans on either side of swing span were carried out under contract by Mr. C. M'Clure. The swing span, pivot pier, rest piers, and protecting platforms were carried out by Messrs. J. M'Cormick and Son; whilst the electric equipment has been supplied by and installed by the Australian General Electric Company. The whole of the contractors, including Mr. R.C. Jeffcott, the electrical engineer, personally directed operations, to which is largely due the fact that the work has been carried out satisfactorily and without loss of life.

Presentations

Sir George Dibbs said that he took it as a great honour that he had been invited to speak on that occasion. He was one of the first to cross the old bridge after its opening. He had listened with great pleasure to the speech of the Governor. He could remember the head of that bay when there was not a house on it, and there were nothing but grassy slopes running down to the water's edge. He remembered the opening of the old bridge by Governor Denison, because it was the day before his marriage. (Cheers). When he looked at Pyrmont now and remembered what it was in the days of his boyhood, he realised the marvellous transformation that had taken place. The state of preservation in which the logs of the old bridge were found showed that the timbers of New South Wales were second to none in the world. (Cheers). He desired to present to Lady Rawson, Mrs. O'Sullivan, and Mr. O'Sullivan some mementoes made from the timber.

Sir George Dibbs then made the presentations. That to Lady Rawson consisted of a vase turned by him from one of the piles of the old bridge. It was mounted in silver, and bore on a silver plate the inscription:— "Lady Rawson. A memento of the opening of the Pyrmont Bridge. Made from a piece of the old bridge. June 28th, 1902". That made to Mrs. E. W. O'Sullivan by Sir George Dibbs was a cup turned from the same pile. It was also mounted in silver, and bore the inscription:— "Mrs. E. W. O'Sullivan, from G.R.D.". A wooden cup of a different design was also presented by Sir George Dibbs to the Minister for Works.

Mr. O'Sullivan, in acknowledging the presentations made to him and Mrs. O'Sullivan, said that on every 28th of June, he would fill the cup with colonial wine and drink the health of Sir George Dibbs. (Laughter).

Mr. Samuel Smith, on behalf of the electors of Pyrmont, presented to the Minister a pair of gold spectacles bearing the inscription:— "Presented to the Hon. E. W. O'Sullivan, Minister for Works, in honour of the opening of the Pyrmont Bridge, 28th June, 1902".

Mr. O'Sullivan in a few words acknowledged the compliment.

Mr. Power, M.L.A., then presented to Mrs. O'Sullivan, on behalf of the subscribers, a beautiful diamond pendant. He hoped that in a few years the bridge would connect the City of Sydney with the City of Pyrmont. (Cheers). He congratulated the citizens of West Sydney and of Pyrmont on the completion of the bridge.

Mr. O'Sullivan briefly acknowledged the presentation of behalf of his wife.

Other Speeches

Mr. Henry Clarke, M.L.A., the "Father of the Assembly," was then called upon. He said he had been a resident of Sydney for nearly 61 years. When he landed here Pyrmont was a grass-grown slope with only about half a dozen houses, so that the progress made was strongly borne in upon him that day. He had much pleasure in being present.

The Mayor of Sydney (Alderman Hughes) said he only wished to say a few words to congratulate their energetic Minister for Works upon the completion of that magnificent structure. He also congratulated him on the fact that an Australian had carried out the work. He was glad that the time had come when Australians were getting a chance in their own country. (Cheers).

Mr. Power, M.L.A., (West Sydney), congratulated the Minister for Works on being one of the most energetic men they had, and he congratulated the people on the completion of such a magnificent bridge.

Mr. Broughton, M.L.A., said that they gave every credit to the engineers, but they must not forget the credit due to the workers who were primarily responsible for the building of the bridge. (Cheers).

Mr. D. O'Connor, M.L.A., proposed a vote of thanks to the Governor.

This was carried amid enthusiastic cheering for Sir Harry and Lady Rawson.

His Excellency, in replying, said he wished every prosperity for New South Wales. He was very proud that he had been selected by his Majesty to represent him here, and the longer he stayed here the more fortunate he thought himself in having his lines cast in such pleasant places.

The vice-regal party then drove across the bridge, accompanied by the guard of honour, and followed by members of Parliament and others.

This ended the function."

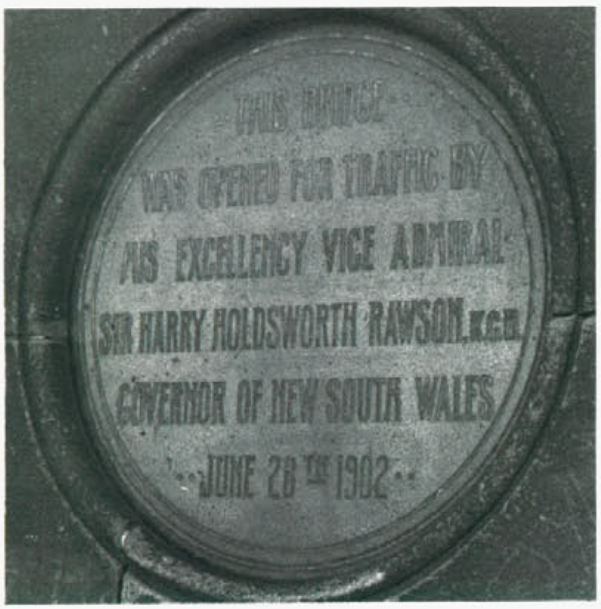
The second, shorter extract describes the celebrations on the first Pyrmont Bridge when the toll was abolished. It is taken from the Sydney Morning Herald of 1 August 1884.

Freeing the Pyrmont Bridge

As the clocks last night chimed midnight the Pyrmont Bridge became the property of the State, and the toll was abolished forever. Pyrmont generally was in some state of excitement last evening, and soon after eleven a crowd began to assemble at the suburban side of the bridge, where a number of tar barrels had been placed ready for a blaze. At the Sydney side there was another contingent engaged in watching some workmen demolishing the wooden gate post, which has hitherto stood between the toll-houses. The night was fine and clear, and the moonlight added a good deal of romance to the proceedings. About a quarter to 12, Mr. Abigail, M.L.A., came down in his buggy from Sydney, and passed across, being attended by an extremely enthusiastic gathering, including the Pyrmont Brass Band, whose efforts were audible for a considerable distance. As the hon. member for West Sydney rose to address his admirers on the Pyrmont side, the word was given to light the barrels, and the eloquence of the speaker, the cheers of the listeners, and the blaze from the bonfire appeared eminently appropriate. A few minutes after the flames had shone out a number of gentlemen arrived from the Legislative Assembly, including the Hon. G.R. Dibbs, Mr. G. Derriman, M.L.A., and Mr. J. Harris, M.L.A., who were duly received by Mr. Williams, the secretary to the now defunct Pyrmont Bridge Company. Mr. Williams of the Harbours and Rivers Department, was also present, his duty being to formally receive charge of the bridge on account of the Government after Mr. Dibbs had taken possession of it. After this there was no speech making of any kind the main interest being provided by the workmen at the post, which appeared entirely obdurate to all the efforts bestowed upon it. It may be of interest to add that this post was placed there by Mr. Moriarty many years ago, just before he accepted his present position, and bore unmistakable testimony to the conscientiousness of the workmen who placed it in position; for, when the ceremony was over the post remained as self-assertive as ever. As the hour rang out there were cheers on both sides of the bridge, together with a good deal of the Pyrmont Band. Two cabs crossed from the Sydney side, toll free, and soon after, Mr. Abigail's buggy, with that gentlemen therein, followed by the band and a large crowd, processioned across. The Parliamentary visitors were just returning to their labours, and in a few minutes the band, which had gone partly up Market Street, returned to outside the toll house, where a remarkably lively selection of airs was performed. Three cheers were given for the Hon. G.R. Dibbs, for the local members, and finally for the band, which returned to Pyrmont to the tune of "Only a Pansy Blossom".

It is stated that the bridge has been in existence for 27 years, and has been acquired by the Government at a cost of £52,500. The secretary of the Bridge Company states that the toll takings within the last few years have varied between £9,000 and £10,000 per annum. The takings yesterday amounted to £56. Mr. Williams has been in the employ of the company for 15 years, and the two toll house keepers have taken the pence for 15 and seven years respectively. Their services will not be dispensed with, in consequence of the extra labour now required for unlocking the swivel part of the bridge, as the shipping traffic will in future be much greater. The average toll paid by the Pyrmont working man appears to be about 4d per diem; a great many, however, whose work is in the city, having had to pay as many shillings a week to the toll keepers. One gentlemen, presumably belonging to Pyrmont, appeared to be the only one who did not enjoy the fact of there being no more payments at the gate.

"They've rose the rents on us over there", said he mournfully, "and that's the way they make it even."



The commemorative stone unveiled at the opening of Pyrmont Bridge in 1902.

FOOTNOTE

'In this speech, the Governor was either misinformed or misreported regarding the date of opening of the first Pyrmont Bridge. Most subsequent references also quote the year of completion as 1857 or in some cases as 1859. Recent research by the Department's Public Relations Section has clarified that the official opening was on Wednesday, 17 March (St. Patricks Day) 1858. In a forthcoming issue, we'll publish a brief report of the opening.

PARRAMATTA BY-PASS —ANOTHER SECTION OPENED TO TRAFFIC

The By-pass grows

A new section of the Parramatta By-pass now carries traffic between Pennant Hills Road (State Highway No. 13) at North Parramatta and Windsor Road (Main Road No. 184) at Northmead, with access to this section available only at these points. It was opened to traffic on Monday, 10 September 1979 by the Minister for Roads, the Hon. H. F. Jensen. Road users can now start to appreciate the full potential of the By-pass by travelling on a high standard road, with no interruption from cross traffic, for almost 4 km from Victoria Road (Main Road No. 165), Rydalmere to Windsor Road, Northmead.

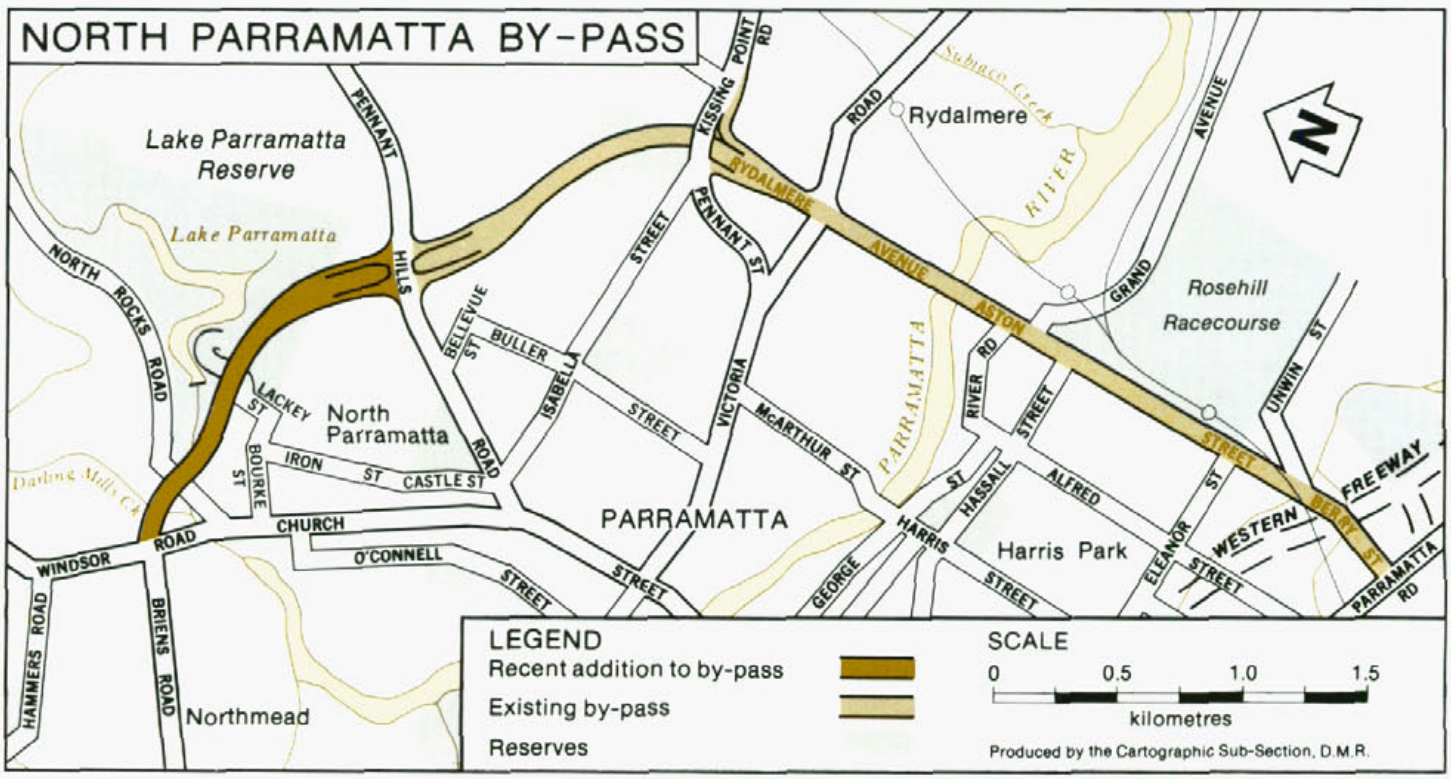
The design for the new section included the provision of a grade separated interchange at Pennant Hills Road, and bridges over Lackey Street, Hunts Creek, North Rocks Road and Darling Mills Creek.

On-loading and off-loading ramps have been brought into use at the Windsor Road junction where a full grade-separated interchange will be provided when the next stage is completed. Access to the Lake Parramatta Reserve is provided by an underpass.

Although the By-pass cuts across the southern portion of Lake Parramatta Reserve, its route generally provides the least disruption and the maximum benefit to the community as a whole. (See further comments in June 1977 issue of "Main Roads" (Vol. 42, No. 4, pp. 114-116).

Route restrictions

The route of the By-pass passes through residential, parkland and industrial environments and each of these placed different constraints on the road location. They affected the width of land which could be acquired and, as a consequence of this, a continuously curved alignment was adopted.



From far left to right: Mr. B. Wilde, M.L.A., Member for Parramatta; the Hon. H.F. Jensen, M.P., Minister for Local Government and Minister for Roads; Mr. B.N. Loder, Deputy Commissioner; and Mr. B. Butcher, Divisional Engineer, Parramatta, after the official opening.

Between kerbs

New Jersey kerb barriers were provided on the outer perimeters of the By-pass roadway between the North Rocks Road and Darling Mills Creek bridges. These barriers are intended to prevent any vehicles from crashing over the top of the embankment and into the adjacent properties. A New Jersey median barrier provides continuous separation of the dual carriageway along the full length of the new By-pass section. These barriers were constructed using an extrusion method. An article beginning on page 53 of this issue describes this process in detail.

Each carriageway has a 1 m wide strip alongside the median barrier, two travel lanes each 3.7 m wide and a 3 m wide breakdown lane, which includes an integral kerb and gutter. In the cuttings, a concrete paved surface is provided between the back of the kerb and the batter face. All kerb and gutter work was constructed using the Department's kerb extrusion machines.

The road pavement consists of a 300 mm sandstone select sub-base layer, the top 100 mm of which was lime-stabilised to improve its strength characteristics at high moisture contents. Next, 150 mm of lime-stabilised fine crushed rock was placed over this as the base layer. The wearing surface is 150 mm of asphaltic concrete.

The bridges

The bridge which carries Pennant Hills Road over the By-pass was described in full in the June 1978 issue of "Main Roads" (Vol. 43, No. 4, pp. 109-111).

The bridges over Lackey Street and Darling Mills Creek were constructed by Reynolds Construction Pty Ltd. for a contract price of $88,869.84, and Hornibrook Group (Sthn. Division) for a contract price of $456,268, respectively. The Hunts Creek, North Rocks Road and Windsor Road bridges were undertaken by the Department's own workforce.

