

MAIN ROADS

MARCH 1992



MAIN ROADS

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CONTENTS

3	THE MAKING OF A MASTERPIECE
8	19 MARCH 1932
9	OPENING CEREMONY SPEECHES
11	SCHOOL CHILDREN'S MESSAGE OF GOODWILL
12	THE OFFICIAL CEREMONY
14	THE MEN WHO BUILT THE BRIDGE
16	1932 CELEBRATION POSTER
18	POETRY IN STEEL
21	DE GROOT... THE MAN WHO BEAT LANG TO THE TAPE
24	TALES AND FESTIVITIES OF OPENING DAY
31	CHRONOLOGY OF EVENTS AND FACTS AND FIGURES



Front cover: The two half-arches reach into the harbour skyline. Back cover: Reproduction from *Art in Australia*, courtesy of John Fairfax and Sons.

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A salute to the past

It may be hard to reason what makes something a truly great event. Some would choose to refer to the attendance figures: the size of the crowd. Others would choose to see how readily the event is recalled in the memories of those who took part.

Whichever criterion is used, the celebration of the opening of Sydney Harbour Bridge has deservedly been written into the books as the greatest mass event in Australia's history. No other event in our past achieved such a popular response in terms of crowds. No other event has been known for such a spectacle.

The procession, the flypast and the harbour activities were each attended by hundreds of thousands of spectators. In all, it was estimated that well over a million people took part in the opening day celebrations, most of whom decided to walk across the bridge before it opened to vehicular traffic at midnight.

Fifty years later, it is no wonder that "the Bridge" is a household name for Sydney's residents and a worthy landmark to its visitors.

Of the people behind the bridge, perhaps there is no more outstanding example of enthusiasm and genius than Dr. J. J. C. Bradfield. He was so thorough in his work that before tenders were opened, he had calculated the details and design of the arch bridge and supplied to the tenderers full particulars of the quantities and prices of the material to be used.

By allowing the tenderers to incorporate their own speciality in manufacture and details, Bradfield probably saved the State about £150,000. The proposals he made were subjected to detailed investigation by the world's leading bridge engineers and designers. One of the tenderers reported: "We have lodged our designs and tenders ... and we can suggest nothing better than Mr. Bradfield has put before us."

However, Bradfield's design was modified by Dorman, Long & Co., the winning tenderers. The changes must have provided a design at least as good as the original; otherwise it would not have been accepted by Bradfield.

The bridge's construction was hailed as an engineering marvel and soon won world acclaim. An outline of the construction appears in this issue (pp 3-8), and a chronology of events appears on p 31.

An official opening was held on 19 March 1932, a day of great pageantry and not without incident. For De Groot, a member of the New Guard, spurred his horse forward and slashed out with his sword, beating the Premier to the ribbon, as had been the talk of the day. The whole incident was conducted in the best manner of melodrama.

Yet even such an incident could do little to mar the day. The opening celebrations were a fitting tribute to the toil and effort of the thousands who gave of themselves in order to complete the task.

It is our hope that this special issue of *Main Roads* will be, in some small but lasting way, our salute to the people involved, as we recall some of the tales and opening day festivities of our world-famous Bridge.

THE MAKING OF A MASTER- PIECE

Summary of the design

The Sydney Harbour Bridge is a steel arch, hinged at the base on each side of the harbour. A steel deck hangs from the arch and five steel truss approach spans lead up to each side.

The hinges, or bearings, support the full weight of the bridge and allow the bridge to move as the steel expands or contracts. This prevents the steelwork from fracturing or buckling as it warms and cools during the day. The arch may rise or fall as much as 180mm during extremes of temperature. The structure can safely withstand temperature variations up to 49°C and winds up to 200 km/hr.

The bridge was designed to carry four rail lines, six road lanes and two footways. Total capacity was estimated at 160 trains per hour, 6,000 vehicles per hour and 40,000 pedestrians per hour.

The designers of the 1920s would surely be surprised to realise that by means of today's traffic management methods, the Department records an average annual daily flow of 160,000 vehicles, with peak days up to 200,000 and with 14,700 in the peak hour.

The function of the arch is to support the deck of the bridge. It carries the entire weight of both the main span bridge deck and all the road, rail and pedestrian traffic on it.



The bearings spread their load through large concrete blocks into a foundation of solid sandstone.

The pylons which are mainly decorative, do not directly contribute to supporting the arch and deck. The pylons are hollow, constructed of reinforced concrete and are faced with granite to give them more visual appeal.

There are five Warren-type steel truss approach spans on each side of the harbour. These rest on concrete piers also faced with granite.

Initial construction

The tender of Dorman Long & Co. Ltd. of Middlesbrough, England, was formally accepted on 24 March, 1924, at a contract price of £4,217,721. Altogether 20 designs from six different companies were received, including seven different designs from Dorman Long and Co.

The excavations for the foundations of the main bearings and approach span piers were commenced in January, 1925.

Dug to depth of 12.2 m, the foundations, known as *skewbacks*, were filled with concrete laid in special hexagonal formations. Immediately under the main bearings, at the top of the skewbacks, special reinforcing and high grade con-

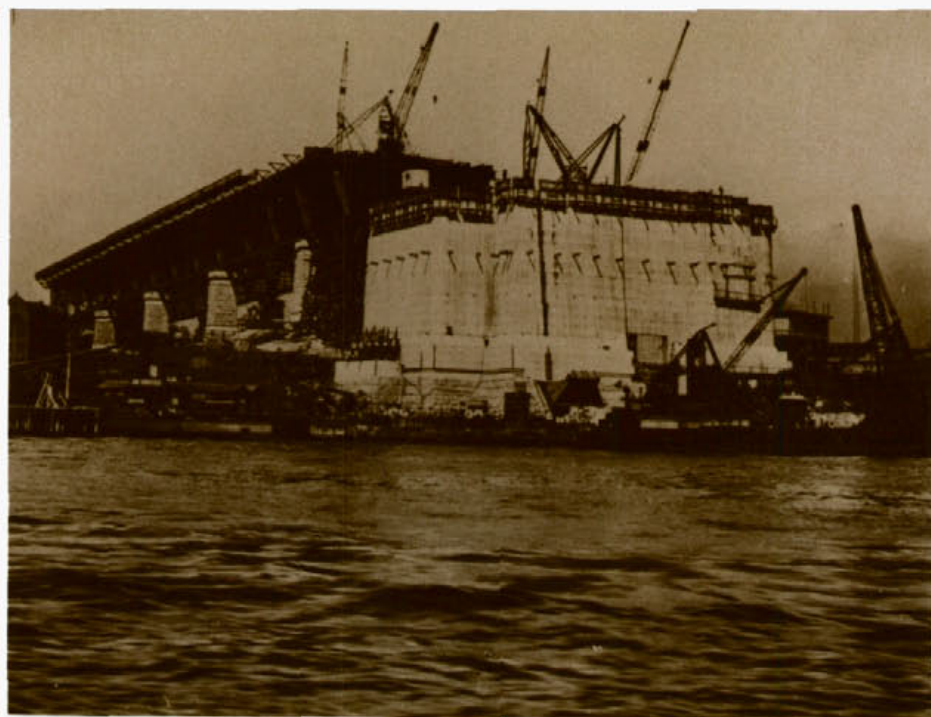
May 1927—The steel hinge pin and main bearing on the south-east corner of the bridge's foundations. The four main bearings carry the entire weight of the arch span and its loading.

crete were used. The skewbacks were well founded in solid sandstone.

The bearings were an assembly of cast and forged steel weighing 300 tonnes each. They were placed using hydraulic jacks for an exact alignment and were then concreted into place.

The skewbacks, as well as forming the foundations for the bearings, also formed the base of the abutment towers and pylons. The abutment towers are hollow and constructed of reinforced concrete. The base measure of each is 68 x 49 m. Total height of the pylons is 87 m. Construction of the pylons above deck level did not commence until after the main arch had been joined and the supporting cables removed.

The approach spans were erected from the inshore ends towards the harbour. Five tonne steam locomotive cranes were used to erect temporary timber trestling, which in turn supported the steel approach spans during construction. The crane moved along the timber work erecting each new section in front of it as it went. On reaching the location for each pier, the crane would help in



their construction before moving on to build the next section of timber trestling. Following behind the steam crane was a 25 tonne electric crane which placed the steel span on top of the timber supports. As each span was completed the timber trestling was dismantled and re-erected in the next section.

This procedure was repeated until all five spans on each side of the harbour were completed. The end of the fifth span rests on the abutment tower.

Moruya granite

The facing of the piers and pylons is of high quality granite, quarried near the New South Wales south coast town of Moruya.

Altogether some 18 000 cubic metres of rock facing were required for the bridge project. Wastage from the quarry was crushed and used in the concrete for the bridge.

Three 400 tonne ships were built at the Government Dockyards at Newcastle, New South Wales, to transport the rock from Moruya to Sydney. The ships were specially designed for the task and had special holds for the rapid loading and unloading of the granite.

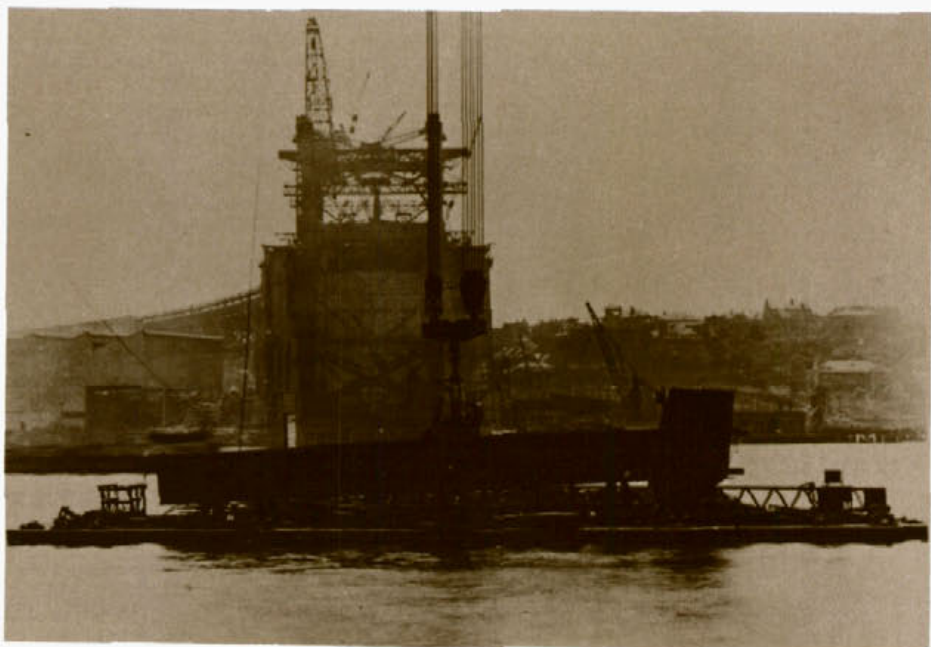
The workshops

Two main workshops were constructed on the site of the original Milsons Point station. The smaller measured 40 x 180 m and had a 40 x 61 m template shop erected directly above it. Four 25 tonne capacity cranes were installed there along with smaller hoists and travelling cranes.