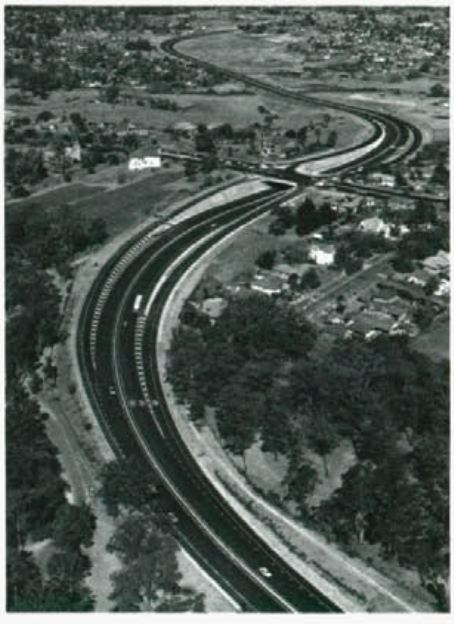
The Windsor Road interchange, on which construction is continuing, involves a bridge similar to the Pennant Hills Road overbridge. It is also being built in two stages in order to cater for traffic during construction. When the next section of the By-pass is opened to traffic in late 1981, the bridge will come into full use, with the By-pass traffic passing beneath it.

Between the bridges over North Rocks Road and Darling Mills Creek, the route was confined to a narrow strip of land between two large industrial establishments, namely United Dairies Pty Ltd and Sydney Woollen Mills Pty Ltd. A car park for the former company's employees previously occupied this land, so it was first necessary to acquire an alternate site to provide a new car park.

Because of the raised road formation, reinforced earth retaining walls were built on both sides of the embankment for the full length between the two bridges, as well as for the abutment walls of the bridges themselves. Reinforced Earth Pty Ltd supplied the components for these walls, which were then erected by the Department's own workforce (see article on this process in September 1977 issue of "Main Roads", Vol. 43, No. 1, pp. 10-13).

Sprayed concrete on batters

At some locations, special treatment of cut batters was required. The four cut batters for the underpass approaches at Pennant Hills Road interchange are in very jointed, weathered shale strata. Chemically grouted rock anchors, 2 m long, were used



The By-pass, looking south-east towards Rydalmere.

for strengthening. The batter surfaces were overlain with steel mesh attached to the ends of the rock anchors and then fully covered with sprayed concrete. The sprayed concrete was applied by a Contractor. This covering prevents the wetting/drying cycles in the shale surface which accelerate the weathering process. Drainage at the foot of this concrete surface was provided to allow excess ground water seepage to dissipate.

Finishing touches

Large directional and advisory signs have been provided, some of which are supported on "modular" signposting structures at the interchange approaches at Pennant Hills Road and Windsor Road. Crash cushions have been installed at the off-loading ramp at the interchange with Pennant Hills Road (see article beginning on page 55 of this issue for details of their design).

A landscaping scheme to screen the By-pass roadway from the Lake Parramatta Reserve as well as from nearby houses, has been instituted, and native plant species have been adopted.

Time and money

Roadworks for this 1.6 km section commenced in June 1974 with the clearing of trees through the Lake Parramatta Reserve. Several cuttings through hard sandstone were necessary in this location, and some use of explosives was required. By using pre-splitting techniques to create a fissure along the cut batter and then using many small explosive charges to loosen the rock, ground vibrations (and disturbances to nearby homes and parklands) were kept to a minimum.

Lack of funds slowed progress of the work almost to a standstill early in 1978. But following the availability of State Government loan funds in the 1978/79 financial year, the rate of work was accelerated to full production in the second half of 1978. This allowed for completion to Windsor Road to be accomplished in September 1979.

Work is continuing at the interchange at Windsor Road, and the next section of the By-pass along Briens Road, Northmead, and via two deviations to Old Windsor Road near Hammers Road and Harris Road, Toongabbie.

The reinforced earth wall near the North Rocks Road overbridge under construction as at August 1978.

The total cost for the section from Pennant Hills Road to Windsor Road was approximately $6 million, divided almost evenly between roadworks and bridgeworks.

Good indications

A traffic study has been carried out to gauge the change in traffic volumes along the Victoria Road - Pennant Hills Road section resulting from the opening of the Pennant Hills Road - Windsor Road section. The findings from the study are summarised in the table below. These figures indicate clearly the latent demand which has existed for the extension of this By-pass.

Total traffic volumes show that the By-pass is already operating at approximately 50% of its ultimate traffic capacity. When the next section opens to traffic in late 1981, a further increase in traffic volumes is likely. The "ring road" nature of the Parramatta By-pass is obviously proving effective in channelling significant portions of the traffic flow away from the congested central area of Parramatta.

* * *

Articles about the Parramatta By-pass have appeared in earlier issues of "Main Roads" . . .

- *New Parramatta River Bridge, September 1966, Vol. 32, No. 1, p. 24*
- *Two New Traffic Relief Routes — Parramatta North, December 1973, Vol. 39, No. 2, p. 55*
- *Aerial colour view of construction, March 1975, Vol. 40, No. 3, Back Cover.*
- *Overbridge at Kissing Point Road, North Parramatta, September 1975, Vol. 41, No. 1, p. 28*
- *Pedestrian Overbridge at Rydalmere, December 1976, Vol. 42, No. 2, pp. 38-39*
- *Parramatta By-pass, New Section opened, June 1977, Vol. 42, No. 4, pp. 114-116*
- *Continuing Work on Parramatta By-pass (Pennant Hills Road Overbridge), June 1978, Vol. 43, No. 4, pp. 109-111*

CHANGES IN TRAFFIC VOLUMES

FIRST SECTION TRAFFIC	NORTHBOUND	SOUTHBOUND	TOTAL	SEASONALLY ADJUSTED
BEFORE OPENING (7 - 14 AUGUST)	7670	8020	15690	14770
AFTER OPENING (5 - 12 OCTOBER)	11630	13760	25390	24250
% CHANGE	52%	72%	62%	64%

BARRIERS TO SAFETY!

Black tyre marks on this New Jersey median barrier tell the tale of an errant vehicle quite graphically.

START OF A GOOD IDEA

Back in the late 1950's a specially designed rigid concrete barrier was developed by the highway authorities in New Jersey and California. The barrier's profile, termed the "New Jersey" profile, is designed to redirect a vehicle which strikes the barrier back onto the roadway in an acceptable and controllable manner. In recent years a growing length of these barriers has been constructed at locations throughout New South Wales, but mainly within the Sydney Metropolitan region.

The design of the barriers means that for low angle impacts, little or no damage is caused to either the vehicle or the barrier. The principle can be incorporated in either median or kerb designs, as the diagrams below indicate.

Initially, the rigid barriers were used where only limited space was available to deflect an out-of-control vehicle, such as on bridge parapets and narrow medians. But they were so effective that their use was extended to wider applications. The barriers have consequently been used extensively throughout the United States of America and Canada.

How it works

With this system of rigid concrete safety barriers, the vehicle absorbs most of the impact energy. When the impact occurs at a low angle, the sloping face of the barrier permits a large quantity of impact energy to be absorbed as the vehicle's suspension system compresses, long before any parts of the vehicle's body come in contact with the barrier.

As the front wheels drag momentarily sideways across the roadway and the barrier's surfaces, friction is greatly increased, and therefore impact energy absorbed. With the wheels riding up the sloping lower wall of the barrier, overturning forces acting on the vehicle are dissipated.

Overseas tests have shown that minimal damage occurs to vehicles which strike the barrier at an angle of up to 10°, even at high speeds. At higher angles of impact, even up to 25°, damage to the vehicle occurs in accordance with the force of impact. But the vehicles do not overturn, and they tend to "hug" the barrier rather than bounce off uncontrolled.

Barrier maintenance was seen to be almost nil except in cases where heavy vehicles strike the barrier at high speeds. The obvious role of these concrete barriers in preventing serious traffic accidents is well illustrated by the photograph above.

Urban locations

Road reserves within urban areas are usually restricted in width by adjacent commercial, industrial or residential developments. Therefore the New Jersey kerbs and medians have been used mainly in these built-up areas. In Sydney, they have been used on the F7 — Cahill Expressway at the northern end of the tunnel near the Conservatorium; Day Street, Sydney; the F3 — North Western Freeway over Darling Harbour; Mona Vale Road (Main Road No. 162) at Pymble; the Botany Road (Main Road No. 170) railway overbridge and approaches near Beauchamp Road; General Holmes Drive (Main Road No. 194) near The Foreshore Road (Main Road No. 617) Botany; Warringah Road (Main Road No. 328) on the northern approaches to the bridge over Middle Harbour at Roseville, Bigge Street (Main Road No. 512) underpass at Liverpool, and extensively along the Parramatta By-pass.

Both the cast-in-place and extrusion methods were used for constructing the barriers along the Parramatta By-pass. Details of both these methods follow, as examples of what is involved in each process.

Cast-in-place barriers

During 1974-75, 1280 m of New Jersey median barrier were constructed on the Victoria Road - Pennant Hills Road section of the Parramatta By-pass using the cast-in-place method. A team of nine men usually carried out the work. Four men prepared the roadbase and inserted steel dowels, and five men prepared for the pouring and stripping of the forms.

Six 3 m long steel formwork moulds were used. 18 m of barrier was constructed every second day. The intermediate days were spent on stripping the pavement, repositioning the formwork and preparation of the expansion joints for the next day's pour.

Before the formwork moulds were placed in position, a basecourse layer of fine crushed rock on which the barrier was to sit was prepared. This involved making a 25 mm cut in the basecourse with a jackpick and spade at 1.2 m intervals, in which a 200 mm deep hole was drilled with a jackhammer. Into each hole a 25 mm diameter deformed steel dowel 300 mm long was then inserted. Concrete was then placed around the dowel, in the cut prepared by the jackpick.

Expansion joints were placed at 9 m intervals. At each joint three 20 mm dowels 600 mm long were placed horizontally. The expansion gap was filled with a precut "mastik" type material, positioned the day prior to pouring. The unit rate achieved in 1974-75 was approximately $35 per metre.

Extruded barriers

Early in 1979, tenders were called for the supply of materials, and construction by extrusion of up to 2200 m of concrete New Jersey barriers on the Pennant Hills Road - Windsor Road section of the Parramatta By-pass. The tenders were won by Seovic Holdings Pty Ltd of Ingleburn, for a total contract price of $105,810.

The barrier was to be laid directly onto asphaltic concrete, 75 mm below the finished surface level. This meant that the height of the barrier was increased by 75 mm, which increased the quantity of concrete used to 0.73 cubic metres per metre. Because of the containing effect of the 75 mm of asphaltic concrete later placed on both sides of the median barrier, dowel bars were not required (as they are in the cast-in-place method).

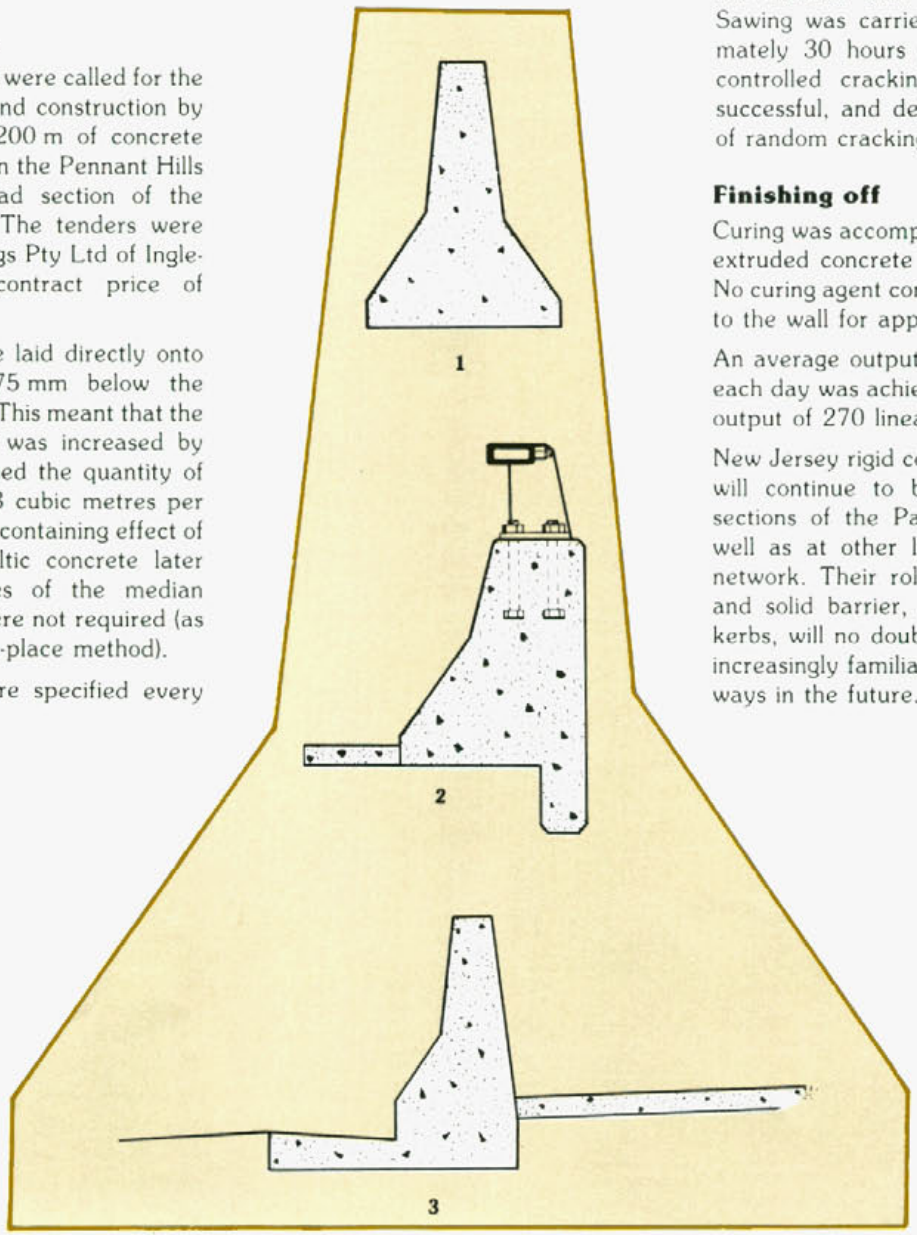
Contraction joints were specified every 5 m and expansion joints every 30 m. The expansion joints were formed simply by sawing through the wall by hand.

The machine that moulds it

The concrete extruder used by the contractor was a Gomaco GT 6000. Electronic sensoring units working off a stringline kept the machine to a predetermined line and level. Pre-mixed concrete was fed into a hopper at the front of the extruder and was then carried by conveyor into the screed under the body of the machine.

Compaction was achieved by hydraulically driven form vibrators. As the machine moved forward, the concrete was extruded into the shape of the New Jersey profile.

Seen in cross section are: (1) a standard New Jersey median; (2) New Jersey kerbing integrated with a bridge parapet; and (3) integral New Jersey kerb and guttering adjoining a footpath.



Problems encountered: solutions found

When pouring began in April 1979, several "teething" difficulties were encountered.

Firstly, the concrete mix was very sensitive to water content. Adjustments were then made to reduce the slump to a minimum. After these adjustments were made, the slump was approximately 6 mm.

Secondly when the contraction joint was initially formed by grooving with a steel trowel, within 45 minutes of extrusion, the top surface of the wall slumped. This produced an undulating surface which was visually unacceptable. It was successfully rectified by grooving the contraction joints after the initial set had occurred.

Thirdly, it was found that shrinkage cracks began appearing, apart from at the formed contraction joints, on the second day after extrusion. It was therefore arranged for the contractor to make a saw cut around the periphery of the median wall in the formed joint. Sawing was carried out within approximately 30 hours of pouring to ensure controlled cracking. This method was successful, and decreased the incidence of random cracking significantly.

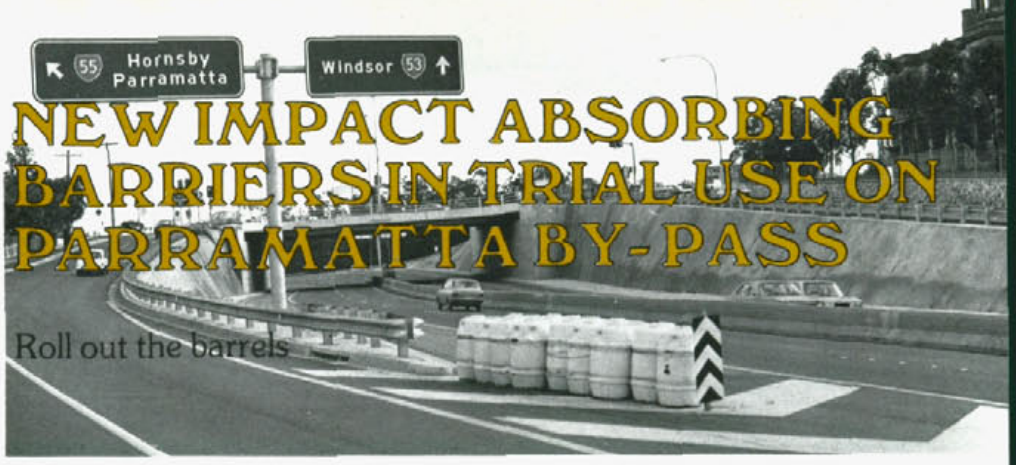
Finishing off

Curing was accomplished by covering the extruded concrete with plastic sheeting. No curing agent compounds were applied to the wall for appearance reasons.

An average output of 190 linear metres each day was achieved, with a maximum output of 270 linear metres in one day.

New Jersey rigid concrete safety barriers will continue to be built on the next sections of the Parramatta By-pass, as well as at other locations on our road network. Their role in providing a safe and solid barrier, as either medians or kerbs, will no doubt confirm them as an increasingly familiar feature on our roadways in the future.

NEW IMPACT ABSORBING BARRIERS IN TRIAL USE ON PARRAMATTA BY-PASS



The prototype of a new style crash barrier is in use on the Parramatta By-pass. The barrier is designed to prevent vehicles colliding with the ends of the guardrails.

The barrier consists of impact absorbing "barrels" or "crash cushions" placed at the points where the north and south-bound off-loading ramps to Pennant Hills Road leave the By-pass. Although these areas have been prominently marked by white painted chevrons, some drivers still persist in crossing over the markings in dangerous last-minute manoeuvres, either to the right to stay on the By-pass or to the left to reach the exit ramp. Travelling through these zones increases the chances of a vehicle making contact with the end sections of the guardrailing, and this could lead to a serious accident.

This area is, in fact, called the "gore area" because of its blade-like shape but at many locations — where tragic accidents occur because of driver inattention or misjudgement — the name is doubly appropriate.

Principle behind the practice

The theory of the barrier is basically that of the progressive absorption of impact energy and is based on an idea used in America.

A series of 200-litre plastic (polythene) containers are filled with a mixture of sand and polystyrene foam pellets. The containers are fastened to each other in something like a ten pin bowling configuration. The mixture of sand and foam pellets varies, the first container has the most foam pellets and the least sand, the second container has less foam pellets and more sand, and so on until the last row of containers are filled with sand only.

The sand-filled plastic container system has been designed using the principle of conservation of momentum. A vehicle hitting the barrier comes into contact with increasing masses of sand while the plastic containers split, allowing the sand to be displaced.

The conservation of momentum principle says that "*mass times velocity is constant*", and so as the vehicle's mass is increased by the sand, its velocity decreases. The design calculations are repeated for each row of containers (or "crash cushions") until a system is attained, which results in a uniform rate of deceleration of 10 g's for a vehicle having a specific design speed and mass. The design is completed when the velocity of the design vehicle (which has progressed through the "crash cushion", i.e. the configuration of containers) has been reduced to 16 km/h. The design assumes that friction and other forces will stop the vehicle by this stage.

For the Department's calculations for this site, a design speed of 80 km/h was adopted. The typical weights (mass) of vehicles selected were 680 kg, 1043 kg and 2041 kg. American design practice appears to be based upon 1020 kg and 2041 kg vehicles but in Australia cars are generally lighter and, with increasing energy costs, there is a continuing trend towards smaller vehicles. The occupants of these vehicles could be subject to a much higher deceleration force on impacting if the "crash cushions" are only designed for heavier vehicles.

Obviously, a large truck travelling at 80 km/h would probably push its way right through the configuration of containers. For this reason, the back-up structure, which is required to prevent the containers from sliding along the road, should be of semi-rigid construction. At the By-pass sites, this back-up structure consists of a section of steel guardrail. The containers have also been attached to each other to reduce scattering during impact as well as to discourage theft.

Cushioned safety

The pattern of the 20 containers used at each of the two sites on the By-pass is two rows with one container in each, three rows with two containers and four rows with three containers.

The containers are filled with loose dry single size particle sand. Full containers weigh about 100 kg, using Cronulla sand which has a density of 1.4 tonnes per cubic metre. Partially filled containers have the polystyrene foam pellets mixed with the sand to avoid having all the sand on the bottom of the container and to thereby allow for more rapid deformation on impact.

The containers are sealed because if the sand becomes wet it will be more difficult to deform under impact and will increase the rate of deceleration of an errant vehicle above the allowable limits.

As initially obtained, the containers are of black plastic but they have been painted white in order to increase their visibility, especially at night time. Their light colour not only makes them easier to see and avoid but also easier to locate and collect if they are scattered on impact.

To monitor the performance of these "cushions" and to assist in the re-positioning of undamaged containers after impact, the containers have been numbered. To determine if this configuration of containers is performing adequately, a wide range of information (including mass of vehicle, estimated speed, number and location of containers damaged, containers misplaced, and any injuries to vehicle occupants) will be collected after impacts.

The major assumption of this design is that the type of containers selected will burst on impact, allowing the sand to scatter. Unfortunately, without running costly tests, the reaction of these containers under impact cannot be predicted accurately. If the containers will not break up sufficiently on impact, modifications will be required to ensure the design concept is reproduced under actual conditions.

Even though the containers are designed to shatter on impact, the vehicle involved will probably still be damaged. The extent of damage, however, should be less than would be expected from impact with other types of crash barriers.

Happily so far, since the erection of these trial barriers in December 1979, no violent vehicle impacts have been recorded, although a few glancing blows have obviously occurred without serious damage to either containers or vehicles. But, one thing is certain and that is, when the time for testing does come, these low-cost barriers will contribute to the slowing-down of vehicles which might otherwise crash unhindered into the end of the guardrails. Their value and effectiveness as a safety measure will then be more apparent and assessable.

* * *

The introduction of these prototype barriers stemmed from the then Divisional Engineer of the Department's Parramatta Division, Mr. Bruce Butcher, seeing similar barriers while holidaying recently in the United States of America. Another engineer at the Parramatta Divisional Office, Mr. Tom Yelland, re-designed the system for Australian conditions, using locally available materials.

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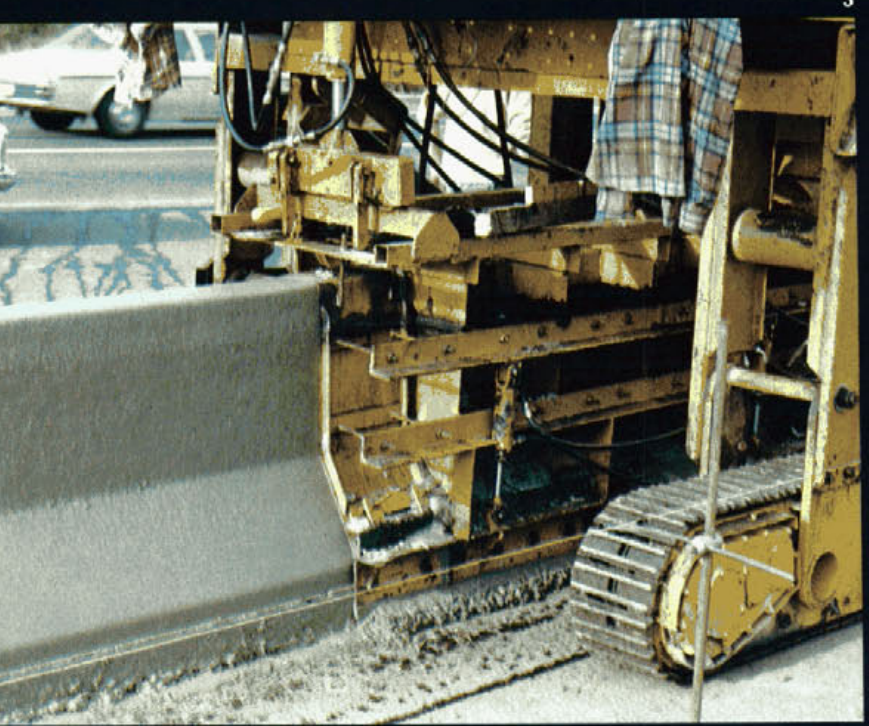

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PARRAMATTA BY-PASS

1. Looking east along the By-pass near the Pennant Hills Road overbridge. Road users can now travel on a high standard road, with no interruption from cross traffic for almost 4 km.
2. The route of the By-pass curves its way through residential, industrial and parkland environments (see article on pp 50–52).
3. Extrusion of the concrete New Jersey median on the Parramatta By-pass.
4. A saw cut around the periphery of the median wall in the formed joint decreased the incidence of random cracking significantly (see article on pp 53–54).

THE BRIDGES OF KOOLOONBUNG CREEK

Pioneers of Port Macquarie

With the completion of the new single span prestressed concrete bridge over Kooloonbung Creek at Gordon Street, Port Macquarie in August, 1979, an historical link has been forged with pioneer bridge builders of the last century. The original timber bridge over the creek at this site was constructed during the early 1840's. The original design incorporated a low rubble masonry weir, built between the stone abutments to impound water in the creek for domestic use. This water supply was used for the Port Macquarie township until the Wauchope pipeline was extended in the mid 1950's.

Two early bridges

A map of Port Macquarie, dated 1831, shows a bridge across Kooloonbung Creek on an extension of Bridge Street, but no bridge in Gordon Street. This was probably the "old long bridge" referred to in the extracts below.

The two extracts, from a journal written by Annabella Boswell*, make reference to two early bridges.

The first is in February 1844, when . . .

"On Saturday morning, about eight o'clock, I had the satisfaction of seeing the steamer pass my window. Miss M'Leod arrived by it, and others of the wedding party are expected next week. This house is two-storied, and joins the hotel, which occupies the corner of the chief street near the landing pier. There is only a wide road between the verandah and the sea. I admired the view very much one morning as we watched a boat loaded with grass coming from the opposite shore — it was drawn into the current, and then carried rapidly down past the house. The men stopped, and landed the grass. It was a Government boat, and there were men in waiting, who soon carried off its contents.

"In the afternoon it was proposed that we should call at Gooloowa, which I was glad to have an opportunity of doing. Mr. Hugh escorted us, and instead of going by the old long bridge, we crossed the new one, which is scarcely finished — it forms a dam also, and will be a fine wide roadway, very different from the old one; there is a flood-gate in progress. Arrived at Blackman's Point, we signalled for a boat, which soon arrived to 'row us o'er the ferry'."

In August 1844, Mrs. Boswell wrote . . .

"On Tuesday 20th August — the eventful day — we set off for Port Macquarie about nine o'clock. The roads were not so bad as we expected, but we had to turn off at the sandy flat, as the bridge was still under water. The morning was sufficiently cloudy to make us anxious about the weather, but was otherwise pleasant. The long bridge was in such a dilapidated condition it was thought it would not be prudent for us to cross it in the carriage. However, on arriving there, we found Bruce and two other men waiting for us, who for greater security walked by the horses' heads, and we soon found ourselves in safety at the other side. The servants, who had preceded us in the cart, had all things in readiness at The Stores, and assisted us to dress. We then drove to Mrs. M'Leod's house".

The crossing of Kooloonbung Creek at Bridge Street would have been of some length, hence the journal description "long bridge". The new bridge (mentioned in the first extract) is presumably the one at Gordon Street, where the adjoining dam was located.

Chain gangs and invalids

Development plans of the 1830's showed that a considerable amount of earth fill was to be obtained by convicts, from an area to the east (where Hayward Street now stands). This fill was apparently used for the approaches to the bridge.

The abutments of the original bridge were probably constructed before 1844. Some of the stone was sandstone foreign to the area, which could have arrived as ship's ballast. The journal quoted above mentions: *"The district was still a depot for invalids and a chain gang at work at the dam, completing the road to New England".*

The stonework was almost certainly carried out by convict labour. Consequently, at the suggestion of the Hastings River and District Historical Society, it was decided to recover a sample of the abutment stonework, and to preserve it as both a tribute to the work of the original builders and a reminder of our pioneering past. A large block of sound rubble stonework has subsequently been erected by the Department as a monument near the eastern approaches to the new bridge.

Changes in time

The timber deck of the original bridge at Gordon Street was renewed in 1892 by the Department of Public Works. In 1932, the timber deck was replaced by a two-span reinforced concrete deck (6 m wide kerb to kerb), supported at the centre on new reinforced concrete piers.

Port Macquarie, from the hill near the church, and from the wharf, including the hotel (possibly built by Major Innes). Ink and grey wash by H.C. Allport, July 1839. Reproduced by courtesy of State Library of New South Wales.

The rubble stonework abutments were retained but the disused low-level weir was demolished after the introduction of the new water supply in 1955.

The new bridge

The new 25.5 m wide bridge has provision for six traffic lanes. It was designed by the Department and constructed by C.T.K. Engineering Pty. Ltd. of Wauchope, at a contract price of $188,902. Supervision of the contract and construction of the approach roadworks was undertaken for the Department by the Municipality of Port Macquarie.

The abutments are 5.4 m high, and are supported on 2.3 m wide spread footings founded on serpentine rock. Some of this rock was of an unsatisfactory quality. Seven deep pockets of decomposed material had to be removed during construction, and replaced with mass concrete. One of these pockets required 40 m^3 of extra concrete.

The abutment walls have been faced with grey split-block masonry. This surface finish is an innovation on Departmental bridgeworks, selected to give added character to the bridge, which is adjacent to an attractive recreation reserve

. . .

With this new bridge and this memorial to the old structure, the present and the past are again blended well at Port Macquarie, where in so many places the modern and the historical stand side by side.

*From "Recollections of Mrs. A.A.C.D. Boswell", published in Sydney, circa 1960 (pages 88 and 92).

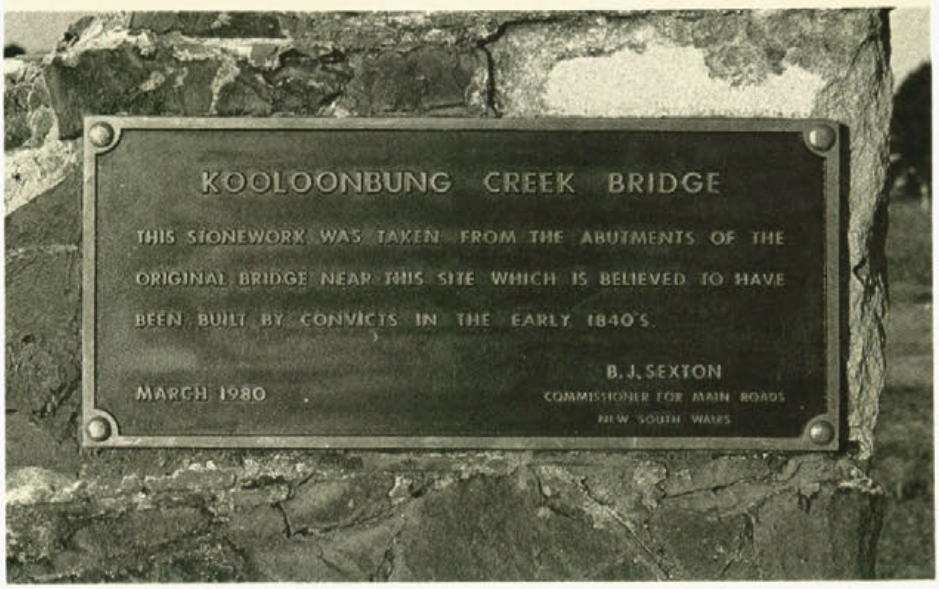
Annabella Boswell was a niece of Scottish-born Major Archibald Clunes Innes (1800 - 1857), who was Commandant of the penal settlement at Port Macquarie briefly in 1826-27. Innes married Margaret, daughter of the Colonial Secretary, Alexander McLeay, in Sydney in 1829, one of the most elaborate weddings that the colony had seen.