The other workshop measured 45 x 152 m and was used for the manufacture of the larger and heavier sections of the bridge steelwork. This workshop had two 120 tonne capacity cranes.

Steel unloaded from the steamers was transferred to the stockyard to be sorted and stacked. It was then dealt with by two straightening machines, one with a capacity for straightening plates up to 57 mm thick and the other capable of straightening angles 305 x 305 x 32 mm.

The material was then handled by heavy shearing machines, cold saws and planing machines, and marked for drilling from templates. This required a high degree of skill and accuracy, as the ulti-



November 1927—Construction of the southern abutment in progress.

October 1929—Lifting the main span post member from a barge in mid-harbour.

November 1929—The beginnings of the arch: Looking south from Fitzroy Street at Milsons Point.

mate correctness of the fabrication depended upon it.

After the drilling, riveting and assembling, the ends of all members were carefully machined before being butted together. To ensure a perfect fit, all members connecting at the main truss joints were assembled in their respective positions on the floor of the shops, prior to their despatch for erection. Full credit must be given to the skill of the workshops personnel in the fabrication of those parts.

Construction of the arch

The problem which confronted the builders was how to erect the huge arch without placing temporary supports in the harbour. Apart from the hazard to shipping, such supports would have also been expensive and difficult to place on the muddy harbour floor.

The solution was to build the arch in halves, holding each half back with steel cables firmly anchored in large horse-shoe shaped tunnels dug into rock between the first and second piers of the approach spans.

Each of the 128 cables weighed 8.5 tonnes, was 366 m long and was made up of 217 individual wires. The tunnels were 36 m long and sloped at 45 degrees. The cables were attached to the arch by temporary "fish tail" plates fitted to the end of the top chord.

The creeper cranes

After the approach spans had been erected and the abutment towers completed to deck level, work commenced on the main arch.

Early work involved the erection of the two giant electric creeper-cranes, the mainstay of the bridge's construction.

The cranes, supplied by Wellman Smith and Owen Engineering Corp Ltd. of Great Britain, were designed specifically to travel along the top of the arch, erecting the bridge members before them as they went.

Each crane weighed 580 tonnes and had a lifting capacity of 123 tonnes. They were also fitted with an auxiliary 20 tonne jigger hoist to help control the heavy bridge members as they were being positioned, a five tonne walking crane to lift work cages and two 2.5 tonne cranes fitted to the back of the creeper crane carriage to assist in the riveting stages.

Because of their enormous weight and precarious position on the end of the half arches, it was important that these cranes did not slip or cause sudden jolts. For this reason the "creeping" mechanism was fitted with a special braking system.



RESUMPTIONS

More than 300 buildings in the Rocks area were demolished to make way for the bridge. Most of them were old, dirty and dilapidated. Some were in such a condition that the demolishers demanded extra money because of the discomfort caused by the various kinds of insects.

SURVEY TRIANGULATION

Visitors to the Royal Botanical Gardens might notice several cast-iron boxes set in the turf. Connecting these with the bridge's construction, to most, would seem quite unlikely.

There are eight boxes in all. Three are in the Gardens and one is on a lawn in the grounds of Government House. The boxes mark the ends of the two baselines used in the triangulation of the bridge's centreline. The surveyor, in his zeal for accuracy, drove two survey pegs into the tennis lawn of Government House, which somewhat interfered with his popularity in those quarters.

Two boxes are located at Milsons Point and Dawes Point, on the bridge's centreline as fixed after preliminary surveys. The other two are at Kirribilli and Mrs. Macquarie's Chair.

June 1930—The two halves of the arch draw near. In the foreground can be seen blocks of Moruya granite assembled for the construction of the pylons.

The cranes were assembled on temporary ramps constructed on the abutment towers. They were then used to erect the first section of the arch span. This section contained the largest and heaviest individual members of the whole bridge.

Joining the arch

Steelwork fabricated in the workshops was taken by barge to beneath the creeper cranes perched high over the harbour and lifted into position.

The erection of the arch began on 26 October 1928 and construction proceeded at a rapid pace. The record was set on 26 November 1929 when 607 tonnes of steelwork were erected in one day. By August 1930 the two half-arches were ready to be joined.

The northern half-arch was ready for joining on 4 August 1930 and the southern half-arch three days later. The gap between the giant arms was only 1.07 m. The slow and careful slackening of the cables commenced on 7 August and was to continue for several days. The slackening process was carried out around the clock.

THE CABLES

Ralph Freeman, designer of the bridge, described the work of the cables in supporting the two arms of the bridge arch:

"Each of the 128 cables is secured to the bridge structure by two parallel bolts, with nuts running on screw threads, allowing any cables to be slacked 20 inches. When first erected the end posts of the half arches over the abutment were inclined backwards 30 inches from the vertical. As the half arches advanced over the Harbour the pull on the cables increased to the maximum of 110 tons per rope, causing the cables to stretch about 13 inches, so that when the half arches were completed the end posts were set back about 17 inches and the gap at the centre was about 42 inches.

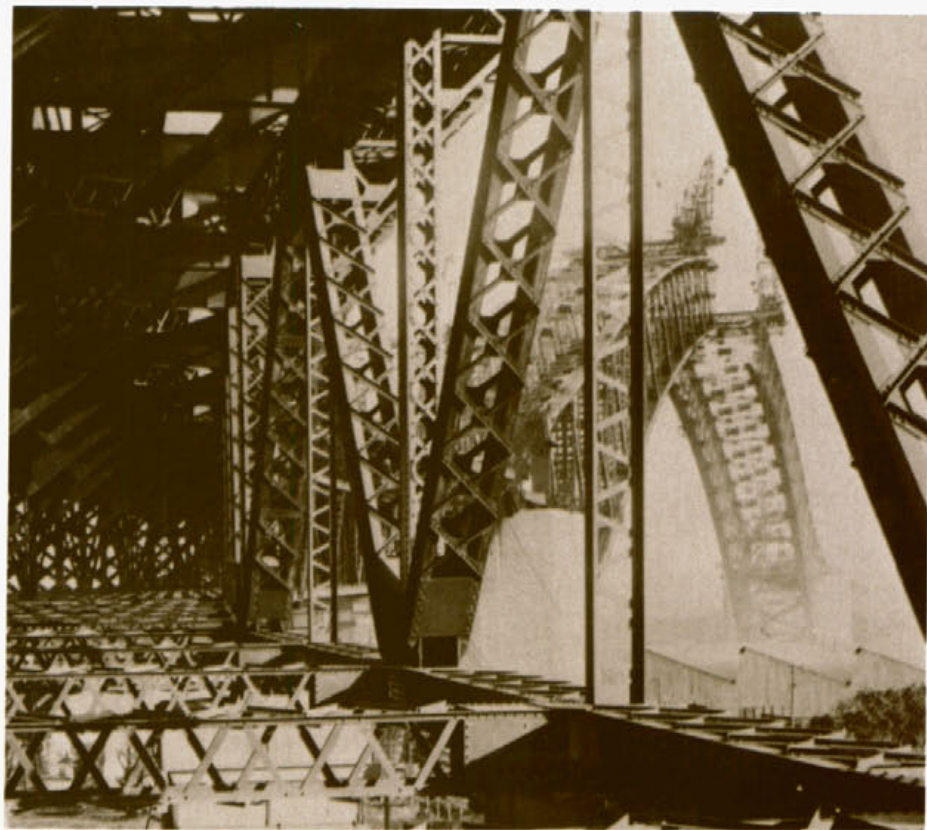
"In releasing the cables to allow the half arches to meet, the pull of every cable in turn is transferred from the two nuts securing it to a hydraulic jack. The nuts are drawn back on the screws four inches, and the cable is then slacked back against the resistance of the jack until the pressure is transferred to the nuts in the new position.

"This process reduces the pull on a particular cable and increases that on all the rest, the effect being to stretch them all a definite amount of one-thirty-second of an inch and cause the end posts to move forward this distance exactly. This moves the centre of the arch one-sixteenth of an inch, and takes four minutes to do, so that the process, which is perfectly steady and under complete control, moves the half arch forward at the rate of one-sixty-fourth of an inch a minute.

"... the total reduction in the gap, by lowering, is about three inches in a working day. The actual movement is complicated by temperature changes, which alone during an ordinary fine day reduce the gap by about three inches between 8 a.m. and 4 p.m. So, roughly, each day at 4 o'clock the gap is reduced six inches, and then opens up during the night by three inches.

"We now look forward to the end of this stage of the work with every confidence of success, and not without legitimate pride ..."

He concluded by paying a tribute to Lawrence Ennis and his staff of engineers, as well as to the Australian workmen employed who were "unexcelled in the history of bridge building".



June 1930—An unusual vantage point from within the curve of the northern approach span.

On 13 August, before the two mighty half-arches had joined, severe wind squalls hit Sydney. Many of the pessimists who had confidently predicted it would all fall into the harbour thought their day had arrived. At 9.15 p.m., 110 km/h winds from the west-north-west were recorded, bringing with them a dust storm and a sprinkle of rain.

Lawrence Ennis, Director of Construction, described standing on the forward end of one half-arch watching the other sway in the wind as an "impressive sight"! Although the actual movement was quite small (barely 7.5 cm), it was nevertheless an impressive display of the forces of nature, as each arm weighed approximately 15 000 tonnes.

The slackening process continued, until 4.15 p.m. on 19 August 1930, when the two halves touched for the first time. However, the contraction of the cables and steelwork as the temperature dropped in the evening caused the gap to re-open. The gap was closed again at 10 p.m., permanently linking the north and south shores of Sydney Harbour.

The next morning the Australian flag and Union Jack were flying from the jibs of the creeper cranes signalling the success of the operation to the residents of Sydney. Every worker involved in releasing

The Sydney Morning Herald of 20 August 1930 described the joining of the arch in more personal terms:

THE STRAIN RELAXES

"At 5 o'clock, Mr. Lawrence Ennis, the bridge builder, and Mr. Ralph Freeman, the designer, reached solid earth with flushed, triumphant faces. Their eyes told a story of tremendous strain suddenly relaxed. The lowering process had not been completed, but the anxiety was over. The pins would never move completely apart again.