In 1830, Innes returned to Port Macquarie to build a magnificent home on his large grant at Lake Innes, where he entertained visitors on a lavish scale through the 1840's. Mrs. Boswell wrote her journal from this convict-built house, portion of which is still in existence.

In 1842, Innes chartered the steam vessel "Maitland" to take wool from Port Macquarie to Sydney and return with supplies for the settlement. He was also largely responsible for having a road built from Port Macquarie to the New England district, where he was one of the first squatters. The town of Glen Innes was established on one of his holdings and was named after him.

Following a depression, Innes went bankrupt in 1852 and took up positions as Magistrate in Nundle and Newcastle, when he died in 1857.

It is interesting to note that the plant species "Lantana" was introduced into the colony at Port Macquarie. An Indian employed by Major Innes arranged for the plant's importation from his homeland, intending it to be used as an ornamental pot plant and hedge. It took rather well to Australian conditions!



NEW PEDESTRIAN UNDERPASS AT PYMBLE

Separation for safety

Mixing traffic types is always a source of danger. Most at risk are pedestrians crossing vehicle flow. In a pedestrian-vehicle encounter, the person on foot nearly always comes off second best.

The most effective way of avoiding such potentially deadly confrontations is to physically separate the two types of traffic streams by providing means for people to walk over or under the carriageway.

The former solution is the more common. Pedestrian overbridges are generally cheaper than tunnelling and usually less constrained by their sites. The construction of an underpass may involve hard-rock tunnelling, reinforcement of the pavement above and/or re-location of public utilities — drains, pipes, cables, etc. For such reasons overbridges far outnumber underpasses in New South Wales.

Where going under is easier

One of the comparatively few pedestrian underpasses in this State has been constructed at the Sydney suburb of Pymble. It demonstrates how site considerations can *sometimes* favour tunnel solution. This underpass now provides pedestrians with a safe and convenient route between the eastern and western sides of the Pacific Highway alongside Pymble Railway Station.

Previously, the only safe way across was via a signalised pedestrian crossing, which was installed in August 1956. The adjacent railway station and the shops, on both sides of the highway south of the site, generate a large amount of cross-street pedestrian traffic. At peak hours this increases along with the vehicular traffic. This commonly results in considerable congestion with long queues of vehicles building up.

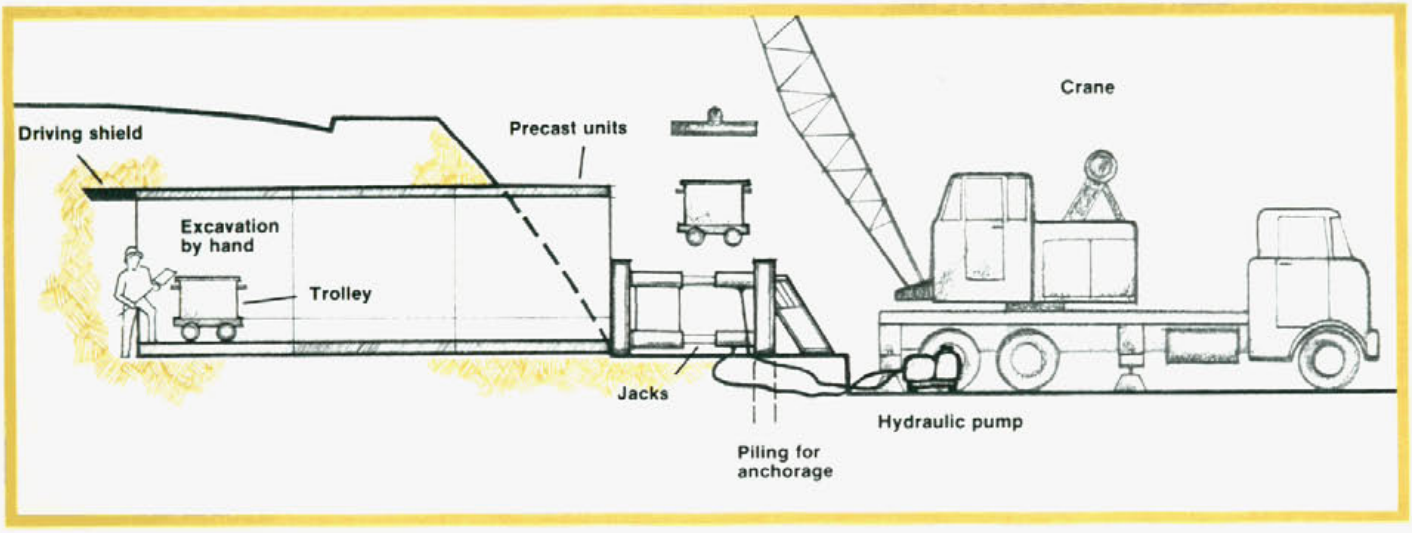
In addition, the alignment and grading of the railway overbridge directly to the north and its ARMCO guardrail give city-bound drivers a very restricted sight distance to the crossing.

Ideal site for a subway

Initially, an overbridge was considered. However, investigation showed this was impractical. The problem of locating the steps or ramp at the western end could only be solved by expensive acquisition and demolition of one of the shops.

Further investigation showed the topography was excellently suited to a tunnel crossing, as here the highway begins its steep climb up Pymble Hill.

Excavated spoil from the tunnel was shovelled into trolleys, lifted by crane at the western end and emptied into trucks for disposal. The four hydraulic jacks which thrust the concrete box units underground can be seen on the left and right.



Although slightly cheaper than the construction method eventually chosen, "cut and cover" or open excavation could not be used because it would disrupt traffic flow. The closure of one or two lanes during peak hours on this major route would have been completely unacceptable. It also would have been dangerous, due to the restricted sight distance already mentioned.

Under and out

Instead of lowering the underpass segments into position, they were jacked into place from the Avon Road end. The box-like sections are pre-fabricated, reinforced concrete units 3.2 m wide, 2.6 m tall and 1.3 m long.

Working from a pit excavated at the western or Avon Road site, the contractors, Pipeline Boring Pty Limited, set up an array of four hydraulic jacks. Each of these could exert forces up to 400 tonnes.

The first box unit was fitted with a driving shield on the leading edge of its "roof". As it was thrust forward by the jacks, the material ahead of it was excavated manually. The spoil was shovelled into trolleys which could be lifted by crane and emptied into trucks for disposal.

After the first box unit had moved one length into the soil, another was lowered by crane behind it and the process repeated. The trolley lines were extended to keep pace with the progress of the driven tunnel. The 19 units gave a total tunnel length of 24.7 m.

The line and level of the growing structure were controlled by variations in the jacking forces and by the excavation methods ahead of the advancing work. When jacking was completed, both line and level were within approximately 35 mm of the design.

The units were bolted together under slight prestress to prevent seepage into the joints. An exposed aggregate concrete finish has been applied to exposed surfaces to minimise vandalism.

The Department used its own forces to carry out the subsidiary works involved. These included approach ramps with their retaining walls, lighting, etc.

During construction, a small leaflet giving details of the project was distributed among local residents, and was made available both at the railway station and from the local shopping centre. The tunnel was completed and opened for pedestrian use on 17 September 1979.

Total cost of the underpass was approximately $250,000. Its completion has helped to relieve congestion at this location on the heavily trafficked Pacific Highway. Eventually, when available funds allow, the position will be further ameliorated by the provision of a third northbound lane on the railway overbridge. This will bring the bridge carriageway into line with the six-lane facility north and south of the bridge.

Pedestrians and vehicular traffic can now enjoy greater safety with the removal of the surface crossing and its replacement by the underpass.

Construction in progress as at June 1979, showing the tunnel, retaining wall and ramp at the western end awaiting finishing touches.

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1, 2. The tunnel at Pymble is not the first time the Department has "gone to such depths" for pedestrians. A series of subways and pedestrian plazas connect York, Grosvenor, Kent and Clarence Streets, Sydney. Opened on 2 September 1972, they allow people to cross safely beneath the Western Distributor.

3. The subway under the Princess Highway at Engadine also provides access to Engadine Railway Station. Opened on 19 December 1972, it replaces a pedestrian crossing on a busy dual carriageway section of the highway.

OFFICIAL OPENING OF NEW BRIDGE AT MALDON

The new bridge which now carries the Picton - Wollongong road (Trunk Road No. 95) over the Nepean River at Maldon was officially opened at a ceremony on the northern approach on Monday 21 April, 1980. In conjunction with the opening of the bridge, a 9.8 km deviation of the road between Picton and Wilton was brought into use.

The slender profile of the bridge is complemented by its cylindrical piers. These piers were constructed using the slip-form process — the first time it has been applied to bridge building by the Department — and their construction is described in detail in the following article.

At the ceremony, the Commissioner for Main Roads, Mr. Brian Sexton, opened the proceedings, and then invited the President of the Shire of Wollondilly, Councillor F.W. McKay to welcome visitors. Other speakers included Mr. W.E. Knott, M.P., State Member for Wollondilly and Mr. M.E. Baume, M.P., Federal Member for Macarthur. The Hon. H.F. Jensen, M.P., State Minister for Local Government and Minister for Roads and the Hon. R.J.D. Hunt, M.P., Federal Minister for Transport also addressed the large gathering. Leaving the dais, the speakers moved to the specially printed ribbon, which was cut by Mr. Jensen to officially open the bridge.

Special guests at the ceremony were Mr. and Mrs. T. DeBurgh. Mr. DeBurgh's father, Mr. E.M. DeBurgh, designed the original Maldon Bridge, which was opened to traffic in 1903 (see article in December, 1978 issue of Main Roads, Vol. 44, No. 2, pp. 61-63). Mr. T. DeBurgh was also a guest almost thirteen years ago at the opening of the new DeBurghs Bridge over the Lane Cove River at Ryde on 15 December, 1967. On that day, Mr. DeBurgh cut the ribbon to open the bridge which was named in honour of his father, a man of great engineering skill and insight. (See "Main Roads" December, 1967 issue, Vol. 33, No. 2, pp. 51-54 and June, 1976 issue, Vol. 41, No. 4, pp. 125-127).

1. The Hon. H.F. Jensen, M.P., Minister for Local Government and Minister for Roads, addressing the crowd at the official opening.
2. Mr. and Mrs. T. DeBurgh, special guests at the ceremony.


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The bridge which carries the Picton—Wollongong Road over the Nepean River at Maldon on opening day, Monday 21 April 1980.
1. 2. Pouring for the slipformed piers continued 'round the clock, under floodlights or through chilling fog.
3. Slipform framework being lifted off the first pier.

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SLIPFORM TECHNIQUE USED AT MALDON

Whenever concrete is cast into a structure, some kind of formwork is needed to give it shape. It may be as simple as the backyard gardener's rough and ready mounds of earth around cast-in-place flagstones. Or it can be an intricate mould, with embedments and reinforcement built in.

Probably the most highly developed and efficient kind of formwork for concrete is the slipform. This method was used recently for casting the piers of the bridge to carry Trunk Road No. 95 — the Picton to Wollongong road — over the Nepean River at Maldon (see article in December 1978 issue of "Main Roads", Vol. 44, No. 2, pp. 48-9 and 56-60, and back cover). As promised, in this article we look more closely at the slipforming procedures used.

Extrusion with a difference

Slipform casting is actually a form of extrusion, similar in many ways to the process used in the plastics industry to produce tubes and rods. Aluminium can also be extruded in complex cross-sections, for such uses as window and door frames. The continuous casting of steel can also be considered as an extrusion process.

Slipform casting works on the same principle, with one important difference. Once extruded, the concrete stays static, while the form itself (analogous to the extrusion die) moves, passing over fresh material and leaving behind the solid product, with only minor hand finishing needed to make it complete.

Not so new

The slipform process apparently dates back to 1885, when a Texan named Carrico used ropes and windlasses to lift the formwork as his mix became hardened into concrete. Later methods included manually operated screwjacks and rack-and-pinion arrangements. In the early 1950's, synchronised hydraulic jacks became the norm and, in this form, the process was introduced into Australia.

Of course, slipform casting of concrete need not necessarily be vertical. In some places the method is used to lay down lengths of kerbs and gutters, as on the F5 — South Western Freeway. On a larger scale, it has been used to construct road pavements (see the article on The Foreshore Road at Botany in the March 1979 issue of "Main Roads", Vol. 44, No. 4, pp. 70-81), as well as to line canals, drains and even tunnels, both horizontal and sloping.

Going up . . .

Amid this versatility, the most spectacular achievements of the slipform process have been in vertical structures. Bridge piers up to 381 metres have been built by this method. The Skylon observation tower at Niagara, Canada, over 200 metres tall, is supported on a tri-lobed tapering column built of slipformed concrete.

Until recently, in Australia, vertical slipform concrete casting has been used mainly in building such cylindrical structures as silos, storage bins, liquid holding tanks, large building service cores, cooling towers and tapered chimneys. The piers of the new bridge at Maldon are the first to be built on one of the Department's works using this technique.

Slipforming advantages

What are the advantages of slipforming concrete? Primarily speed and the economy that results from a high production rate. As is usually the case, the continuous flow process is more efficient than the batch method. The latter requires that such a column be built in a number of distinct lifts. These would be restricted in height by the outward pressure of the wet concrete on the formwork and the possibility of the mix ingredients segregating during placement.

Basically, the slipform used by the contractors at the Maldon site was a steel tube with a slight taper. It was constructed of standard 1.2 m deep flexible steel sheets clipped together to form a cylinder. At one joint, a tapered timber wedge was inserted to make the bottom of the form approximately 6 mm wider than the top. The dimensions of the slipform ensured that the finished piers each had a nominal diameter of 3.2 m.

This taper in a slipform is desirable for several reasons. Firstly, it provides a control on concrete adhesion; a perfectly cylindrical form might stick and tear the setting concrete away from that already in place. Secondly, the taper also allows slight vertical adjustments to be made while slipping. Thirdly, it is also a safeguard against a mechanical wedging action if the form becomes slightly distorted.

Five jacks

The form was moved upward by five hydraulic jacks, which climbed up the jacking rods passing through them. The rods had threaded ends so that they could be coupled together as the pier grew. The jacking rods were left in place in the curing concrete as additional reinforcement.

Where jacking rods are to be salvaged for re-use the usual practice is to sheathe them with thin-walled steel pipes as loosely fitting sleeves. These are left embedded when the rods are pulled free. However, this was not done at the Maldon site, as the rods were simple (and inexpensive) mild steel, 25 mm in diameter.

The upward thrust of the five hydraulic jacks used at Maldon was transferred to the form by means of five heavily-braced modified A-frame yokes. These also formed the main support members for the concrete shute platform, the working platform and the hanging finishing platform, as well as various items of machinery and the live loading of operators as they moved about their jobs. Further stiffening of the form's designed shape was provided by two RSJ wales running as circumferential ribs around the form.

Reinforcement

The reinforcing steel components were arranged both vertically and horizontally. The vertical steel consisted of 56 bundles of C32 reinforcing bar, with the bundle sizes ranging from four bars at the base to two bars from mid height to the top. The bars were all 5 metres long, (for handling purposes) and were butted onto each other in a staggered formation to give continuity throughout the full height of the cast-in-place pier.

A hoop-shaped temporary mobile template, fitted with clips, grouped the bundles which were assembled at ground level. They were then craned up and passed through two fixed templates, one

at the mix discharge level and the other about 1.5 m higher. They were rigidly supported in correct alignment by the yokes.

The horizontal reinforcing steel was helical, using three continuous ties of C24 reinforcing bar with 200 mm vertical space between them. Three bars were needed for each turn and the splices were in the form of seamless steel sleeves crimped on the ends of the rods. To expedite placement of the reinforcing, a bench press at ground level locked a sleeve on one end of each rod before it was lifted to the working platform.

The vertical and helical bars were tied together to locate them accurately and keep them stable during pouring and slipping. The arrangement of the reinforcement was designed to leave a large area clear to facilitate pouring.

Mix delivery

The mix for the concrete was delivered to the bridge site by transit mixers from Maldon, working to a co-ordinated timetable. On arrival a slump test was immediately taken to help determine its setting characteristics. Quality control was also carried out at the batching plant by a Departmental Superintending Officer.