"The last stage developed into a race between the men who were releasing the cables and the falling temperature. After 5 o'clock the steelwork contracted so rapidly that the slackening cables could not keep the arch arms together, although the pilot pins were still in their sockets. Under the glare of arc lights, with whistles shrilling and telephones ringing, the slow battle dragged on, hour by hour, until towards midnight the arms began again to approach each other.

"In the early morning hours human patience won. The arms touched, the pins thrust firmly into their sockets, and the terrific strain of all that steel rested no longer on the cables, but on the bearings that will hold its weight for all time.

"Above the sleeping city the bridge-builders smiled, shook hands, and then went home to bed. The job was done."

Reproduced courtesy of John Fairfax and Sons.

the cables was given a golden sovereign and other bridge workers a two shilling piece in order to join in the toast "success to the Bridge". Every worker was given an hour and a half off.

With the arch joined, the cables were removed. The next task was to fill in the "triangle" at the apex, converting the arch from its temporary three hinged status to its completed two hinged form.

The correct stressing of the top chord using hydraulic jacks was as important as the joining of the arch itself. Fortunately, 8 September 1930 was an overcast day with mild temperatures. The twenty thermometers distributed around the arch indicated that the temperature was spread equally throughout the structure.

The jacks forced apart the gap in the top chord, steel spacing slabs were inserted in the gap and the jacks were removed. The arch was now converted to its two hinge form and was complete, ready for the deck to be placed.

The hangers and deck

Work then commenced on the main deck, which was erected from the centre outwards. This made use of the creeper cranes which were already in the centre of the bridge.

March 1932—A final inspection of the arch and deck before the official opening.

November 1930—The bridge nears completion as the concrete decking is laid on the northern approach span.





Dr. J. J. C. Bradfield, appointed Chief Engineer of Sydney Harbour in 1912, was the driving force behind the planning and design of the bridge.

The hangers were lifted into place using a specially designed cradle. This enabled them to be positioned underneath the arch in a place not accessible by the cranes' lifting cables.

The hangers varied in length from 58.8 m at the centre to 7.3 m at each end. Hangers on each side of the bridge supported the crossbeams which carried the deck.

The railways (and tramways) were located immediately on either side of the hanger, the vehicle lanes in the centre and the footway (and cycleway) on the extreme outside. This configuration brought the heaviest loads closest to the hangers, allowing the cross beams to be lighter. This also reduced both the total weight the bridge had to carry, and the total size and weight of the structure.

The relative simplicity of the deck construction enabled rapid progress to be made so that all steelwork for the deck had been placed within nine months of the closing of the arch. With the deck in place the two creeper cranes were dismantled.

In February 1932 the bridge was test loaded. All four rail tracks were loaded with a total of 72 steam locomotives, placed buffer to buffer. Different loading configurations were tried by removing the engines from one side or from one end. Instruments measured the smallest deflection or movement in the bridge.

After more than three weeks of tests, measurements and checks, the bridge was declared to have passed with flying colours, conforming with every one of the designers' and builders' expectations. ●

19 MARCH 1932

The following reports appeared in the Sydney Morning Herald on Saturday, 19 March 1932, summarising the opening ceremony:

HARBOUR BRIDGE OPENING

Memorable Scenes on Land and Water

RECORD CROWDS IN THE CITY

Message of Congratulation from the King

"A clear blue sky and a fresh sea breeze made conditions ideal for the official opening of the Sydney Harbour Bridge by the Premier (Mr. Lang) this morning. It was a memorable scene, and fittingly marked the realisation of the dream cherished by many generations.

"Every vantage point was crowded. Never before had so many people gathered together in Sydney. History was to be made, and it seemed that everyone was intent upon being associated with the event.

"The Governor (Sir Philip Game) read a message from His Majesty the King congratulating the people of New South Wales upon the successful conclusion of the enterprise, and expressing the earnest hope that the bridge might be a means of increasing their prosperity and contributing to their comfort and welfare.

"Mr. Lang said the completion of the bridge was symbolical of the unity the people of New South Wales were striving after. Statesmen of the past had set out to build a bridge of common understanding that would serve the whole of the people of our great continent. That bridge, unlike the Harbour Bridge, was still building.

"Other speakers paid tributes to the skill of the bridge engineers and workmen, and expressed the hope that the occasion of the opening of the structure would herald in an era of prosperity and goodwill.

"There was an exciting scene for those in the vicinity of the entrance to the bridge. A man who, dressed in military uniform, had followed the Governor-General's escort on to the approach, suddenly galloped up to the ribbon stretching across the bridge roadway, which Mr. Lang was to sever in declaring the bridge open, and cut it with his sword. He was quickly dragged from his horse and placed under arrest.

"The pageant that followed the opening was most impressive as it proceeded through the city streets and across the bridge."

Reproduced courtesy of John Fairfax and Sons.



OPENING CEREMONY

The Governor of New South Wales, Sir Philip Game, and the Premier of New South Wales, Jack Lang, were the first to speak at the opening ceremony. Their speeches are reproduced below.

The Governor's speech

"Your Excellencies, Mr. Prime Minister, Mr. Premier, Ladies and Gentlemen.

"As His Majesty's representative I am privileged to read to you the gracious message which the King has sent to his people of New South Wales on this great occasion.

"His Majesty's message is as follows:

"I have learnt with great pleasure that the Sydney Harbour Bridge has now been completed and I desire to congratulate my people of New South Wales and all who have been concerned with the planning and construction of the bridge on the successful conclusion of the enterprise.

"Today, which sees the formal opening of this magnificent triumph of engineering skill, will be memorable in the annals of New South Wales. It will be remembered with legitimate pride and satisfaction by all those who have played their part in the conception, design and execution of this great work, the largest arch bridge in the world.

"It is my earnest hope that the bridge may be a means of increasing the prosperity and of contributing to the comfort and welfare not only of the citizens of Sydney but of the whole of the people of New South Wales."

The Governor said he had replied on behalf of the people of New South Wales:

"The people of New South Wales and all those who have helped in the completion of the Sydney Harbour Bridge desire to express to His Majesty their unbounded loyalty and affection and to tender to him their heartfelt thanks for his gracious message of thanks on the occasion of the opening ceremony."

Sir Philip Game continued:

"Ladies and Gentlemen, I will not detain you long. Of the material wonders of the bridge I am not qualified to speak. But no one can live almost in its shadow without paying continual, even if silent, tribute to the marvels of design and workmanship which have fashioned by the hand of man a bridge which adds beauty and dignity to the works of nature around and about it.

"Bridge builder has been a proud title throughout the centuries. Is it too much to hope that the builders of Sydney Harbour Bridge have builded (sic) even better than they knew and have given

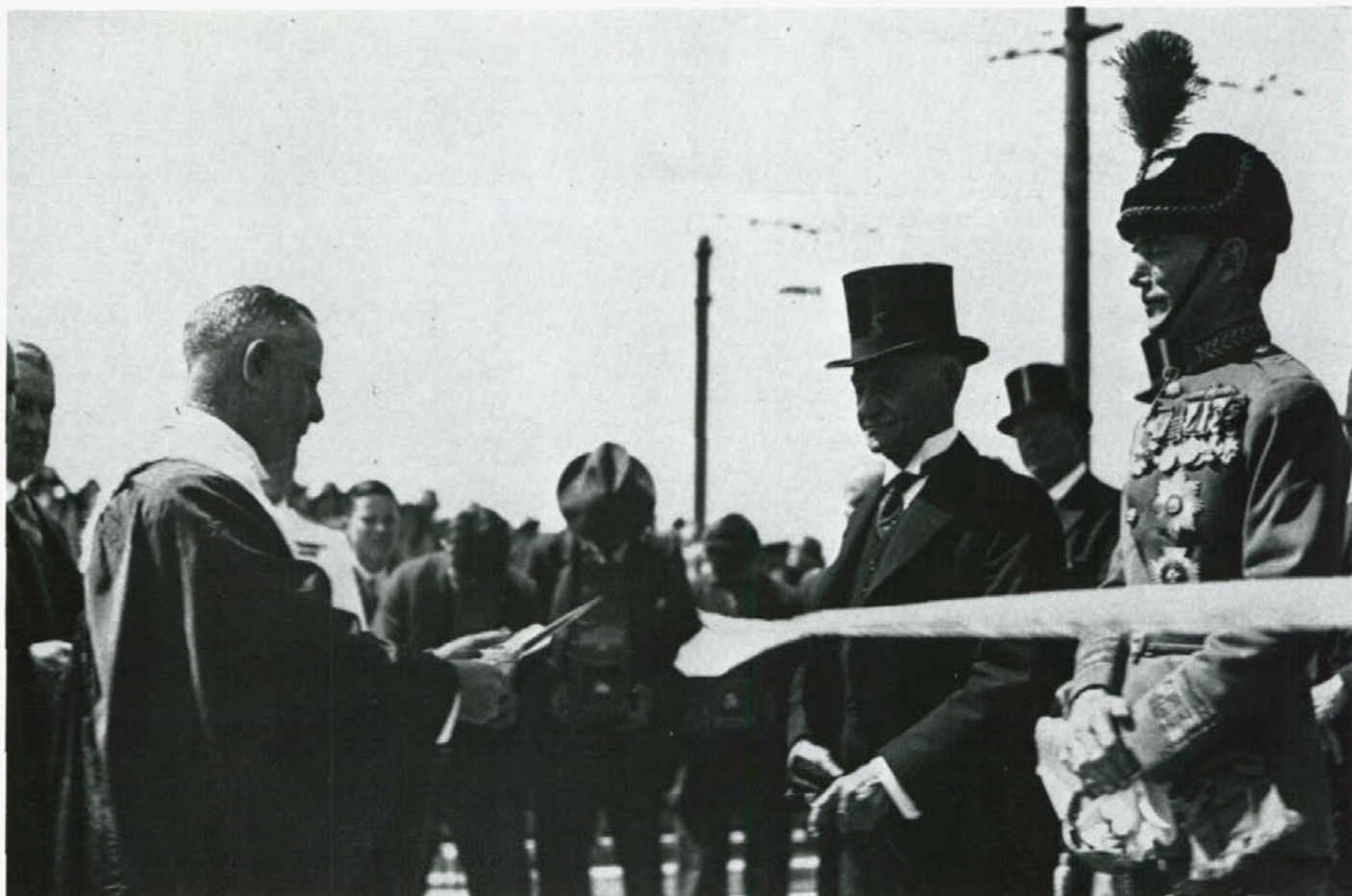
Lady Game, Premier Jack Lang, Mrs. Lang and Sir Philip Game before the ceremony. (Reproduced from *The Official Opening of the Sydney Harbour Bridge*.)

us a lasting monument which has its moral lesson as well as its material use. "I am now to have the honour of unveiling the tablet which names this great achievement 'The Sydney Harbour Bridge' and the roadway linking the city with the northern suburbs 'The Bradfield Highway'. The tablet is let into the wall in its southern face where the roadway narrows a hundred yards to my right. I am afraid not many of you can see it but as I unveil the tablet the Union Jack will be broken at the mast head immediately above it.

"I will now unveil the tablet.

"Ladies and Gentlemen, I wish to draw your attention to one more tablet without which the bridge would have been incomplete. I refer to a tablet placed on the arch at the end of the bridge recording those officially associated with its construction and completion. Prominence is given to two names, those of Mr. Lawrence Ennis, Director of Construction and Dr. Bradfield, Chief Engineer, and I feel convinced that you will all agree that this is entirely fitting.

"I now call upon the Honourable the Premier to address the gathering."



Premier's speech

"The achievement of this Bridge is symbolic of the things Australians strive for, but have not yet obtained.

"The Bridge itself unites people who have similar aims and ideals, but are divided by physical geographical boundaries.

"The unity is brought about by a harmonious blending of English and Australian resources.

"The engineering brains and the financial facilities of the Centre of Empire, have combined with the skill, the labour and determination of the Australian people.

"This amalgamation has produced an edifice that is of great utility to the people of New South Wales, that is an adornment to the City to which it belongs, and a pride to the whole Empire.

"It is the fulfilment of a dream entertained by many of our pioneers, who have not lived to see its realisation.

"The Sydney Harbour Bridge has been many years building.

"Long before the engineer drew the plans, or the labourer turned the sod, the people of Sydney dreamed about, worked for, and fought over, the bridge which is about to be made available to them.

"Just as Sydney has completed this material bridge which will unite her people, so will Australia ultimately perfect the bridge which it commenced just over thirty years ago.

"The statesmen of that period set out to build a bridge of Common Understanding, that would serve the whole of the people of our great Continent.

"That bridge, unlike this, is still building.

"The builders of that bridge, as the builders of this bridge, meet with disappointments, which make the task difficult sometimes—often delicate.

"But that Bridge of Understanding among the Australian people will yet be built and will carry her on to that glorious destination, which every man who loves our native country, feels is in store for her.

"I now officially declare Sydney Harbour Bridge open for traffic, and by pressing this Button, will unveil a Tablet recording this fact.

"At the conclusion of these proceedings, I shall complete the Opening Ceremony of severing the ribbon stretched across the highway and duplicated on the Bridge itself."

An extract of the speech delivered by the Mayor of North Sydney, Alderman H. L. Primrose, follows:

Alderman Primrose, Mayor of North Sydney, severs the ribbon in the presence of the Governor of New South Wales and the Governor-General.

"On behalf of the Northern Suburbs, I wish to express the gratification we feel in participating in this historic and momentous ceremony. It is the realisation of over a century's agitation and effort. We rejoice that we are now directly linked with the Great City of Sydney and we hope to share with it the benefits which must result from ready communication. From today on a continuous course of people and traffic will flow between these kindred territories bringing about increased commercial development and activity. Vast tracts of country yet untouched will be opened up and new residential districts created, thus adding to the wealth of the community. The beauties and advantages of the northern beaches will be made accessible. The time required for daily travel will be considerably reduced, adding to the health and leisure of the people.

"After many years of waiting, of toil and anxiety, the Sydney Harbour Bridge now stands dominant and majestic, ready to take its part in our National Life, an inspiration to higher thoughts and deeds . . ."

SCHOOLCHILDREN RELAY MESSAGE OF GOODWILL

In a period marked by deep economic depression, the opening of the Sydney Harbour Bridge was a symbol of hope. It was fitting, therefore, that the future leaders of the State played a special role in the official opening celebrations.

On 'Children's Day', 16 March 1932, 50,000 pupils marched across the new bridge in a downpour of rain. They were given a school holiday on the day before the opening in recognition of this deed.

Meanwhile, relays of schoolchildren were carrying a message of goodwill from Tottenham, the geographical heart of New South Wales, to reach the Premier on 19 March 1932.

At the conclusion of the formal addresses, a scroll was officially presented to the Premier by the Captains of Fort Street Girls' and Fort Street Boys' High Schools. It was worded as follows:

"A Message of Goodwill and Congratulations from the Heart of New South Wales on the Occasion of the Completion and Opening of the Sydney Harbour Bridge.

*To the Honourable John T. Lang,
M.L.A.*

Premier of New South Wales

Greeting!

This is a message of Goodwill and Congratulations to the Councils of Sydney and to the People of New South Wales

on the occasion of the completion and opening of the Sydney Harbour Bridge. The message comes from the heart of New South Wales and has been conveyed to you by relays of pupils first from Tottenham near the centre of the State and thence from school to school. The pupils have travelled on foot, by pony, bicycle and car, and they have been cheered on their way by many thousands of children and their parents who are with you today in spirit and who join with you in the earnest prayer: God Bless Our Fair Australia!"

At the end of the message appeared the names of the schools that participated in the relays and the signatures of teachers, schoolchildren, the Minister for Education, the Hon. W. Davies, the Director of Education, G. Ross Thomas, and A. J. McCoy, Headmaster of Darlinghurst Junior Technical School, who conceived the idea of the message.

After accepting the scroll, the Premier said:

"I am grateful to you and to all the children who have taken part in relaying this message.

"With you, I pray that God will bless Australia, that He will give her the greatest blessing that any country can have—a wide generation of bright-eyed, healthy children, reverencing the God who made them and loving the country that bore them." ●



The Captains of Fort Street Girls' and Fort Street Boys' High Schools read the message of goodwill which was relayed from the centre of New South Wales to the Premier at the bridge opening.

Schoolchildren were given a chance to see the bridge three days before its official opening.



The Official Opening Ceremony.

The Governor of New South Wales (Sir Philip Game), presided, and read the message from His Majesty the King, reproduced on page 3.

The Premier of New South Wales (The Honourable J. T. Lang) declared the Bridge open.

Other speakers were: The Hon. M. A. Davidson (Minister for Public Works), Alderman S. Walder (The Right Honourable the Lord Mayor of Sydney), Mr. D. Clyne (M.L.A. for King, City of Sydney), Mr. B. Howe (M.L.A. for North Sydney), Alderman H. L. Primrose (Mayor of North Sydney), Dr. J. J. C. Bradfield (Engineer-in-Chief, Sydney Harbour Bridge), The Hon. Roland D. Kitson, D.S.O., M.C. (Vice-Chairman, Dorman, Long and Co., Ltd., the Bridge Builders), and Mr. Lawrence Ennis, O.B.E. (Director of Construction for the Builders).

Tablets, the texts of which are reproduced on page 3 of cover, were unveiled by the Governor, the Premier, and the Lord Mayor.

The Premier, with gold scissors presented to him by Mr. Roland Kitson, on behalf of Messrs. Dorman, Long and Co., Ltd., cut a ribbon on the Southern Approach, signifying the opening of the Bridge.

The Mayor of North Sydney, with the gold scissors used at the opening of the Bayonne (Kill Van Kull) Bridge, New York, in November, 1931, cut a ribbon on the Northern Approach, signifying entry into North Sydney.

The Premier was presented with a message of goodwill and congratulation from the country school children to the citizens of Sydney in particular and the citizens of the State in general on the successful completion and official opening of the largest arch bridge in the world.

Then followed aerial and aquatic displays, a pageant (headed by 750 school children) portraying the history of New South Wales (and Australia) from the landing of Captain Cook, and a Harbour procession of ocean liners and numerous other vessels, piloted by the "Captain Cook," the Australian pilot steamer named after the Great Circumnavigator.

The official guests of the New South Wales Government included the following:—The Governor-General and Lady Isaacs, Lady Game, the Lieutenant-Governor of Victoria and Lady Irvine, the Governor of South Australia and Lady Hore-Ruthven, the Prime Minister of Australia (The Hon. J. A. Lyons) and Mrs. Lyons, the Minister for Home Affairs (The Hon. Archdale Parkhill) and Mrs. Parkhill, the Federal Minister for Health (The Hon. C. W. C. Marr) and Mrs. Marr, the Assistant Minister for Customs (The Hon. J. A. Perkins) and Mrs. Perkins, Admiral G. Blake (Third Lord of the Admiralty), Lieut.-General Sir Harry Chauvel, Admiral J. B. Stevenson, C.M.G., and Mrs. Stevenson, the Chief Justice (Sir Phillip Street) and Lady Street, all the Consular Representatives located in Sydney, Commodore L. S. Holbrook, Brigadier F. B. Heritage, the Chancellor of the Sydney University (Sir William Cullen) and Miss Cullen, the Vice-Chancellor (Professor R. S. Wallace), Sir Wallace and Lady Bruce, the Hon. Chas. Taylor (Speaker of the Queensland Legislative Assembly), Sir Francis and Lady Wyley, The Hon. W. Slater, M.L.C. (Attorney-General of Victoria), The Hon. R. T. Pollard, M.L.C. (Assistant Minister for Agriculture of Victoria), The Hon. S. R. Whitford, M.L.C., and Mrs. Whitford, The Hon. J. H. Scullin and Mrs. Scullin, the President of the Legislative Council (Sir John Peden) and Miss Peden, and the Speaker of the Legislative Assembly (Mr. F. M. Burke) and Mrs. Burke.

The afternoon following the opening was given over to sporting events on land and sea and in the air, while the evening was devoted to a Venetian Carnival on the Harbour, fireworks displays, Harbour and City illuminations, and the floodlighting of the Bridge by Australian and New Zealand warships.

On the day following the official opening, a United Church Thanksgiving Service was held on the Southern Approach to the Bridge.

On the Monday, at a civic function on the north side, the Governor unveiled a tablet, the text of which is reproduced on page 3 of cover.

The Chairman of the Sydney Harbour Bridge Organising Committee was the Premier (The Hon. J. T. Lang), the Deputy-Chairman, the Minister for Public Works (The Hon. M. A. Davidson), and the Organising Secretary and Executive Member, the Under Secretary to the Premier's Department (Mr. Clifford H. Hay).

(Extract from The Official Opening of the
Sydney Harbour Bridge.)