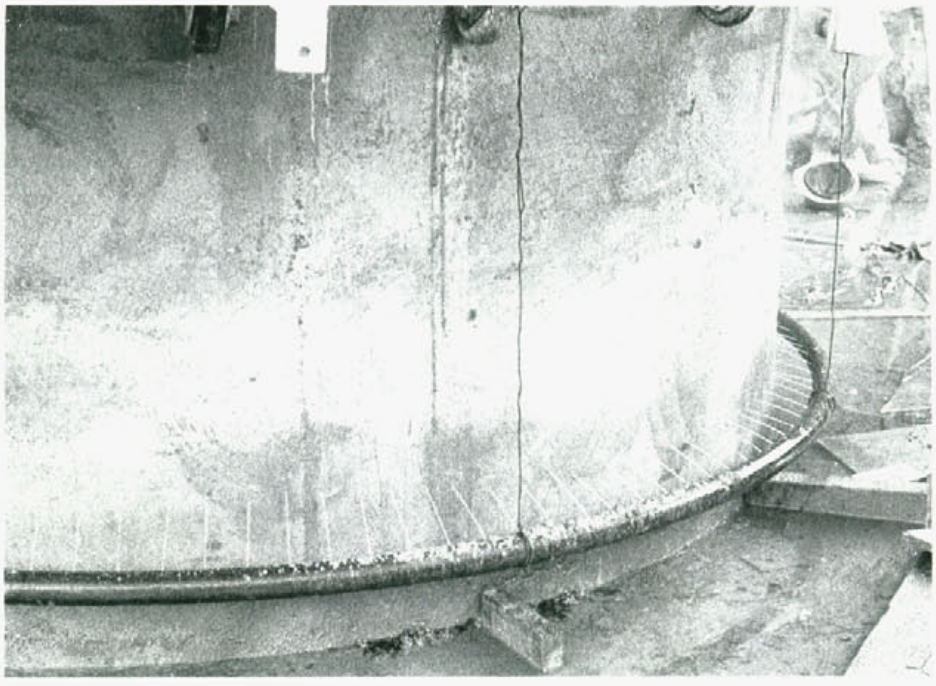
Once the on-site testing was satisfactorily completed the mix was loaded into skips. These were lifted and then lowered within the circle of exposed reinforcing steel. The skip was emptied into a pair of hoppers fitted with flexible discharge tubes. Compaction was carried out by means of poker vibrators.

Finishing and curing

The design compressive strength at the standard 28 days was easily surpassed by the mixes for both piers. The most important property of the mix appeared to be the predictability of its initial setting time. This seemed to be largely controlled by the additive (retarder) dosage and the slump. The range of ambient temperatures at the site had only marginal effect. Other factors considered included aggregate proportions, workability and bleeding characteristics.

The finishing platform was hung below the main working platform, giving the finishing team easy access to the green (although set) concrete as it emerged from the climbing form. This greenness meant it was comparatively easy to rectify any minor defects with sponge floats.

Below the main working platform there was a ring of perforated tubing fed with water from ground level for curing the concrete. Overall this system operated efficiently, although fluctuations of the water supply and slurry blocking the nozzles created some problems.



A ring of perforated tubing, fed with water from ground level, was used for curing the concrete.

Level, verticality, rotation

A simple water level network using plastic tubing and coloured water was used to check levels. As the stroke of each jack could be varied from the normal 25 mm down to 10 mm, corrections were comparatively simple to carry out by differential jacking.

Verticality and rotation were checked regularly during each shift by means of plumb-bobs, and once during each day shift with theodolites. The piers were kept remarkably vertical. The first (southernmost) pier (35.64 m) was within 17 mm — 1 in 2,000. The figure for the second pier (34.56 m) was 10 mm — 1 in 3,500.

There was a tendency for the form to rotate somewhat more on the first pier than on the second. This was due to a combination of differential friction forces and uneven thrust forces by the jacks. The problem was overcome by packing tapered metal shims under the jacks and using guy-wires from the edge of the gorge.

Pressure problem

The uneven thrust forces by the jacks on the first pier appeared to be caused by the ring mains system of hydraulic lines. The more distant jacks suffered from pressure drop. On the second pier this was replaced by a radial system, i.e. each jack was connected to the pump's output by a separate line to equalise pressures in the jack array. This is one example of how both the Department and the contractor were able to improve technique and so improve performance on the second pier. The target jacking rate proposed was 300 mm/hr. Although the slipforming of the first pier was plagued by heavy rain and showers between 14 June and 16 June, the table below does give an indication of the experience gained and the lessons learned while erecting the first pier.

Rain, cold and heat

The rain experienced during the construction of the first pier tended to cause the form to fill with water. This was partially overcome by keeping the form brim-full of mix and allowing the slurry to overflow. As there was a gap between the form and the working platform, the slurry ran down the sides and the finishers had a difficult time controlling slurry runs. Even in fine weather, there were leakages at the form's joints, especially where a tapered

	First pier	Second pier
Slipform commenced	1800 hrs — 11.6.78	1800 hrs — 23.7.78
Slipform completed	0400 hrs — 17.6.78	1800 hrs — 27.7.78
Elapsed time (hrs)	130	96
Height (m)	35.64	34.56
Theoretical volume (m^3)	287	278
Average jacking rate (mm/hr)	274	360

wedge was inserted to give the form itself the necessary taper.

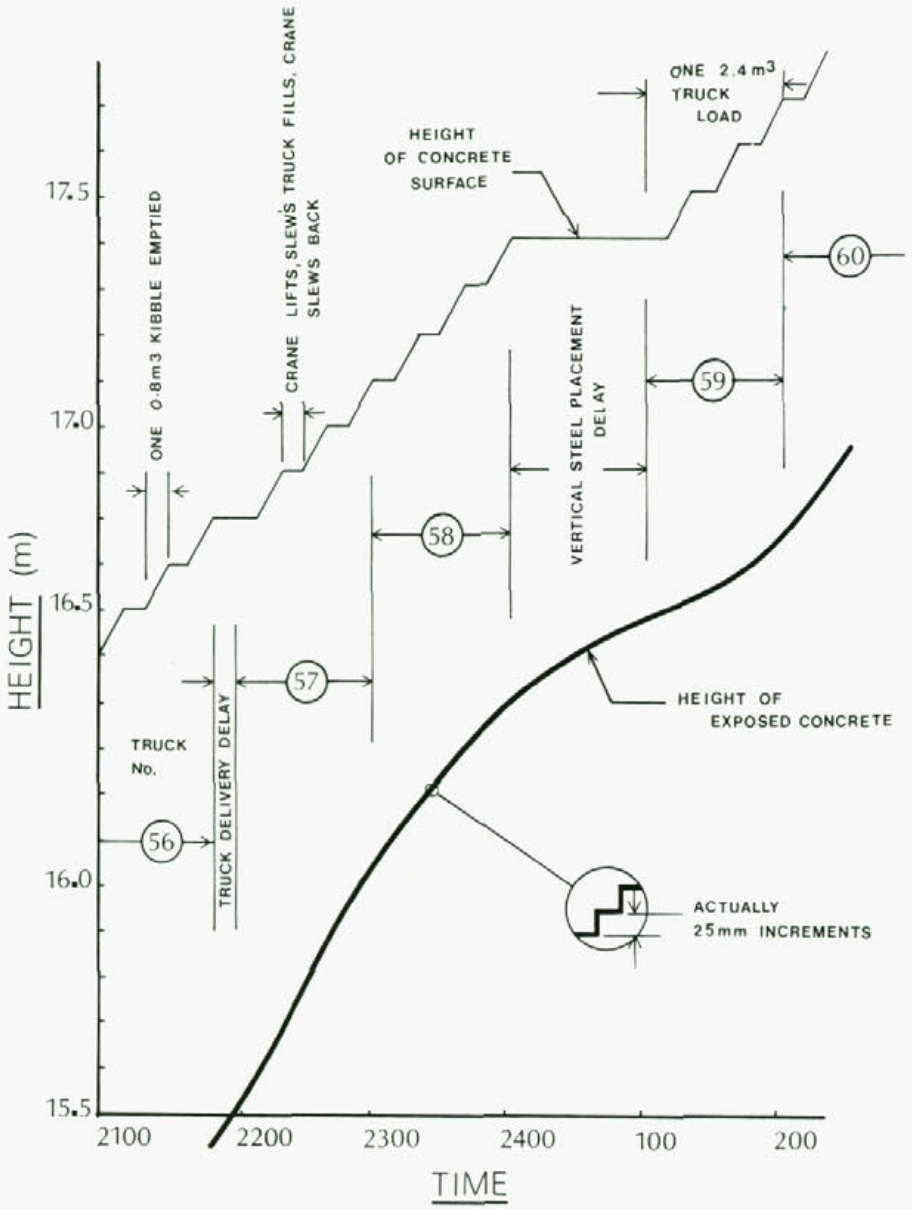
Another weather-related problem was "icing up" of freshly placed mix at low temperatures, mainly at night. The mean minimum temperature during the slipforming of the first pier was 3.0 °C and for the second was 0.1 °C. This problem was solved by reducing the slump and minimising delays between mix placements.

The heat generated by the hydration of the setting cement had no deleterious effects. In fact, it caused the core of the material to set somewhat sooner than the surface and was therefore an inbuilt safety factor. Because of this heat effect, calculation of initial setting time (by the standard penetration test) could not be as accurate as originally expected.

In spite of such difficulties, plus the varying jacking rates and the wide range of slumps used, the physical finish of both piers was satisfactory.

Steady flow

The greatest single problem faced by the contractor was caused by delays in the placement of reinforcing steel. The accompanying graph shows just how sensitive slipforming is to any interruptions to the supply of materials. If too many delays occur, the time factor advantage (and the accruing cost savings) can be markedly reduced.



TYPICAL 1.25 m height CYCLE

Ancillary to the slipform was the access scaffolding which grew to keep pace with the rising piers. The scaffolding remained in place to cater for the crews who later worked on the headstocks and other components of the bridge.

Gang size

The "round-the-clock" slipforming of the bridge piers was carried out in two 12 hour shifts. The normal gang on the slipform itself consisted of the following:

1 foreman
1 slipform pump operator
2 steel fixers
3 labourers
1 concrete finisher

The ground level gang was comprised of:

1 crane operator
2 steel fixers
1 dogman
1 labourer

A scaffolding tower gang and storeman were employed on day shifts. The contractor's Engineer operated at both operational sites. Departmental supervision consisted of a Resident Engineer and Superintending Officer at the site plus a further Superintending Officer at the batch plant.

Timing is crucial

The slipforming of the Maldon bridge piers was undoubtedly a qualified success. Qualified in the sense that although there were problems, much was learned that will make future projects of this type more efficient and therefore more economical. The experience gained in constructing the first pier contributed to the 31% increase in average jacking rate for the second.

The exercise also emphasised in practice what was so well known in theory. Slipforming of bridge piers demands detailed planning in time, with every contributing operation from batching to curing "orchestrated" into a single smooth performance. Any break in the flow of supplies or the carrying out of operations can bring the process to a halt.

Maldon Bridge is another example of the Department's desire and capacity to try new techniques, to ensure that the construction methods used are the most appropriate and most efficient.

Tenders Accepted by Councils

1. The following tenders (in excess of $20,000) for road and bridge works were accepted for the three months ended 30 June 1979.

Council	Road No.	Work or Service	Name of Successful Tenderer	Amount
Cobar	Main Road No. 411 and Various Shire Roads	Bituminous surfacing	Emoleum (Aust) Pty Ltd	$27,203.85
Coonamble	Main Road No. 212 and Main Road No. 333	Bituminous resealing at various locations	Spraywave Pty Ltd	$42,106.11
*Eurobodalla	Main Road No. 560	Construction of Caseys bridge over Two Storey Creek	Gordon Ryan & Sons Pty Ltd	$116,000.00
Holroyd	Secondary Road No. 2071	Construction of deviation from Sturt Street to Woodpark Road	Gigante and Jeames	$449,880.33
Lockhart	Main Road No. 543	Construction of bridge over Burkes Creek at The Rock	W.A. Winnett & Sons	$138,046.66
Narrandera	State Highway No. 17	Reconstruction of approach to railway overbridge near Whitton Street, Narrandera	Pioneer Asphalts Pty	$27,820.55
Shellharbour	Main Road No. 611	Supply and delivery of precast reinforced concrete box culverts for construction of dual carriageways between Shellharbour Road and The Kingsway	Rescrete Industries Pty Ltd	$42,345.96
Yarrowlumla	Main Road No. 268	Construction of pipe and box culverts in connection with the reconstruction from 31.9 to 34.6 km north of Queanbeyan	Woden Construction Pty Ltd	$25,179.88
Parry	State Highway No. 11	Construction of 3/4 cell 2.0 x 2.0 m reinforced concrete box culvert over Onus Creek at 35.6 km west of Tamworth	M. & P. Campese	$63,118.08
Waugoola	State Highway No. 6	Supply and spray bitumen for reseals	Allen Bros. Asphalt Ltd	$112,954.67
Wollondilly	Various	Maintenance and improvement programme 1978/79	Boral Asphalt Ltd	$31,752.50

*This tender was accepted in September, 1978 but was omitted from the relevant return.

2. The following tenders (in excess of $20,000) for road and bridge works were accepted for the three months ended 30 September 1979.

Barraba	Main Road No. 360	Construction of reinforced concrete bridge culvert over Ti-Tree Creek at 17.7 km west of Cobbadah	R. & F. Bruno	$46,653.55
Boolooroo	Main Road No. 232 and Main Road No. 507	Bituminous surfacing of main roads in Council area	Spraypave (Tamworth)	$76,540.55
Cabonne	Trunk Road No. 61	Construction of bridge over Molong Creek at 8.3 km west of Orange	Eodo Pty Ltd	$190,137.06
Cootamundra	Trunk Road No. 78	Bituminous sealing and resealing of roads in Council area	Polson and McKinley Pty Ltd	$30,905.90
Gundagai	Various	Supply heat and spray R90 bitumen. Supply, mix, heat and spray flux. Spread aggregate and subsidiary works.	Emoleum (Aust) Ltd	$25,504.04
Harden	Main Road No. 381	Construction of bridge over Cunningham Creek	Golf Constructions Pty Ltd	$244,140.00
Inverell	Trunk Road No. 73	Construction of 4 x 21 m span prestressed concrete bridge 84 m long	A. R. Dickinson Construction Co (Tamworth)	$344,264.85
Tallaganda	Various	Bituminous sealing	Polson & McKinley Pty Ltd	$61,271.56
Wakool	Rural Road — Goon Road	Construction of bridge over Little Merran Creek	Newmac Pty Ltd	$71,876.15
Wentworth	Trunk Road No. 68	Supply of 750 m^3 of 10 mm and 14 mm aggregate	L. G. & J. T. Behsmann	$28,000.00
Wollondilly	Various	Supply and laying of asphaltic concrete	Allen Bros. Asphalt Ltd	$32,740.50
Wyong	Main Road No. 335	Construction of 3 span prestressed concrete bridge over Ourimbah Creek	Hornibrook Group	$457,645.00
Yarrowlumla	Various	Bituminous resurfacing	Allen Bros.. Asphalt Ltd	$39,263.05
Yarrowlumla	Main Road No. 268	Reconstruction to earthworks stage including approaches to Deep Creek bridges, 31.89 to 34.56 km north of Queanbeyan	Woden Constructions Pty Ltd	$25,179.88
Yarrowlumla	Rural Local Roads	Construction of reinforced box culverts over Sheepyard Creek	Woden Constructions Pty Ltd	$24,708.80

3. The following tenders (in excess of $20,000) for road and bridge works were accepted for the three months ended 31 December 1979.