*The Government of New South Wales
requests the honour of the presence
of Dr and Mrs J. F. C. Bradfield
at the Ceremonies associated with the
Official Opening of the Sydney Harbour Bridge
by the Honourable J. T. Lang M. L. A.
Premier and Colonial Treasurer
on Saturday 19th March 1932.
His Excellency the Governor Sir Philip W. Game G.B.E., K.C.B., D.S.O.
will preside.*

*Please reply to the
Under Secretary, Premier's Department*

*On receipt of acceptance
card of entry will be forwarded.
(not enclosed)*



AN OFFICIAL INVITATION TO THE OPENING CELEBRATIONS



1.



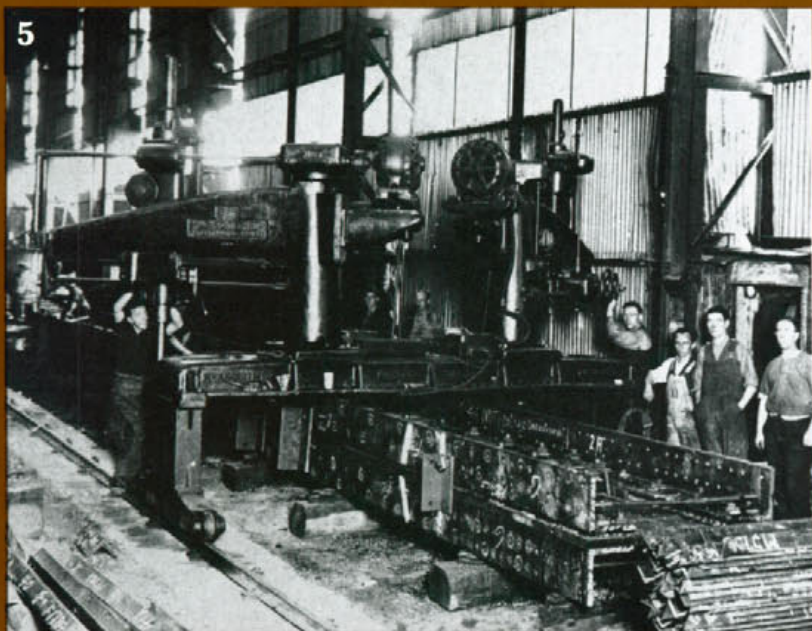
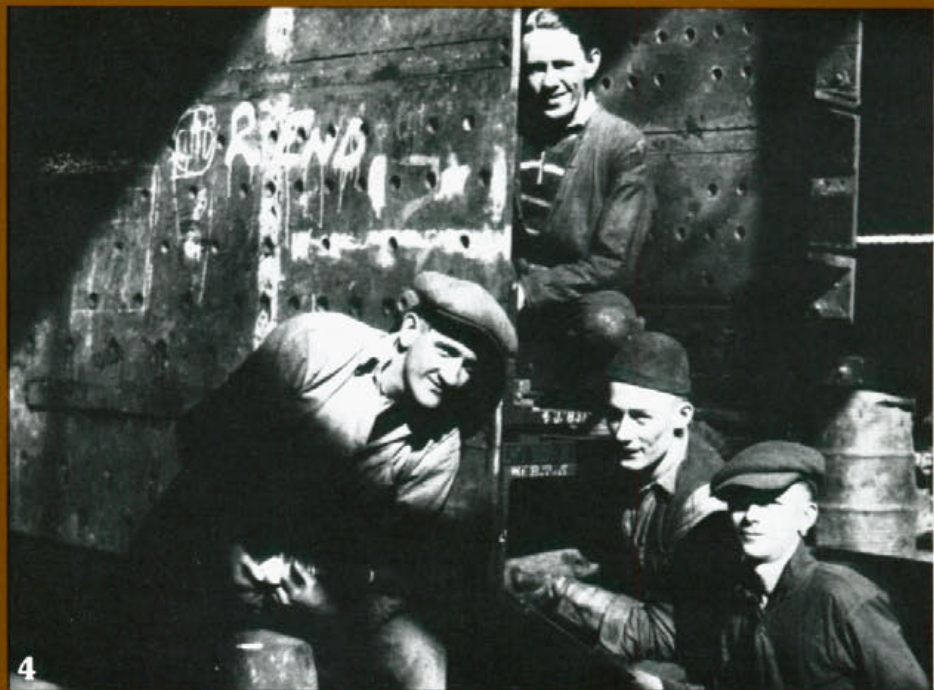
2.

1. Lifting granite blocks into place on the south-east pylon (September 1931). 2. Edge-planing in progress in a fabrication workshop (January 1930). 3. Bridge-workers gathered around a giant hinge bearing to pose for a photograph. 4. Construction workers take a breather in one of the workshops especially set up during the building of the Sydney Harbour Bridge (May 1927). 5. Solid drilling web plates to the main chord angle in one of the fabrication shops (May 1930). 6. Preparing falsework on the approach spans to the bridge (September 1927).



3.

THE MEN WHO BUILT THE BRIDGE





SYDNEY CELEBR

MARCH
19th 1932



D. S. ANNAND
A. WHITMORE
SYDNEY

BRIDGE ATIONS

BE
THERE!

Simmons Ltd. Sydney

POETRY IN STEEL

The opening of the Sydney Harbour Bridge inspired many poets of the day in one way or another.

Many of the sentiments were as lofty as the Bridge itself. Thus wrote Roderick Quinn, the novelist and poet, in a poem entitled *The Harbour's Crown*, dedicated to the children of Australia:

"Above the ranging tides,
Arched o'er by radiant skies,
Nobly the Bridge stands forth
A triumph in all eyes."

And later in the same poem . . .

"High-stationed, massive, bold,
Proud-pyloned, firm and wide
Art in its graceful curves
It arches o'er the tide
Praised be the minds that planned
This wonder through tense hours,
And praised the tireless hands
That raised it where it towers!"

Another writer to celebrate the structural achievement of the Bridge was artist, inventor and journalist George A. Taylor, in his poem *The Bridge*:

"I see in it the long past years
A giant defying stress and strain,
Its great arch links each far-stretched ridge:
A triumph of the human brain!"

Unfortunately, George Taylor did not live to see the completion of the "mighty arch"; he died as the result of an accident in 1928. However his wife, Florence M. Taylor, the first Australian woman architect and structural engineer, penned the following lines in 1932, in a poem also entitled *The Bridge*:

"Curving onwards
Graceful line
Sweeping heavens
Most Divine.
Noble structure,
Stout of frame,
Yet reposeful
All acclaim."

While extolling the engineering feats that built the Bridge, Florence Taylor's final verse shared the honours!

"Praise give science
As you plod
O'er your bridge and
Then praise God."

Others found that the spanning of the harbour evoked stirring memories of the First Fleet and the visionary dreams of early settlers. *The Bridge Opening* by Nellie A. Evans paid tribute to those pioneers:

"And those may see, who keep
God's Vision yet,
The gallant ones who fought for this
great day,
Whose feet of old in barren ways were set,
Who saw the gold where dark clouds
formed and met,
Where lesser souls had only seen
the grey.
All praise to them who toiled the
long years through
That we might see their splendid
dream come true."

This thought was echoed in *Sydney Harbour Bridge* by Minnie Pilson:

"Around your little lovely bays
I see the folk of other days
The lean dark-men and red camp flame,
Ere the white-winged ships and the
white-men came.
I see them all go sailing by—
Phillip, Macquarie, Flinders, Bligh."

... While in *I Dips Me Lid (Being Further Musings of 'The Sentimental Bloke')* by C. J. Dennis, the hero actually encounters the ghost of Captain Phillip, while viewing the Bridge from Mrs. Macquarie's Chair. The good Captain confides his hopes and fears for Sydney, and then . . .

from the sublime to the ridiculous

"Young sir," 'e sez. "The tears well in my eyes
When I behold yon arch that cleaves the skies—
That mighty span, triumphant, where we view
My old friend Darwin's vision now made true:
'There the proud arch, Colossus-like, bestride
Yon glittering stream and bound the chafing
tide!"
'Twas so he dreamed a few short years ago.
Spoke truly, sir; they keep on keeping on."

By C. J. Dennis. Commissioned by Lewis Berger and Sons
Aust. Ltd. Printed with permission of Berger Paints (Aust.)
Pty. Ltd.

Yet other poets found the opening ceremony to be
a greater source of inspiration. And, of course, for
those whose verse was in a lighter vein, the De Groot
incident was a boon.

E. T. Allard, a World War I veteran, who spent a good
deal of time in Randwick Military Hospital, described
the scene with relish:

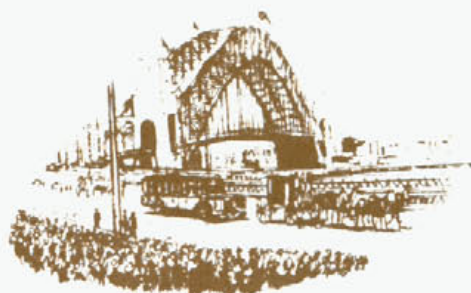
"The day the bridge was opened I went to see
the show
Where forty politicians were sitting in a row.
I gazed across the shoulder of a drummer in the
band
And saw old Jack Lang standing with the scissors
in his hand . . .
. . . The ribbon stretched across the bridge just
waiting to be cut.
It wanted just two minutes before the time was
up.
Then came the gallant Captain, he galloped to
the scene,
He raised his sword, with one big slash he cut the
ribbon clean.
Mackay got very ferocious; he said, "You bally
hound!"
And grabbed him by the wishbone and slung him
on the ground.

*These lines are from a well-known poem by Erasmus Darwin, contained
in his book *Voyage to Botany Bay*, 1789

A fat dame in grandstand said, "Oh, you horrid
brute!"
Up came the Black Maria and in went Cap. De
Groot."

An anonymous author produced a fine parody of the
popular ballad *How We Brought the Good News
from Aix to Ghent* with the title *How We Brought the
Good News from Eric to Jack*. The protagonist is
Captain De Groot himself:

"I drew out my sword and as onward we sprang,
I thought, will I tackle the ribbon, or Lang?
And swiftly decided the ribbon more meet:
As the Premier would make so much mess on
the street:
So, waving my sword in a soldierly way,
I severed the silk 'mid the Crowds' wild Hooray!
Then into the arms of the Hops I did fall,
But—Lang didn't open the Bridge after all."●



The **SYDNEY MAIL**

SOUVENIR BRIDGE NUMBER



This Issue Includes a Beautiful Supplement for Framing

"THE MAN WHO BEAT LANG TO THE TAPE"



**De Groot rides forward to slash the ribbon.
(Reproduced courtesy of News Limited.)**

While the opening of the Sydney Harbour Bridge on 19 March 1932 was spectacular in every sense of the word, an incident occurred which was so controversial that it has since become a part of national folk-lore.

The incident was brought about by an organisation called the New Guard which was formed in Sydney by Eric Campbell. Their primary concern was the threat of communism, and they were sworn to combat what they saw as disloyal elements of government and society.

Their feeling that the Labor Government under Jack Lang was associating with revolutionary socialists led them to organise a petition in 1931 which they presented to the Governor, to be forwarded to the King. The petition asked that the Lang Government be removed from office.

Shortly thereafter, members of the New Guard were dismayed by the Premier's announcement that he would officiate at the opening of the Sydney Harbour Bridge. They felt that an occasion of such importance in the Empire demanded that the opening be performed by the Governor or a member of the Royal Family. At a meeting of the New Guard in Chatswood Town Hall, Eric Campbell pledged that Lang would not open the Bridge. Campbell later said: "I had hoped by focusing public thought on this that Lang would gracefully retire in favour of someone more suitable. But Mr. Lang was not a weakling and stuck to his determination to do the job himself..."

"I let the matter ride for a few weeks, hoping that circumstances would come to my aid. But nothing turned up. As time went on it looked as if my statement had

been a rash one. There is no doubt that I had spoken rather to interest the crowd at the meeting than to convey a considered decision. I was not happy about it, nor worried about it. If Lang did open the Bridge, it was only one game in a long rubber. But the Localities thought differently, and so did the public... I could not go down the street without being stopped a number of times to be asked, 'Who's going to open the Bridge?' So I thought I had better get busy. After all, I had made the statement and in all fairness it was my job to carry out what I had said...

"Then along came De Groot, and his plan had everything and was the best of the lot. I do not know when De Groot joined the New Guard. My first contact with him was when he was Locality Commander of the City Locality, which used to meet in the basement of an old red brick building in Hunter Street, No. 26, I think it was. The City Locality was composed of caretakers, watchmen and lift-drivers and an excellent lot of fellows they were. I liked De Groot from the start and recognised his ability. He rose to be B Zone Commander. He had not been more than a few years out from his native Ireland and in World War I had risen to the rank of Captain in the Xth Hussars. By occupation he was a manufacturer of period furniture and a recognised authority on antiques and objets d'art."

(Extract from *The Rallying Point—My Story of the New Guard* by Eric Campbell, Melbourne Uni. Press, 1965)

Francis De Groot had seen a cartoon in Smith's Weekly entitled "The Man Who Beat Lang to the Tape".

De Groot said: "This contained some very unflattering caricatures of those officially invited and one who was not.

"Mr. Lang, in the centre of the Bridge, with legs like a horse-breaker on holiday, just about to cut the ribbon with his scissors, when an ordinary bloke gets in first with a clasp knife, slashes the ribbon in two, much to the horror of the leading citizens, including Police Commissioner Childs, well in the foreground."

(Extract from *Daily Telegraph*, Monday, 18 March 1957, as told by Francis De Groot.)

While rumours circulated that the New Guard was going to stage a coup on opening day, or even kidnap Lang and dump him in the Harbour, De Groot laid the plans that would cause a world-wide sensation and place his name in the history books. De Groot continued: "In view of the fact that news had been cabled out from London that there was a threat to attack or kidnap the Premier, and that 1500 police would be around the Bridge during the opening, and 500 more would guard the official dais, I thought it would be well to have a horse.

"I might find it necessary to jump a barrier, and rather thought all those police would remove themselves out of the way of a horse, as later indeed they did.

"The whole idea was one of those brain-waves where the entire picture presents itself.

"Borrow a horse, dress up in uniform, sharpen a sword, wait until the ribbon is



stretched taut, charge it at the gallop, cut the ribbon before Lang, and declare the Bridge open on behalf of the decent and respectable citizens of New South Wales, hang the expense, and let Lang cut it again on behalf of the others if he gets any pleasure out of it, keep Campbell's promise, prevent the New Guard disintegrating, and, while showing Lang and his mob that they cannot push us around, let the sharp sword be a hint to the Communists that revolution here would not be a one-sided affair."

(De Groot, *ibid.*)

On the morning of 19 March 1932, De Groot dressed himself in an old Hussar Regiment uniform complete with sword and drove himself to Macquarie Street, near the southern end of the bridge. As arranged, a horse was waiting there for him which, by all accounts, was not a prime specimen. Campbell was to say of the horse: "It was quite a decently bred looking animal but with its thin neck, poddy gut, and goose rump and light bone it certainly did not qualify for the 'charger' class—and its scraggy mane and tail didn't help either."

(Campbell, *ibid.*)

De Groot mounted and rode up Macquarie Street amid the bustle of the impending event. By chance, a group of New South Wales Lancers arrived to escort the Governor-General, Sir Isaac

Isaacs, from Government House to the Bridge. So De Groot fell in behind them and made his way to a point near the dais on the Bridge approach, quite unnoticed. Campbell added:

"The area simply bristled with police who had been detailed to watch out for any New Guard activity. Sergeant Meldrum, who was in charge of this squad, took up his position on foot next to and a few inches away from De Groot. On one occasion Sergeant Meldrum accidentally brushed against De Groot's stirrup, looked up, and touching his cap said 'Sorry Sir!'"

(Campbell, *ibid.*)

While various numbers of the official party addressed the gathering, Francis De Groot waited, undetected, and took in the atmosphere of the scene around him. He wondered, for a moment, whether he should go through with his plan.

"In spite of my strong feelings against Mr. Lang's regime, I might have decided to let him get away. But one thing decided me.

"A few minutes before when the Governor-General had arrived the R.A.A. Band had played the National Anthem, Guards of honor presented arms, officers in uniform saluted, and those included most if not all of the visiting State governors, Generals and Admirals. Loyal citizens bared their heads.

De Groot is led away by police.

"But not the Premier of New South Wales, Mr. Lang. He remained covered. Taking their cue from him the majority of men in the stands nearest to me not only kept their hats on but laughed and jeered at those who did uncover.

"This in the presence and within sight of the King's representatives and senior officers who, because of their official positions, could not even protest at this conduct.

"I no longer had any doubts as to the correct thing for me to do. As a citizen who also happened to be a retired officer, I could and would make a very public protest and let the world see that Mr. Lang and his friends did not represent us."

As Mr. Lang prepared to leave the dais for the official opening, De Groot located the ribbon, which was then being stretched across the bridge, and made his way towards it.

"Before leaving the side of the bridge I had taken a short grip of the reins and now that I was so ideally placed facing the ribbon, I applied both spurs, shaking up my poor old horse in a way he had probably not experienced for years.

"Then he taught me something I did not previously know.

"He had been trained as a racehorse. A lot of his early education had been devoted to refusals to break tapes. Up on his hind legs, yes, ready to jump off when the tape removed itself, but not until then."

"Now when a big horse goes right up on his hind legs he goes a long way up. He carried me well beyond the reach of a number of police, who, by that time, were surrounding me with uplifted hands."

(De Groot, *ibid.*)

After a couple of attempts, De Groot slashed the ribbon through with his drawn sword and shouted: "On behalf of the decent and loyal citizens of New South Wales, I declare the bridge open".

The police, led by Superintendent Mackay, sprang up to De Groot and dragged him from the saddle. He was taken to the tollhouse where he remained for an hour while the ribbon was replaced and the ceremony concluded. De Groot was then driven to the Reception House at Darlinghurst where he was kept for "observation" over the weekend.

He was found sane and discharged by a magistrate on the following Monday, only to be rearrested and charged with maliciously damaging a ribbon, offensive behaviour and threatening language.

While De Groot awaited the hearing of his case which had been adjourned to April, the Chief Secretary, Mr. Gosling, banned the screening of a film which showed Francis De Groot cutting the famous ribbon. It seems that Mr. Gosling was displeased with public reaction to the film. In most instances, De Groot's picture was the signal for an outburst of cheering, while the cutting of the ribbon by the Premier met with a "mixed reception".

Legal proceedings against Francis De Groot commenced on 1 April 1932 at the Central Police Court. The case, which lasted three and a half days, was marked by street clashes between the police, members of the New Guard and a smattering of what the daily newspapers referred to as "Communists".

Campbell said: "At the end of the first day's proceedings at the Central Police Court, in Liverpool Street, when De Groot as already mentioned was being prosecuted for injuring government property (to wit one ribbon, etc.), Mr. Ernest Lamb, K.C. and De Groot and I left the court room together, and went down the long flight of steps to Liverpool Street to pick up a hire-car that was to be waiting for us. There was a large crowd and our progress was hailed with alternate cheers and boos. When we got to

the footpath the situation was pretty grim. Our car was there alright—but it was parked on the other side of the street, and in the roadway between us and the car was a crowd of some hundreds of men in shirt sleeves who greeted our arrival with a howl of rage. In appearance they looked like world finalists in a global ugly man's competition. In attitude they were unequivocally menacing and in speech tauntingly coarse. Clearly we were 'for it' if we set foot on the roadway. There were a large number of uniformed police, but they did not seem interested. Three senior policemen then came up and urged me not to attempt to go to the car and suggested that we return to the Court House and they would arrange for the car to meet us at the back entrance. But I said, 'To Hell with that. The day's not come when a bunch of Communists will stop me lawfully crossing a public street'. I could see that De Groot's lower lip was jutting out, a sure sign that he, too, was not going to be bullied. Mr. Lamb looked on, an elderly, handsome, austere figure with a slight quirk of amusement on his thin lips. Anyhow, with



Temporary custody was provided at the toll offices.

the aid of a number of police we crossed to the car. On the way, more than once, there was nearly a showdown, but the senior policeman beside me kept saying to me, 'Don't say a word, these men are really dangerous and will stop at nothing'."

(Campbell, *ibid.*)

In the end, De Groot was fined the maximum penalty of £5, with £4 costs, by Mr. Laidlaw, C.S.M., for offensive behaviour on Bradfield Highway, a public place. Charges of damaging a ribbon to the extent of £2, and of using threatening words to Inspector Stuart Robson, were dismissed.

Francis De Groot died in April 1969 in a Dublin nursing home, aged 79. Three years before he died, De Groot made his last known public statement about the famous incident of 1932: "I had opened the bridge, and that was all that mattered." ●

Reproduced courtesy of
Australian Consolidated Press

THE SIGNIFICANCE OF THE SYDNEY HARBOUR BRIDGE

By J. S. MacDonald (Director of the National Art Gallery of N.S.W., 1932)

"One can see the engineers of the great pyramid, the Mesopotamian irrigation works, the Panama Canal and the Sydney Harbour Bridge meeting and exchanging ideas. As is usual when experts foregather they would not brag but confine themselves to impersonal "shop" which is the best of all talk. They would discuss weights and measures, stresses, strains, expansions and contractions. Just as when artists handle and thrash out matters of art, the talk would be outside the scope of laymen and for their understanding require considerable interpretation. Technical matter would seize their serene minds, for to the initiated the accurate inner working of the craft is the true indication of its corporal worth. We who are outsiders cannot hope to get successfully behind their minds but must content ourselves with gazing at, letting the wonder grow, using, and reflecting on the concrete results of their thinking.