Bingara	Development Work No. 3191 — Elcombe - Caroda Road	Construction of bridge over Double Gully 23.3 km south of Elcombe	L. G. Rixon	$52,632.50
Bogan	Main Road No. 204	Construction of approaches to bridge over Belar Creek	Hickey Plant Hire	$33,510.00
Carrathool	Various Trunk and Main Roads	Supply of aggregate to roads in Carrathool Shire	Griffith Metal, Sand and Gravel Pty Ltd	$31,130.79
Carrathool	Various Trunk and Main Roads	Supply of bitumen to roads in Carrathool Shire	Allen Bros. Asphalt Ltd	$96,565.00
Conargo	Various Trunk and Main Roads	Supply of bitumen to roads in Conargo Shire	Emoleum (Aust) Ltd	$24,779.51
Crookwell	Main Road No. 248, Trunk Road No. 54 and various roads	Bituminous sealing	Canberra Asphalters Pty Ltd	$21,460.54
Gilgandra	Trunk Road No. 77	Construction of bridge over Beelong Creek 17.7 km east of Gilgandra	Steve Perry Manufacturing Pty Ltd	$151,893.00
Gloucester	Trunk Road No. 90 — Bucketts Way	Construction of bridge over Avon River at Stratford, 13.1 km south of Gloucester	A. R. Dickinson	$258,782.90
Goulburn	Trunk Road No. 54 and Main Road No. 256	Bituminous resealing of Trunk Road No. 54. Reconstruction and sealing of Main Road No. 256.	Allen Bros. Asphalt Ltd	$44,651.68
Goulburn	State Highway No. 2	Reconstruction of Hume Street between Lansdown Street and Finlay Road	Allen Bros. Asphalt Ltd	$61,206.60
Guyra	Trunk Road No. 73 and Main Road No. 135	Bituminous sealing and resealing	Emoleum (Aust) Ltd	$59,158.95
Harden	Main Road No. 381	Construction of bridge over Cunninghams Creek	Nelmac Pty Ltd	$244,285.00
Hume	Various Trunk and Main Roads	Bituminous sealing works on roads within Hume Shire	Allen Bros. Asphalt Ltd	$57,120.28
Taree	State Highway No. 10	Laying of asphaltic concrete at the intersection of Victoria and Commerce Streets, Taree	Bitupave Ltd	$21,384.00
Tumbarumba	Various Trunk and Main Roads	Bituminous sealing of various roads within Tumbarumba Shire	Polson and McKinley Pty Ltd	$66,103.92
Wakool	Various Trunk and Main Roads	Supply of aggregate for various roads within Wakool Shire	Lake Boga Quarries Pty Ltd	$47,005.37
Warren	Various	Bituminous resealing on various roads within Warren Shire	Spraypave Pty Ltd	$74,138.86
Waugoola	Various classified roads	Bituminous sealing and resealing of various classified roads within Waugoola Shire	Allen Bros. Asphalt Ltd	$82,187.40

4. The following tenders (in excess of $20,000) for road and bridge works were accepted for the three months ended 31 March 1980.

Council	Road No.	Work or Service	Name of Successful Tenderer	Amount
Bland	Trunk Road No. 57	Construction of bridges over Tea Tree Creek 5.51 to 5.64 km north of West Wyalong	Herbert Bros. Unit	$258,218.06
Coolamon	Various	Bituminous sealing works on Trunk and Ordinary Main Roads	Canberra Asphalters Pty Ltd	$69,713.79
Griffith	Rural Local Road	Construction of bridge over Main Canal on Crossing Street, Griffith	J. & L. Evans Pty Ltd	$75,499.28
Grafton	Trunk Road No. 74	Construction of bridge over Musk Valley Creek, 4.0 km south of Grafton	Bricul Civil Constructions	$113,335.08
Gundagai	Main Road No. 243	Construction of bridge over Nangus Creek at Nangus, 24.45 km west of Gundagai	Siebels Concrete	$89,802.00
Jemalong	Main Road No. 377	Construction of bridge over Jemalong Creek, 23.47 km west of Forbes	Dallas Civil and Building Pty Ltd	$215,594.73
Mitchell	Various	Bituminous sealing works on Trunk and Ordinary Main Roads	Boral Road Surfaces	$32,023.18
Murrumbidgee	Various	Bituminous resealing works on Trunk and Ordinary Main Roads	Emoleum (Aust) Ltd	$30,198.84
Murrumbidgee	Various	Supply of Aggregate	Emoleum (Aust) Ltd	$35,448.85
Tenterfield	Rural Local Road	Manufacture and supply of 32 deck units to Manners Steel bridge over Tenterfield Creek	Humes Ltd (Grafton)	$27,296.00
Tenterfield	Rural Local Road	Construction of 600 mm diameter bored piles for Manners Steel bridge over Tenterfield Creek	Godfreypile Pty Ltd	$28,320.45
Urana	Various	Bituminous sealing works on Trunk and Ordinary Main Roads	Emoleum (Aust) Ltd	$101,670.74
Wakool	Various	Bituminous resealing works on Trunk and Ordinary Main Roads	Allen Bros. Asphalt Ltd	$179,593.35
Wakool	Various	Bituminous resealing works on Trunk and Ordinary Main Roads	Allen Bros. Asphalt Ltd	$70,321.98
Wentworth	Trunk Road No. 68 and Main Road No. 431	Supply and delivery of bituminous surfacing materials	Mobil Oil Australia Ltd	$44,781.28

Tenders Accepted by the Department of Main Roads

1. The following tenders (in excess of $20,000) for road and bridge works were accepted for the three months ended 30 June 1979.

Road No.	Work or Service	Name of Successful Tenderer	Amount
F4 — Western Freeway	Municipalities of Concord and Strathfield. Manufacture, supply, delivery and stacking of precast bridge girders for bridge over the northern railway at North Strathfield.	Transbridge (a division of Transfield (N.S.W.)) Pty Ltd	$1,495,800.00
F4 — Western Freeway	Municipality of Auburn. Construction of continuously reinforced concrete paving along the section between Marlborough Road, Homebush, to Silverwater Road, Silverwater.	Friend and Brooker Civil Engineering Pty Ltd	$974,164.00
State Highway No. 1	Princes Highway. Shire of Imlay. Supply and stockpile up to 13 200 m^3 of rock for approaches to bridge over Merimbula Lake at Merimbula.	K. J. & J. A. O'Callaghan	$67,320.00
State Highway No. 1	Princes Highway. Shire of Eurobodalla. Supply and delivery of up to 7000 m^3 of gravel for reconstruction on Princes Highway south of Batemans Bay.	Batemans Bay Sand and Gravel	$30,800.00
State Highway No. 2	Hume Highway. Shire of Mittagong. Construction of bridge over Picton Loop railway line.	Gordon Ryan and Sons Pty Ltd	$111,574.00
State Highway No. 3	Federal Highway. Shire of Mulwaree, Gunning and Yarrowlumla. Supply and delivery of 20 mm fine crushed rock.	Readymix Group (N.S.W.)	$20,120.00
State Highway No. 5	Great Western Highway. City of Bathurst. Proposed deviation to eliminate the level crossing at Kelso, including construction of approaches.	E.O.D.O. Pty Ltd	$162,501.06
State Highway No. 5	Great Western Highway. City of Blue Mountains. Slipforming of concrete kerb and gutter: 1. near Kidman Street, Blaxland; 2. between Ridge Street and Pork Road, Woodford; 3. between Leura subway and Mount Hay Road, Leura.	Seovic Holdings Pty	$38,610.25
State Highways Nos. 5, 6 and 7. Main Roads Nos. 184 and 516. Trunk Road No. 55	Great Western, Mid Western and Mitchell Highways and other roads. Cities of Blue Mountains, Greater Lithgow, Bathurst and Shires of Evans, Rylstone and Mudgee. Pavement marking including centre, lane and edge lines.	Mercury Linemarking	$48,000.00
State Highway No. 7	Mitchell Highway. Shire of Cabonne. Protection of bridge abutments at Angus, Larras Lee, Claremont and Three Rivers bridges, between 45.1 and 55.5 km north of Orange.	Foreshore Protection	$39,506.00
State Highway No. 8	Barrier Highway. Shire of Central Darling. Construction of two bridges over Talyawalka flood plain at 9.2 and 10.8 km east of Wilcannia.	Murray Constructions	$464,565.90
State Highway No. 9	New England Highway. City of Maitland. Supply and lay up to 1100 t of 10 mm asphaltic concrete to reconstruction between Verge Street and Anambah Road, Rutherford.	Boral Road Surfaces	$42,020.00
State Highway No. 9	New England Highway. Supply and load up to 800 t of 10 mm cold mixer bins into Department's trucks for use on the highway.	Bitupave Ltd	$20,432.00
State Highway No. 10	Pacific Highway. Shire of Wyong. Win, load and haul up to 15 000 m^3 of selected sub-grade material from Nords Wharf to reconstruction of dual carriageways between Saliena Road and Elizabeth Bay Road, Lake Munmorah.	Elesamer Constructions Pty Ltd	$25,500.00
State Highway No. 10	Pacific Highway. Municipality of Lake Macquarie. Supply and delivery of 2618 concrete blocks for retaining wall at O'Brien Street, Gateshead.	Rescrete Industries Pty Ltd	$20,881.00
State Highway No. 10	Pacific Highway. Shire of Nambucca. Construction of bridge over the main northern railway line at Nambucca Heads and construction of a 3 cell box culvert near Cedar Creek, 2.9 km north of Nambucca Heads.	C.T.K. Engineering	$228,807.23
State Highway No. 10	Pacific Highway. Shire of Manning. Winning, crushing and stockpiling of up to 30 000 m^3 of natural rock at Blackbutts Quarry, 16.0 km south of Taree.	C.T.K. Engineering	$117,640.00
State Highway No. 10	Pacific Highway. Municipality of Lake Macquarie. Supply and delivery of up to 10 000 m^3 of base gravel for construction of dual carriageways from Swansea bridge to soldiers Road, Pelican.	Beneverin Mining Pty Ltd	$25,000.00

1. The following tenders (in excess of $20,000) for road and bridge works were accepted for the three months ended 30 June 1979.

Road No.	Work or Service	Name of Successful Tenderer	Amount
State Highway No. 10	Pacific Highway. Municipality of Lake Macquarie. Supply and delivery of up to 4500 t of 10 mm minus crusher run for construction of dual carriageways between Soldiers Road, Pelican and Swansea bridge.	Blue Metal and Gravel (North) Pty Ltd	$32,490.00
State Highway No. 10	Pacific Highway. City of Newcastle. Supply and lay up to 1100 t of 10 mm asphaltic concrete to southbound carriageway of construction works, 13.4 to 14.5 km west of Newcastle.	Bitupave Ltd	$39,985.00
State Highway No. 10	Pacific Highway. City of Newcastle. Supply and lay up to 1100 t of 10 mm asphaltic concrete to northbound carriageway of construction works, 13.4 to 14.5 km west of Newcastle.	Bitupave Ltd	$39,985.00
State Highway No. 10	Pacific Highway. City of Newcastle. Supply and lay up to 1300 t of 10 mm asphaltic concrete to pavement strenghtening and construction of median kerbs and storage lanes on the northbound carriageway between Ironbark Creek and the junction of the Pacific and New England Highways at Hexham, 14.5 to 15.9 km west of Newcastle.	Boral Road Surfaces	$46,800.00
State Highway No. 10	Pacific Highway. City of Newcastle. Supply and lay up to 1300 t of 10 mm asphaltic concrete to pavement strengthening and construction of median kerbs and storage lanes on the southbound carriageway between Ironbark Creek and junction of the Pacific and New England Highways at Hexham, 14.5 to 15.9 km west of Newcastle.	Boral Road Surfaces	$46,800.00
State Highway No. 10	Pacific Highway. Shire of Coffs Harbour. Winning, crushing, stockpiling of up to 10 000 m^3 of conglomerate rock at Taylors Pit, 43.5 km north of Coffs Harbour.	Prodger Bros. Construction	$48,500.00
State Highway No. 10	Pacific Highway. Shire of Coffs Harbour. Supply and lay up to 727 t of asphaltic concrete on sections of the highway up to 109.7 km north of Kempsey.	Bitupave	$40,127.79
State Highway No. 10	Pacific Highway. Shire of Bellingen. Supply and delivery of up to 4000 m^3 of base material to 85.3 km north of Kempsey.	A. D. & C. J. Munro	$25,920.00
State Highway No. 10	Pacific Highway. Municipality of Lake Macquarie. Supply and lay up to 925 t of 5 mm of asphaltic concrete to resheeting Cains Hill, 12 km south of Newcastle.	Bitupave Ltd	$35,150.00
State Highway No. 14	Sturt Highway. Shire of Mitchell. Construction of bridge over Sandy Creek at Yarragundry 14.3 km west of Wagga Wagga.	Nelmac Pty Ltd	$45,798.00
State Highway No. 14	Sturt Highway. Shire of Narrandera. Construction of culvert over Gillenbah Creek 94.9 km west of Wagga Wagga	Edenlee Constructions	$77,073.00
State Highway No. 16	Bruxner Highway. Shire of Ashford. Construction of two concrete bridges over MacIntyre River at Yetman.	L. M. Robertson & Co	$1,207,890.00
State Highway No. 17	Newell Highway. Shire of Talbrager. Construction of bridge over Medway Creek at 18.3 km north of Dubbo.	Nelmac Pty Ltd	$108,066.00
Main Road No. 111	Shire of Great Lakes. Strengthening of piers 24 to 28 and 34 to 36 of the bridge over Wollomba River, between Tuncurry and Forster.	McConnell Dowell Constructors Ltd	$388,073.00
Main Road No. 357 and Unclassified Road	(a) Main Road No. 357. Shire of Namoi. Repainting of bridge over Namoi River at Boggabri. (b) Unclassified Road — Kelvin Road. Municipality of Gunnedah. Repainting of Cohens bridge over Namoi River at Gunnedah.	Mondello Bros.	$83,012.00
Main Road No. 503	Shire of Singleton. Supply and delivery of up to 4000 m^3 of A1 gravel to reconstruct various lengths of failed pavement and widening of narrow cuttings 80 to 92 km south of Singleton.	G. J. Pierce	$20,000.00
County Road No. 5037	City of Parramatta. Construction of New Jersey median on Parramatta By-pass.	Seovic Holdings Pty Ltd	$48,460.00
Unclassified Road — Harris Street	City of Parramatta. Repainting Gasworks bridge.	Jerali Pty Ltd	$42,435.00
Various	Municipality of Bankstown. Installation of traffic signals at various intersections.	K. J. Aldridge Ltd	$38,373.00

2. The following tenders (in excess of $20,000) for road and bridge works were accepted for the three months ended 30 September 1979.

Sydney Newcastle Freeway	Shire of Wyong. Construction of bridge over the main northern railway line at 103.1 km north of Sydney.	Oneata Investments Pty Ltd	$297,574.90
Sydney Newcastle Freeway	Shire of Wyong. Construction of bridge over Spring Creek on northbound carriageway of proposed motorway between Sydney - Newcastle Freeway and Pacific Highway at 103.4 km north of Sydney.	Oneata Investments Pty Ltd	$219,254.00
Southern Freeway	City of Wollongong. Construction of bridge over Byamee Street on the southbound carriageway of the Southern Freeway at Dapto, 94.1 km south of Sydney.	The Hornibrook Group (Southern Division)	$182,600.00
State Highway No. 1	Princes Highway. Shire of Shoalhaven. Construction of culvert over Browns Creek at 2.6 km south of Nowra.	Citra Constructions Pty Ltd	$68,364.00
State Highway No. 1	Princes Highway. Shire of Eurobodalla. Reconstruction between Batemans Bay and Mogo — crushing and stockpiling of river rubble.	Coastal Quarry Pty Ltd	$27,000.00
State Highway No. 2	Hume Highway. Shire of Gundagai. Construction of reinforced concrete pavement for approaches to bridge over Murrumbidgee River.	Mr. P. Eluga	$32,253.50
State Highway No. 2	Hume Highway. Shire of Gundagai. Supply and delivery of 5000 t of crushed aggregate to sites between 28 and 37 km south of Gundagai.	F. A. Delaney	$42,600.00
State Highways Nos. 2 and 3	Hume Highway and Federal Highway. Shires of Mulwaree, Gunning and Yarrowlumla. Supply and delivery of up to 750 t of quicklime.	Blue Circle Southern Cement Ltd	$40,393.00
State Highway No. 8	Barrier Highway. Shire of Central Darling. Supply, heat, haul and spray up to 100 000 l of Class 160 bitumen.	Canberra Asphalters Pty Ltd	$30,360.00
State Highways Nos. 8 and 21 and Trunk Roads Nos. 66 and 81	Barrier Highway and Cobb Highway and Menindee and Silverton Roads. City of Broken Hill and district. Supply, heat, haul and spray up to 150 000 l of Class 160 bitumen.	Polson and McKinley Pty Ltd	$41,700.00
State Highway No. 9	New England Highway. Shire of Singleton. Supply and delivery of up to 13 000 m^3 of A1 base gravel to reconstruction of bridge over Rix's Creek 52.3 to 53.5 km west of Maitland.	W. A. Shearer Pty Ltd	$41,600.00
State Highway No. 9	New England Highway. Shire of Singleton. Supply and delivery of up to 12 350 m^3 of lower base gravel to reconstruction with inclusion of parking lane at Minimbah, 34.8 to 37.1 km west of Maitland.	D. J. & C. R. Barner	$32,110.00
State Highway No. 9	New England Highway. Shire of Singleton. Supply and delivery of up to 7500 m^3 of A1 base gravel to reconstruction with inclusion of passing lane at Minimbah, 34.8 to 37.1 km west of Maitland.	Les Russell and Son Pty Ltd	$27,600.00
State Highway No. 9	New England Highway. City of Maitland. Supply and lay up to 550 t of 10 mm asphaltic concrete to construction of deviation at Red Post Hill, 15.6 to 17.27 km west of Maitland.	Boral Road Surfaces	$23,662.00
State Highway No. 9	New England Highway. City of Maitland. Supply and lay up to 1150 t of 10 mm asphaltic concrete to construction and strengthening of pavement through Lochinvar, 10.6 to 12.3 km west of Maitland.	Bitupave Ltd	$48,955.00

2. The following tenders (in excess of $20,000) for road and bridge works were accepted for the three months ended 30 September 1979.