"In the Sydney Harbour Bridge we have the stoutest and stiffest bridge of its kind in the world. Yet its sturdiness is deceptive, and in this way, that though when viewed near at hand it impresses by its massiveness, rigidity and its hugeness, its air of indestructibility; away from it, particularly when seen at right angles to its length, it looks slim and delicate.

"All this appearance of beauty has been provided for by the engineer, but he has also taken care that utility requirements shall be met; eye contenting pleasure mating with service — form and satisfactory rightness of scale.

"The bridge proper will saturate the minds of most people, for size and singularity usually oust other thoughts, but it should not be forgotten that it has two ends; the approaches to the north of one and to the south of the other. Their planning has called for great ingenuity and

patience, for a multitude of problems were presented for solving where the railway, roadway, motorway and footway gather and take off for their leap across the harbour.

"Allowance has been made for everything; every hole, lump, level, kerb, pillar, post, point and pipe has been conceived and drawn on paper and turned into material; all materials have been examined, chosen, tested, moulded, cast, stamped, welded, turned, assembled and placed to serve and be served by the bridge.

"No grade rises or falls without warrant. Without any post-impressionistic or self-determining notions, tunnels, levels, ramps, platforms and street bridges take their exact places in order to do their proper work, each achieving value in accordance with the service it renders the rest of the components of the great scheme. The curves on the railway on the north and the sweep of the approaching roadway on both sides of the bridge are large and noble, the grades leading to the great nave of the traced arch easy and impressive.

"The row-boat ferrymen must have resented the coming of the steam ferries whose faithful engines and loyal crews (as we now see them) ousted the former from cross-harbour water-ways. But except as a sentiment we will forget the latter as a past generation did the hand-plied, wind-driven boat.

"A static giant now takes the place of a swarm of kinetic pigmies. Gulliver substitutes his body for the feverish exertions of many Lilliputians.

"It is less wasteful, it simplifies, it should result in energies being made available for application elsewhere. It will serve for many years; it will last for many more.

"But apart from all that it will be a great example and incentive to achievement. In that its main significance lies."

Reproduced courtesy of John Fairfax and Sons.

A COLOSSUS OF THE SOUTHERN HEMISPHERE

World's Greatest Arch

"Across Sydney Harbour has been thrown the greatest arch bridge of the age, a commanding structure with stately towers that stand like the Pillars of Hercules bestriding the tide. "The bridge is finished. And, by no matter what standards of comparison we measure it, its place is assured as one of the greatest of its age throughout the world.

"It is an outstanding feat of engineering because, though since rivalled in length, it is the heaviest, the widest and the greatest single span arch yet constructed by man. The size and weight of its members and girders are unequalled; and the smooth progress of its erection involved the solution of problems of engineering, quite unprecedented elsewhere, without a hitch or an error of any kind. The tragic but almost inevitable loss of life was the smallest ever known in the construction of a great Bridge.

"Its magnificence as a commanding gateway to the docks, the shipping, and the industries of the second port of the Southern Hemisphere is unsurpassed. Flanked by four granite-faced pylons of Cyclopean proportions, its roadway could clear the masts of all but a few of the world's largest liners. Its arch, soaring 440 feet above water-level, is as aptly proportioned to the scale of the Harbour and its hills as were the finely designed stone arches of our forefathers to the meadow-bordered streams of England, and can hardly be outbalanced even by the greatest skyscrapers that may some day arise. Its vast, sweeping curves, from wherever one may view it, give a sense of rhythm and harmony, of strength combined with lightness and grace. In short, it is one of the finest and most typical products of the Age of Steel.

"Finally, the Bridge will stand as a lasting memorial to the co-operation of the industries, the workers, the organisation, and the scientific skill of Australia and England. Planned and supervised by New South Wales Government engineers, designed and constructed by a great English firm, made by Australian workers, partly of Australian steel, it is Imperial both in design and in execution." ●

Reproduced courtesy of John Fairfax and Sons.

The pageant and the procession from the air

The occasion of the Bridge's opening seemingly cleared Sydney's suburbs of all life, according to contemporary reports. More than 300,000 people are thought to have packed the city to view the procession, or to be "one of the first" to walk across the massive structure.

The Sydney Morning Herald reported on the spectacle from the air:

"The human confetti vanishes. Speedboats dash before a white wake of swirling foam. Launches move slowly westward. Rowing boats follow them, or are overtaken. All are bound westward."

"And suddenly one realises that to the west is the focus of all this activity—the bridge, curved like a bow half-drawn. Now it is silhouetted against the silver-blue, a colossus in its mighty stride... To the north, and to the south, one sees people, and people, and yet more people, on lawns, on rocks, in trees, on roofs."

'Around Milsons Point station is another dense unmoving mass of people. And from it one sees, like an overflow, spilled down hill, more crowds to Kirribilli, where the waterfront is packed like Henley-on-Thames.

"A stream of cars crosses Darling Harbour Bridge—nearly all bound citywards, in the direction of the greater bridge. One sees the southern approach of the bridge, the official stands, and more people. Are there any left?"

"There are. The plane is over the city again. Crowds around the Town Hall, crowds in George Street, crowds everywhere. No wonder the suburbs are deserted. The procession has now moved off, and ... one sees colour more bright than that of the crowds."

"The plane flies lower ... the bridge looms greater, a gigantic tracery of grey steel, beneath whose arches now pass magnificent floats ..."

"The crowds break up, slowly. Motor cars move out from the city. Like black beetles, they fill the main arterial streets, branch into smaller thoroughfares, stop here and there and move again ..."

"The suburbs awaken to life. The bridge is open."

Reproduced courtesy of John Fairfax and Sons.



Members of the public stream across the bridge in their thousands, following the official opening.

THE AERIAL DISPLAY

As thousands of spectators crowded on to the bridge to inspect it at closer quarters, nearly 50 aircraft provided an additional, and somewhat surprising treat. The spectators' attention was firstly given to a faint drone, which became a loud roar as the planes came into sight and swept down over the bridge, passing closely over the arch in perfect formation.

While many aeroplanes circled over the bridge at various altitudes, three planes broke from a formation of seven (representing the Aero Club of N.S.W.) to perform various aerobatics. These included dropping smoke bombs near Fort Denison, looping the loop, spiralling seawards as if they had been shot down, and the "Prince of Wales Feathers" manoeuvre.

At around 3.30 p.m., Air Force Wapitis staged a mock attack against Fort Denison, which was assumed to be an isolated cable station. The planes swooped low over the Fort as if bombing it, and, within a few minutes, reduced it (theoretically) to smoking ruins.

THE VENETIAN CARNIVAL

The evening celebrations centred on Farm Cove, where a colourful spectacle delighted the crowds of people who lined the Harbour and watched from every available window and vantage point.

The highlight was the fireworks which were let off simultaneously from Kirribilli and Fort Denison, forming fiery arches in the sky.

The many warships stationed around the Harbour alternately illuminated their own huge outlines, then blacked out their forms to cast searchlights through the sky. At a given signal, the bizarre patterns of light ceased and every brilliant beam was focused on the bridge.

There was also an impressive display by the firefloats of the Sydney Harbour Trust. The *Pluvius*, *Hydra* and *Achilles* manned by the Sydney Harbour Trust Fire Brigade and assisted by the Metropolitan Fire Brigade, were stationed in front of Mrs. Macquarie's Point opposite Garden Island. Their delicate sprays of water fell through the sky in showers of coloured light as the warships played their searchlights on them.

Passenger ferries steamed slowly down the eastern channel and back around Fort Denison, providing revelers with an excellent view of the carnival.



The harbour activities were watched by hundreds of thousands of onlookers, many of whom added to the spectacle by joining the procession in smaller water craft.

sity float bore a miniature of its famous Great Hall while the final historical float represented the Federation of the Australian States.

Contingents of war veterans accompanied the Australian Imperial forces float, and a tableau of the "Future of Australia" preceded a section of the pageant which was devoted to the development of transport. A detachment of Boy Scouts marched along in front of six primary producers floats, featuring wool, agriculture, dairying, fruit, the wine industry and mining.

The British Empire float was followed by the magnificent floral section of the procession. This comprised 11 floats representing the various districts of Sydney, all covered in thousands of native flowers.

The last unit of the pageant was the "Return to Prosperity" float, which no doubt represented the hopes of all those watching. After a short trip through North Sydney, the pageant returned over the bridge and dispersed in Kent Street.

Meanwhile, every bay and stretch of water from the north to the south of the Harbour was full of activity, the main focal point being the procession of large commercial and passenger ships.

The pilot steamer Captain Cook swung in ahead of the 21,000 ton liner, R.M.S. *Maloja* which led the procession. As they rounded Walsh Bay and made for the centre of the bridge, others moved out from Darling Harbour and Pyrmont to join them: *Orford*, *Nieuw Zeeland*, *Manunda*, *Port Auckland* and a dozen other flag-bedecked giants.

It was an impressive sight, with craft of every kind, from stately yachts to tiny canoes, crowding the water between the larger ships, and with speed boats dashing in and out of the procession.

Once the liners had been berthed, the Harbour was given over to a regatta. Events included displays and races by sail, dinghy, skiff, 18-footers, service boats, rowers and motor yachts. Hydroplanes were also put on show in special events.

AQUATIC DISPLAY AND PAGEANT

As the official ribbon was cut, a Royal twenty-one gun salute sounded out, signalling the commencement of a spectacular aquatic display.

For fifteen minutes, a multitude of motorcraft enthralled the crowds with skilful manoeuvres, which left frothy white patterns criss-crossing the harbour.

By this stage a huge pageant, consisting of dozens of brightly decorated floats was moving slowly past the official dais. The enormous tableau told the story of the State's development

since the days of the first settlement at Sydney Cove.

At the head of the procession marched nearly 700 school children, 100 workmen who took part in the building of the bridge and a party of 20 aborigines. Numerous pipe bands, district bands and armed services bands performed as part of the pageant.

Then began the lavish historical floats, depicting Cook and the "Endeavour", Governor Phillip, the early explorers, Governor and Mrs. Macquarie and Francis Greenway, all set in appropriate surroundings. The Sydney Univer-

The procession, watched by eager spectators, approaches North Sydney.



A BEGINNING...