Road No.	Work or Service	Name of Successful Tenderer	Amount
State Highway No. 10	Pacific Highway. Municipality of Lake Macquarie. Supply and lay up to 1100 t of 100 mm asphaltic concrete to construction works — dual carriageways from Swansea bridge to Soldiers Road, Pelican, 141.1 to 143.2 km north of Sydney.	Boral Road Surfaces	$38,478.00
State Highway No. 10	Pacific Highway. Shire of Wyong. Supply and delivery of up to 10 000 m^3 of base gravel to the construction works — Doyalson to Gwandalan turn off, 117.34 to 125.83 km north of Sydney.	D. & J. Constructions Pty Ltd	$36,000.00
State Highway No. 10	Pacific Highway. Municipality of Lake Macquarie. Haulage of up to 10 000 t of slag skulls from B.H.P. stockpile to the construction site — dual carriageways from Swansea bridge to Soldiers Road, Pelican, 141.0 to 143.2 km north of Sydney.	G. Hawkins Pty Ltd	$24,000.00
State Highway No. 10	Pacific Highway. Shire of Nambucca. Construction of bridges over Boggy Creek and Boggy Creek Flood channel 14 km north of Nambucca.	Bridge and Civil Pty Ltd	$266,894.00
State Highway No. 10	Pacific Highway. Municipality of Lake Macquarie. Haulage of up to 10 000 t slag skulls from B.H.P. stockpile to the construction site — dual carriageways from Swansea bridge to Soldiers Road, Pelican, 141.0 to 143.2 km north of Sydney.	Blue Metal and Gravel North	$29,800.00
State Highway No. 10	Pacific Highway. Shire of Wyong. Supply and delivery of up to 10 000 m^3 of selected subgrade material to construction of dual carriageways from Wentworth Avenue, Doyalson to Vales Road, 117.75 to 119.58 km north of Sydney.	D. & J. Constructions Pty Ltd	$47,000.00
State Highway No. 10	Pacific Highway. Shire of Wyong. Supply and delivery of up to 10 000 m^3 of selected subgrade material to construction of dual carriageways from Wentworth Avenue, Doyalson to Vales Road, 117.75 to 119.58 km north of Sydney.	D. & J. Constructions Pty Ltd	$25,000.00
State Highway No. 10	Pacific Highway. Shire of Wyong. Supply and delivery of up to 10 000 m^3 of lower base material for reconstruction work from State Highway 26 to Bangalow Creek at Ourimbah.	R. L. Scadden	$25,500.00
State Highway No. 10	Pacific Highway. Various areas. Supply, heat, haul and spray of up to 230 000 l and incorporate Department's cutter oil to various lengths of Pacific Highway.	Spraypave Pty Ltd	$61,045.00
State Highway No. 10	Pacific Highway. Shire of Port Stephens. Supply and lay up to 850 t of 10 mm asphaltic concrete for resheeting work between 22.84 and 23.84 km north of Newcastle.	Bitupave Ltd	$33,949.00
State Highway No. 10	Pacific Highway. Supply and spray up to 88 000 l of R16 bitumen at various sections of resealing of shoulders between Ironbark Creek bridge and Twelve Mile Creek.	Boral Road Surfaces	$31,865.00
State Highways Nos. 10 and 12	Pacific Highway and Gwydir Highway. Various areas. Supply, heat, haul and spray of up to 210 000 l of C160 bitumen and incorporate Department's cutter oil to various lengths of Pacific and Gwydir Highways.	Polson and McKinley Pty Ltd	$43,360.00
State Highways Nos. 10 and 16	Pacific Highway and Bruxner Highway. Various areas. Supply, heat, haul and spray of up to 850 000 l of C160 bitumen and incorporate Department's cutter oil to various lengths of Pacific and Bruxner Highways.	Boral Road Services	$209,330.00
State Highways Nos. 10 and 16	Pacific Highway and Bruxner Highway. Various areas. Supply and deliver of up to 800 t of hot mixed cold laid bituminous plant mix to various sites on Pacific and Bruxner Highways.	Bitupave Ltd	$225,200.00
State Highway No. 11	Oxley Highway. Shire of Warren. Construction of bridge over Eivenmar Creek at Beemunnel 3.2 km from Warren.	Bridge and Civil Pty Ltd	$309,155.00
State Highway No. 12	Gwydir Highway. Shire of Nymboida. Supply and delivery of up to 6000 m^3 of sub-base gravel to a site 8.0 km west of Grafton.	Bitupave Ltd	$30,600.00
State Highway No. 12	Gwydir Highway. Shire of Nymboida. Supply and delivery of up to 6500 m^3 of base gravel to site 8.0 km west of Grafton.	R. V. Bloomer	$39,000.00
State Highways Nos. 12 and 17	Gwydir Highway and Newell Highway. Shires of Boomi and Booloorоо. Supply of up to 1850 t of bituminous coldmix for use by Moree Works Office.	Pioneer Concrete (N.S.W.) Moree	$47,175.00
State Highway No. 14	Sturt Highway. Shires of Wentworth and Balranald. Supply, heat, haul and spray up to 100 000 l of Class 160 bitumen.	Canberra Asphalters Pty Ltd	$27,730.00
State Highway No. 19	Monaro Highway. Shire of Yarrowlumla. Supply and delivery of ready mixed concrete for bridge over Yellow Waterhole Creek.	Pioneer Concrete	$28,392.00
State Highway No. 22	Silver City Highway. Shire of Wentworth. Supply, heat, haul and spray up to 100 000 l of Class 160 bitumen.	Canberra Asphalters Pty Ltd	$28,590.00
State Highway No. 24	Mt. Lindesay Highway. Shire of Kyogle. Crushing and stockpiling of 10 000 m^3 of Ryolite, 11 km north of Woodenbong.	Pine Ridge Quarries	$78,500.00
Main Road No. 532	City of Parramatta. Construction of seawall on Silverwater Road.	Roach Industries Pty Ltd	$41,566.00
Main Road No. 537	Municipality of Windsor. Construction of reinforced concrete box culvert on Blacktown Road.	Oneata Investments	$99,928.50
Main Road No. 543	Shire of Mitchell. Construction of Beavers Creek bridge, 32.4 km south of Coolamon.	Nelmac Pty Ltd	$229,951.70
Secondary Road No. 2046	Municipality of Leichhardt. Construction of bridge over Whites Creek stormwater channel in Brenan Street, Leichhardt.	Enpro Constructions	$110,008.00
Various	Shire of Mudgee. Supply, heat and spray bitumen including incorporation of cutter and additive.	Polson and McKinley Pty Ltd	$93,372.27
Various	Shire of Mudgee. Supply and delivery of cover aggregate for sealing and resealing works.	Blue Metal and Gravel (Country) Pty Ltd	$28,375.45
Various	City of Bathurst. Bentinck and Durham Streets. Concrete kerb and gutter and laying of median strips.	Seovic Holdings Pty Ltd	$21,249.80
Various	Hunter Valley Division. Supply and load up to 1500 t of 10 mm dense graded asphaltic concrete into Department's trucks for National and State Highways Maintenance and Improvement Programme 1979/80.	Bitupave Ltd	$41,700.00
Various	Hunter Valley Division. Supply and load up to 1000 t of fluxed coldmix into Department's contract trucks for work in various shires in connection with 1979/80 and 1980/81 National Highways Maintenance and Improvement Programme.	Bitupave Ltd	$27,950.00

3. The following tenders (in excess of $20,000) for road and bridge works were accepted for the three months ended 31 December 1979.

F3 — Sydney - Newcastle Freeway	Shire of Wyong. Construction of bridge over the Freeway on Cobbs Road 87.3 km north of Sydney.	Gida Pty Ltd	$490,339.00
F3 — North Western Freeway	City of Sydney. Construction of reinforced concrete road and walkway parapets on Decks PE 3, 4 and 5.	A.A.M.M. Constructions Pty Ltd	$75,950.00
F4 — Western Freeway	Municipalities of Concord and Strathfield. Construction of Abutment A and Piers 1 and 2 for bridge over northern railway line at Strathfield	Frankipile Australia Pty Ltd	$411,758.00
F4 — Western Freeway	Municipalities of Concord and Strathfield. Manufacture, supply and delivery of bearings for attachment plates for bridge over the northern railway line at North Strathfield	Repco Glacier Bearings (NZ) Ltd	$65,134.00

3. The following tenders (in excess of $20,000) for road and bridge works were accepted for the three months ended 31 December 1979.

Road No.	Work or Service	Name of Successful Tenderer	Amount
F4 — Western Freeway	Municipalities of Concord and Strathfield. Construction of Pier 3 for bridge over northern railway line at North Strathfield.	A.A.M.M. Constructions Pty Ltd	$70,992.40
F5 — South Western Freeway	City of Liverpool. Supply and construction of piles for the bridge over Georges River and main southern railway line at Casula.	Frankipile Australia Pty Ltd	$249,248.73
F5 — South Western Freeway	Shire of Wollondilly. Construction of bridge over the Freeway at 74.2 km south of Sydney.	I.S.K. Constructions Pty Ltd	$174,303.41
F6 — Southern Freeway	City of Wollongong. Construction of bridge over the Southern Freeway at Fowlers Road, Dapto.	The Hornibrook Group	$747,665.00
State Highway No. 1	Princes Highway. Municipality of Kogarah. Repainting of steelwork of six steel twin spans on bridge over Georges River at Tom Ugly's Point.	Gardner Bros. Pty Ltd	$129,124.00
State Highway No. 2	Hume Highway. Shire of Kyeamba. Investigation drilling of "Kyeamba Gap" 33.5 to 35.5 km south of Tarcutta.	Mulligan and Grech Pty Ltd	$20,955.00
State Highway No. 2	Hume Highway. Shire of Kyeamba. Construction of culvert at Keajura Creek, 19.1 km south of Tarcutta.	W. A. Winnett and Sons	$324,483.00
State Highway No. 2	Hume Highway. Shire of Holbrook. Bituminous surfacing 5.3 to 8.0 km and between 10.0 km east of Hume Highway.	Polson & McKinley Pty Ltd	$93,968.88
State Highway No. 2	Hume Highway. Shire of Gundagai. Supply, delivery and laying of up to 2000 t of 20 mm and up to 1100 t of 10 mm asphaltic concrete.	Boral Road Surfaces	$146,982.00
State Highway No. 2	Hume Highway. Shires of Mulwaree and Gunning. Supply and delivery of 7 mm, 10 mm, 14 mm and 20 mm of aggregate.	Industrial Undertakings, Dept. of Housing & Constructions and Boral Resources (N.S.W.) Pty Ltd	$57,803.13
State Highways Nos. 2 and 3	Hume and Federal Highways. Shires of Mulwaree, Gunning and Yarrowlumla. Supply and delivery, if and when required, of up to 350 t of quicklime.	Blue Circle Southern Cement Ltd	$21,571.00
State Highways Nos. 2 and 15	Hume and Barton Highways. Shires of Gundagai and Goodradigbee. Supply and delivery of 10 mm and 14 mm aggregate.	Boral Resources	$149,040.00
State Highway No. 3	Federal Highway. Shires of Mulwaree, Gunning and Yarrowlumla. Supply and delivery of aggregate.	Industrial Undertakings, Dept. of Housing & Construction	$34,270.55
State Highway No. 9	New England Highway. Supply and delivery of up to 850 m^3 of 10 m.p.a ready mixed concrete to reconstruction of junction of Melbourne Street with New England Highway at East Maitland.	Blue Metal & Gravel Concrete	$33,660.00
State Highway No. 9	New England Highway. Supply and delivery of up to 850 m^3 of 30 m.p.a. ready mixed concrete to reconstruction of junction of Melbourne Street with New England Highway at East Maitland.	Blue Metal & Gravel Concrete	$41,633.00
State Highway No. 10	Pacific Highway. Haulage of up to 10 000 t of slag skulls from B.H.P. stockpile to construction site on Pacific Highway for dual carriageway from Swansea Bridge to Soldiers Road, Pelican.	K. Mathews	$28,600.00
State Highway No. 10	Pacific Highway. Supply and delivery of up to 10 000 m^3 of lower base gravel for construction of dual carriageways from Swansea Bridge to Soldiers Road, Pelican.	Benwerin Mining Pty Ltd	$27,000.00
State Highway No. 10	Pacific Highway. Supply and lay up to 600 t of 10 mm asphaltic concrete to resheeting work between 150.6 and 152.35 km north of Sydney.	Bitupave Ltd	$24,276.00
State Highway No. 10	Pacific Highway. Supply and lay up to 960 t of 10 mm asphaltic concrete to resheeting work between 151.5 and 157.66 km north of Sydney.	Bitupave Ltd	$38,794.00
State Highway No. 10	Pacific Highway. Supply and lay up to 950 t of 20 mm dense graded asphaltic concrete to construction site at Nords Wharf turn-off from 132.1 to 133.3 km north of Sydney.	Bitupave Ltd	$39,111.00
State Highway No. 10	Pacific Highway. Supply and delivery of up to 150 m^3 of 15 m.p.a. ready mixed concrete to construction of dual carriageway and 15 m.p.a. extruder mix ready mixed concrete to construction of dual carriageways from Swansea Bridge to Soldiers Road, Pelican.	Guaranteed Concrete Pty Ltd	$24,465.00
State Highway No. 10	Pacific Highway. Supply and lay up to 950 t of 20 mm asphaltic concrete to construction of dual carriageways from Swansea Bridge to Soldiers Road, Pelican.	Boral Road Surfaces	$37,915.00
State Highway No. 10	Pacific Highway. Supply and lay up to 1000 t of 20 mm dense grade asphaltic concrete to reconstruction and widening from Glenelg Street to Carpenter Street, Raymond Terrace.	Bitupave Ltd	$39,480.00
State Highway No. 10	Pacific Highway. Supply and delivery of up to 5000 m^3 of upper base gravel for reconstruction of southbound carriageways from State Highway No. 26 to Bangalow Creek and reconstruction of northbound curve, 92.73 to 94.05 km north of Sydney.	D. & J. Constructions Pty Ltd	$25,000.00
State Highway No. 10	Pacific Highway. Supply and delivery of up to 10 000 m^3 of selected subgrade material for pavement widening and construction of dual carriageways from Wentworth Avenue, Doyalson to Vales Road.	Construction Pty Ltd	$41,000.00
State Highway No. 10	Pacific Highway. Supply and delivery of up to 10 000 m^3 of selected subgrade material to pavement widening and construction of dual carrigeways from Wentworth Avenue, Doyalson to Vales Road.	D. & J. Constructions Pty Ltd	$44,700.00
State Highway No. 10	Pacific Highway. Supply, delivery and erection of motorway fencing in various sections between 14.0 and 24.5 km north of Coffs Harbour.	R. & Y. Frost	$22,133.00
State Highway No. 21	Cobb Highway. Bituminous resealing at various locations within the Finley Works Office area.	Emoleum (Aust.) Ltd	$30,426.91
Trunk Road No. 57	Shire of Lachlan. Construction of bridge over Lachlan River at Condobolin.	Bridge & Civil Pty Ltd	439.186.00
Main Road No. 164	Municipality of Mosman. Drive new piles, remove old piles from fender and dolphin system. Renew timber walings in fenders at Spit Bridge.	Australian Wharf & Bridge Pty Ltd	$177,700.00
Main Road No. 284	Shire of Holbrook. Bituminous surfacing 5.3 to 10.0 km east of Hume Highway.	Polson & McKinley Pty Ltd	$93,968.88
Main Road No. 503	Supply and lay up to 1050 t of 10 mm asphaltic concrete for various sections between 30.0 and 80.0 km south of Singleton. This relates to section 31.23 to 32.015 km south of Singleton.	Bitupave Ltd	$47,796.00
Main Road No. 503	Supply and lay up to 1050 t of 10 mm asphaltic concrete for various sections between 30.0 and 80.0 km south of Singleton. This relates to section 32.015 to 32.8 km south of Singleton.	Bitupave Ltd	$47,796.00
Main Road No. 503	Supply and lay up to 500 t of 10 mm asphaltic concrete for various sections between 30.0 to 80.0 km south of Singleton.	Bitupave Ltd	$23,350.00
Main Road No. 531	City of Greater Lithgow. Reconstruction from 10.35 to 12.60 km north of Great Western Highway.	G. Abignano Pty Ltd	$220,009.00
Secondary Road No. 2060	City of Bankstown. Construction of Bridge over railway line at Punchbowl railway station.	Christies Civil Contracting	$585,241.64
Various	Shire of Evans. Sealing and resealing of various roads with bitumen.	Polson & McKinley Pty Ltd	$51,931.50
Various	Cities of Blue Mountains, Greater Lithgow and Bathurst. Shires of Oberon, Evans, Coolah, Rylstone and Mudgee. Application of painted road marking materials.	Western Roadmarking Pty Ltd	$39,703.00
Various	Shire of Tumbarumba. Bituminous sealing of trunk and ordinary main roads.	Polson & McKinley Pty Ltd	$66,103.92

 — *continued inside back cover*

THE THAI CONNECTION

DEPARTMENTAL OFFICER AIDS OVERSEAS PROJECT

While some government authorities commonly employ outside consultants to help them study specific problems, the reverse arrangement is comparatively rare. It usually occurs when a particular combination of expertise is needed that is not generally common in the commercial world.

During 1979 the Department of Main Roads was able to supply such a combination of skills to aid an Australian firm of consulting engineers, Messrs. Vallentine, Laurie and Davies of Sydney, in an important project in Thailand. The consultants were selected, as a result of competitive proposals from a short list of international consultants, to undertake

- the design and establishment of an internal hire system for highway maintenance equipment (including such ancillary services as stores and parts procurement and accounting and workshop repair facilities), and
- the design and implementation of an attainable, reliable road maintenance costing system.

The project will extend over 2½ years and will cover about 3,000 plant items used for routine highway maintenance carried out directly by the Thai Department of Highways.

The consultants sought the assistance of a suitably qualified Cost Accountant with adequate experience in the costing of highway maintenance equipment.

The obvious body for the N.S.W.-based consulting engineers to approach was the Department. Accordingly, a formal approach was made in November 1978 to the Commissioner for Main Roads, Mr. Brian Sexton who nominated Mr. N. Hunziker, one of the Department's accountants experienced in this field.

Mr. N. Hunziker

At the request of the Minister for Roads, (Mr. H.F. Jensen), the Acting Premier (Mr. L.J. Ferguson) approved of the Department's participation in the project on the understanding that all costs would be met by the consultants.

Consequently, Mr. Hunziker was in Thailand for four weeks during April and May 1979 and for a further period of four weeks in November 1979. The following is a summary of his report on his activities in Thailand.

Road construction in Thailand

Thailand's Department of Highways is responsible for the construction of roads and bridges (mostly by contract) and for the maintenance and improvement of some 30,000 km of roads throughout the nation (by direct control). Thailand has an area approximately the same as New South Wales, with roads fairly evenly distributed. It has a population of approximately 45 million people, compared with 4.5 million in New South Wales.

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1, 2. The Grand Palace, Bangkok
3. Stockpiles for reseals along a rural Thai road
4. A shipment of graders awaiting distribution

4

Administration of the Department of Highways is decentralised into 12 divisions containing 67 districts. Most divisions have 6 to 7 districts. With the completion of major road construction projects, district boundaries are frequently changed, and some two or three new districts are created every 18 months. The maximum number of districts is expected to be approximately 80. The main roads appear to have been constructed to a high standard and the 1,000 km of road travelled by Mr. Hunziker seemed to be well maintained.

The World Bank is providing the equivalent of about $100 M (Australian) to Thailand for major road projects and for the purchase of plant and equipment for road maintenance.

However, a condition of the loan specifies that the Department of Highways must establish a system which will lead to the automatic generation of funds for the purchase of replacement plant as needed.

Internal plant hire system

Most of Mr. Hunziker's activity related to designing systems and forms for the generation and costing of plant hire charges. This included such associated activities as the procurement and accounting for spare parts and stores, and the analysis of data relating to the use and maintenance of plant. He was involved in a study of the existing storekeeping procedures of the Department of Highways, with the object of retaining those elements that could be of value in the proposed new system. Analysis was made of the procedures in use at Lopburi, Chiangmai and Chiangrai and at the Snowy Mountains Engineering Corporation's office at Lampang, where that organisation is working in association with the Department of Highways on a major construction project.

While the Department of Highways' storekeeping system is broadly similar to this Department's, it does not provide the control available under the DMR system. Naturally, the system proposed for the Revolving Fund will follow very closely the procedures used here in New South Wales.

Data encoding

A considerable amount of discussion took place on areas in which data could best be handled in code. Coding systems were devised for such information as division and district office numbers, numbering of plant and equipment, stores, materials and plant parts, road lengths, and maintenance activities.

Road Maintenance Costing

The existing road maintenance costing system does not readily permit an assessment of either costs or work performed. The Department of Highways has been aware of this deficiency, and during 1977 and 1978 it attempted detailed maintenance costing in the Chiangmai area. However the results were of limited benefit for the system involved was far too complex having regard to the limitations of the data sources.

The costing system proposed by the consultants acknowledges these limitations, and will yield reliable and timely information for improved management control.

At the conclusion of his report, Mr. Hunziker had these personal comments to make. "I would like to take this opportunity to place on record my gratitude for the privilege of repesenting the Department on this project. I found the work quite challenging, the project team members most considerate and co-operative, the Thai people very friendly, and the climate really trying. Despite this last aspect, I enjoyed excellent health, and am delighted to have had such a rare and valuable experience."

Previous articles on related themes, appearing in earlier issues of "Main Roads" include

- *"DMR — Designed Traffic Control System Selected for Kuala Lumpur" — September 1977 issue, Vol. 43, No. 1, pp. 24–5.*
- *"A Spreading Pattern of Involvement — NAASRA Courses for African and Asian Engineers" — December 1971 issue, Vol. 37, No. 2, pp. 36–40.*

TENDERS — *continued*

4. The following tenders (in excess of $20,000) for road and bridge works were accepted for the three months ended 31 March 1980.

Road No.	Work or Service	Name of Successful Tenderer	Amount
Western Freeway	Municipality of Holroyd. Construction of pedestrian overbridge at southern end of Franklin Street, Mays Hill.	Christie Civil Contracting	$100,500.00
Western Freeway	Municipality of Auburn. Construction of continuously reinforced concrete pavement from Marlborough Road, Homebush to Saleyards Creek.	McGregor Construction (Australia) Pty Ltd	$210,501.96
Southern Freeway	City of Wollongong. Construction of bridge over Southern Freeway at Fowler's Road, Dapto.	The Hornibrook Group	$753,365.00
State Highway No. 1	Princes Highway. City of Shoalhaven. Construction of precast mini crib block retaining walls along East Street deviation, Nowra.	Olinda Landscaping Services	$24,236.49
State Highway No. 1	Princes Highway. City of Wollongong. Supply of pre-stressed concrete planks for bridge over American Creek.	E.P.M. Concrete Pty Ltd	$46,545.00
State Highway No. 2	Hume Highway. Shire of Gundagai. Construction of bridge over Flood Channel at Jessops Lagoon, 4.34 km south of Gundagai.	Tamenco Pty Ltd	$233,507.00
State Highway No. 2	Hume Highway. Shire of Gunning. Fabrication and treatment of steelwork on Biscuit Bridge over main southern railway line, 39.3 km south of Goulburn.	Basic Industries Pty Ltd	$47,974.00
State Highway No. 2	Hume Highway. Shire of Kyeamba. Construction of culvert at Keajura Creek, 19.14 km south of Tarcutta.	W. A. Winnett & Sons	$324,483.00
State Highways Nos. 2 and 15	Hume and Barton Highways. Shires of Yass and Yarrowlumla. Supply, delivery and laying of asphaltic concrete on the Hall deviation on the Barton Highway, and on the deck of the bridge over Yass River, 5.5 km north of Yass.	Allen Bros. Asphaltic Ltd	$45,165.00
State Highway No. 5	Great Western Highway. Municipalities of Strathfield and Concord. Manufacture, supply and delivery of precast, prestressed concrete beams for bridge over Powells Creek near Station Street, Homebush.	Hastings Prestressed Concrete Pty Ltd	$20,243.00
State Highway No. 5	Great Western Highway. City of Greater Lithgow. Construction of dual carriageways from Main Road No. 516 to Marrangaroo Creek, Section C, 4.0 to 6.0 km west of Lithgow.	Horner Plant Hire	$49,000.00
State Highway No. 7	Mitchell Highway. Shire of Evans. Widening and construction of bridge over Rocks Creek No. 3, 18.4 km west of Bathurst.	Dalland Civil Engineering Pty Ltd	$85,845.20
State Highway No. 9	New England Highway. City of Maitland. Supply, delivery and spread of up to 300 t of bulk quicklime to reconstruction of pavement from Kaludah Creek to Harpers Hill, 13.7 to 15.6 km west of Maitland.	Newcastle Lime & Cement Co Ltd	$21,150.00
State Highway No. 9	New England Highway. City of Maitland. Supply and delivery of up to 7000 m^3 of lower base gravel for reconstruction of pavement from Kaludah Creek to Harpers Hill, 13.7 to 15.6 km west of Maitland.	D. J. & C. R. Barnes	$20,650.00
State Highway No. 9	New England Highway. City of Maitland. Supply and delivery of up to 7000 m^3 of upper base gravel for reconstruction of pavement from Kaludah Creek to Harpers Hill, 13.7 to 15.6 km west of Maitland.	D. J. & C. R. Barnes	$20,650.00
State Highway No. 9	New England Highway. City of Maitland. Construction of bored piles for Stage 2 of bridge over Lochinvar Creek, 11.41 km west of Maitland.	J. Parkinson	$40,606.00
State Highway No. 10	Pacific Highway. Shire of Byron. Driving and splicing of piles for new bridge over Tyagarah Swamp, 10.7 km north of Ballina.	Bricul Civil Construction	$64,661.50
State Highway No. 10	Pacific Highway. Shire of Port Stephens. Supply and delivery of up to 1650 t of 10 mm precoated sealed aggregate to 4 stockpile sites between Raymond Terrace and Bacons Quarry.	Blue Metal and Gravel (North)	$24,320.00
State Highway No. 10	Pacific Highway. Shire of Port Stephens. Haulage of up to 10 000 t of slag skulls from B.H.P. stockpile to construction site between Glenelg and Carpenter Streets, Raymond Terrace, 25.5 to 26.9 km north of Newcastle.	J. T. & B. W. Johnson	$36,000.00
State Highway No. 10	Pacific Highway. Shire of Wyong. Supply and spray up to 70 000 cold litres of C160 bitumen to pavement widening and construction of dual carriageways from Wentworth Avenue, Doyalson to Vales Road.	Boral Road Surfaces	$23,454.00
State Highway No. 10	Pacific Highway. Municipality of Great Lakes. Supply and spray up to 60 000 cold litres of C160 bitumen to construction work between Bangalow Creek and Bacons Quarry.	Boral Road Surfaces	$21,612.00
State Highway No. 10	Pacific Highway. Municipality of Great Lakes. Supply and spray up to 110 000 cold litres of C160 bitumen to resealing work between Bulahdelah and Wang Wauk River.	Spraypave Pty Ltd	$40,690.00
State Highway No. 12	Gwydir Highway. Shire of Yallaroi. Win, load, haul and spread 16 000 m^3 of shale and 1500 m^3 of sand between 31.64 and 36.89 km west of Warialda.	R. L. Davis	$26,400.00
State Highway No. 12, Trunk Road No. 63 and various Rural Local Roads	Gwydir Highway and other roads. Shire of Yallaroi. Supply and delivery of aggregate.	Ron Johnstone Pty Ltd	$52,779.00
State Highway No. 12, Trunk Road No. 63 and various Rural Local Roads	Gwydir Highway and other roads. Shire of Yallaroi. Supply, heat, haul and spray C160 bitumen.	Emoleum (Australia) Ltd	$105,680.12
State Highway No. 17	Newell Highway. Shire of Boolooroo. Construction of Boolooroo bridge over Gwydir River at Camurra, 11.2 km north of Moree.	Alan Varley Pty Ltd	$533,489.20
State Highway No. 17	Newell Highway. Shire of Boolooroo. Rectification work on bridge over the Nee Nee Creek, 47.2 km north of Moree.	Dallas Civil and Building Pty Ltd	$91,626.00
State Highway No. 19	Monaro Highway. Shire of Monaro. Reinforced concrete cast-in-place piles for the bridge over Ingelara Creek, 50.45 km north of Cooma.	Godfreypile Pty Ltd	$46,119.80
State Highway No. 25	Illawarra Highway. Municipality of Shellharbour. Exploratory drilling on Illawarra Highway at Macquarie Pass.	Stewart Bros. Pty Ltd	$41,680.00
Trunk Road No. 55	City of Greater Lithgow. Construction of bridge over coal haulage road to Power Station at Wallerawang.	G. Abignano Pty Ltd	$93,048.00
Trunk Road No. 55	City of Greater Lithgow. Construction of bridge over Un-named Creek at Wallerawang, 12.5 km north of Lithgow.	Thiess Bros. Pty Ltd	$52,813.00
Trunk Road No. 73	Shire of Uralla. Repainting bridge over Gwydir River at Bundarra.	Kada Painting Contractors Pty Ltd	$88,800.00
Main Road No. 164	Municipalities of Mosman and Manly. Driving of new piles, removal of old piles from fender and dolphin system and renewal of timber walings in fenders at the Spit Bridge.	Australian Wharf and Bridge Pty Ltd	$177,700.00
Main Road No. 286	Shire of Snowy River. Supply, deliver and lay asphaltic concrete 16.9 to 30.64 km west of Jindabyne.	Pioneer Asphalts Pty Ltd	$273,941.15
Main Road No. 503	Shire of Singleton. Construction of bridge over railway line at John Street, Singleton.	Bridge and General Pty Ltd	$395,162.69
Secondary Road No. 2060	Municipalities of Canterbury and Bankstown. Construction of bridge over railway line at Punchbowl Station.	Christie Civil Contracting	$585,241.67
Alice Street	Municipality of Auburn. Construction of pedestrian bridge over railway line at Alice Street, Auburn.	Pearson Bridge (N.S.W.) Pty Ltd	$95,000.00
Alpine Way	Shire of Snowy River. Winning, crushing and stockpiling of rock for pavement material.	Petamin Exploration Ltd	$77,580.00