When the morning formalities had finished, and the procession had passed out of sight, the C3426 left Wynyard, the first electric passenger train to take the new railway link from the city to Milsons Point.

Decorated with flowers and bunting, it moved slowly across the bridge to give the passengers, who cheered and waved handkerchiefs out of the windows, an uninterrupted view of the harbour. After a brief stop on the north side, the train made a triumphant return to Wynyard at high speed.

Thus began the vital passenger service from the city to the northern suburbs. The same C3426 still runs the North Shore line today.

... AND AN END

That night, at precisely 12 o'clock, the last Milsons Point ferry left Circular Quay. Having served as one of Sydney's main traffic arteries for generations, the ferry was no longer needed. Dwarfed by the great steel arch, the *Kirrule* made its final voyage with a crew of master, engineer, fireman and two deckhands.

This description appeared in the *Sydney Morning Herald*, 21 March 1932:

"There was no ceremony—just the usual last-minute rush, the clanging of gates, the ringing of the bell, in this instance it seemed to have almost a tolling effect, and the Kirrule was on her way. There was the usual jump for the boat after the gangways had been cleared, and a rousing cheer from those aboard welcomed the last passenger — a young lady."

"There was the usual dozen disappointed travellers left behind at the barriers and, as ever, the inevitable Saturday night slumberer reclining peacefully on a seat as the ferry steamed away."

Reproduced courtesy of John Fairfax and Sons.

The float which lead the historical section of the pageant featured Captain Cook surveying the strange new land he had discovered, from beside a model of the Endeavour.

This floral float, staged by the Waverton to Hornsby section of the North Shore, was one of the biggest in the procession. The focal points were Hermes, symbolised as the god of progress, the 'queen of the northern suburbs', and a figure representative of Australia.

A TALE OF TWO SCISSORS

On Saturday, 19 March 1932 not one but two official openings took place: the opening of the Sydney Harbour Bridge by the Hon. J. T. Lang, M.L.A., Premier of New South Wales, and the opening of the entry to Sydney's Northern Suburbs at Milsons Point by Alderman H. L. Primrose, Mayor of North Sydney.

Since there were two separate ceremonies involved, two pairs of scissors were required. One was borrowed from New York and the other was fashioned in Sydney especially for the occasion.

The scissors which the Premier used to open the bridge began as a humble pair of household scissors. Dorman, Long and Co., the builders of the bridge, commissioned Angus and Coote to remodel them for the important event.

They were gold plated and their handles decorated with a replica of the Sydney Harbour Bridge, as well as Flannel Flowers, Waratahs and Gum Leaves, all hand-wrought by Les Denham. Upon this he mounted six Australian opals.

The blades of the scissors were engraved by Norm Neal with the following inscription: *"Presented to the Hon. J. T. Lang, M.L.A., Premier and Treasurer of N.S.W. by Dorman, Long*

and Co. Ltd., Contractors, Opening of the Sydney Harbour Bridge, 19th March, 1932."

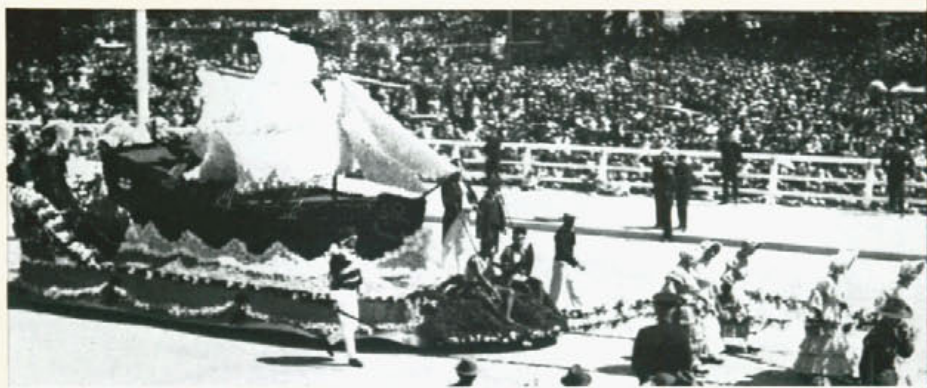
The Angus and Coote motif was also engraved on the scissors. Some time later, the scissors were presented to the New South Wales Parliament.

The other scissors, which the Mayor of North Sydney used to open the entry to Sydney's Northern Suburbs, had quite a different history.

In November 1931, the Bayonne Bridge, which joins New York State and New Jersey, was opened to traffic. It crosses the Kill van Kull and measures just 700 mm more across the arch span than our own bridge, with a total length of 1762 m.

The New York Port Authority lent the scissors that had been used at their ceremony to the New South Wales Government for the Sydney Harbour Bridge opening, which took place just four months later.

When the scissors reached Sydney, one of the blades was joined with a locally produced blade for the ceremony at Milsons Point. A corresponding pair of scissors was put together with the remaining Bayonne Bridge blade. This pair was to be sent back to the New York Port Authority, thereby forming an historic link with our 'sister bridge' on the opposite side of the world.



THE SAGA OF THE RIBBON

The cutting of the ribbon at a bridge opening ceremony is a simple yet significant event; significant because it represents the culmination of years of planning and labour, as well as the realisation of the hopes of many people. The official ribbon-cutting at the opening of the Sydney Harbour Bridge was no exception.

The ribbon-cutting was made all the more spectacular by Francis De Groot's unprecedented act of beating the Premier to the draw, in front of thousands of astonished onlookers.

The official satin ribbon was of a pale blue and bore an inscription of the official opening. It was stretched across the bridge at both the southern and northern approaches. At the southern end, the ribbon was stretched across the bridge near the toll offices. It was fixed at one end to the concrete wall by wires drawn through small holes in the concrete. The bulk of the ribbon was rolled up and held by an attendant throughout the formal addresses.

When the Premier left the dais, several men unrolled the ribbon from one side of the bridge to the other, taking care that it did not touch the dusty surface of the road. But before Lang could sever the tape, De Groot galloped forward, and, at the second attempt with his sword, had burst the

ribbon into tatters for about a metre of its length.

In an account to the Daily Telegraph, De Groot said:

"When I was hustled away, attempts were made to knot the ribbon for Mr. Lang, but it was made to an exact length, and after I had gashed a yard out of the middle, there was not enough left to tie a knot."

"It had been obtained from a big Sydney store but today was a public holiday and the store was shut."

"So they telephoned the manager at Vaucluse, asked him to come into the city, open up and supply a couple of yards of similar ribbon."

"After an hour's delay, Mr. Lang was able to cut the new part of the ribbon with his golden scissors."

At this point there was a twenty-one gun royal salute fired in honour of His Majesty, followed by a procession of watercraft and a fifteen-minute aerial display.

The official party then drove to Milsons Point Station where the Mayor of North Sydney, Alderman Primrose, severed the second ribbon (without mishap), signifying entry to the Northern Suburbs.

A section of the ribbon used at the official opening of the bridge can be viewed in the Exhibition Hall at the Sydney Opera House from 10-26 March 1982, along with many other items of Sydney Harbour Bridge memorabilia.

SPECIAL CHURCH SERVICE

An item in the Sydney Morning Herald on 21 March 1932 recorded the special church service, held the previous day, in these terms:

"A strong south-westerly wind, carrying clouds of dust, caused unpleasant conditions at the thanksgiving and dedication service held yesterday afternoon in an open-air enclosure on the west side of Bradfield Highway. The Primate of Australia, Archbishop Wright, presided, and the service was broadcast by 2FC and was also amplified."

"Included in the gathering were the Governor-General (Sir Isaac Isaacs) and Lady Isaacs, the State Governor (Sir Philip Game) and Lady Game, and the Lieutenant-Governor of Victoria (Sir William Irvine) and Lady Irvine. Those who took part in the ser-

vice were the Moderator of the Presbyterian Assembly (the Right Rev. R. J. H. McGowan), Rabbi Cohen, the President of the Methodist Conference (the Rev. H. C. Foreman), the President of the Baptist Conference (the Rev. W. Barry), the President of the Church of Christ (Dr. Verco) and Commissioner Maxwell, of the Salvation Army."

"The Rev. Alexander P. Campbell, of Killara Congregational Church ... who delivered the address, said they ... were holding the service to honour before God the happy consummation of a most difficult and perilous enterprise ... (he said). The massiveness and majesty of it must surely awaken their wonder and awe, which in turn must drive them back upon God, for before ever the work was begun in the whole thing was seen completely in

Sydney Morning Herald, Saturday, 19 March 1932.

TWO FATALITIES

Hundreds collapse in Crowd Watching the Bridge

"Two deaths occurred in the crowd during the bridge celebrations, and hundreds of people collapsed."

"The roofs of three sheds near the southern approach to the bridge collapsed beneath the weight of the numerous sightseers, who had clambered on to the frail structures, and many people received cuts and abrasions. A woman fractured her arm, and several others suffered sprains."

"Frederick Watson ... was standing on a lorry that was being driven slowly through the crowd along Elizabeth-street early in the morning. Near King-street he attempted to alight with his companions, but slipped, and fell under the rear wheel. The vehicle passed over his head. He was killed instantly."

"Later in the morning, Alexander McArthur ... collapsed and died in the street at Circular Quay."

"It was estimated that about 3000 people fainted or collapsed during the day. The blazing sun took a heavy toll of women and aged people. So dense was the throng that in many cases people had to be lifted over the heads of the crowd to the ambulance men and women on the outskirts ... stretcher-bearers brought in cases at the rate, at times, of four a minute."

Reproduced courtesy of John Fairfax and Sons.

the mind of man. It was a creative wonder, a visible and compelling evidence of the marvellous powers of man, an evidence of man's master over nature."

BRIDGE BLESSED

The Roman Catholic Archbishop of Sydney, Dr. Kelly, who was unable to be present at the celebrations, decided to pray for the bridge before its opening.

According to the Sydney Morning Herald of Saturday, 19 March 1932, Dr. Kelly said: *"No special service was arranged, but it was none the less a real blessing. With three priests I motored across the bridge and stopped at its centre to give the blessing. My prayer was for the safety of the structure and of the people who will use it."*

Reproduced courtesy of John Fairfax and Sons.



50th ANNIVERSARY COMMEMORATIVE PLATE

The Department of Main Roads, on behalf of the State Government, is issuing a limited edition of 10,000 plates to commemorate the 50th Anniversary of the opening of the Sydney Harbour Bridge.

The 260 mm diameter plates have a full-colour centre illustration based on the original invitation and sepia illustrations around the rim which depict various stages in the bridge's construction.

Purchase of the plate will represent a unique opportunity for those who wish to remember this important celebration. The plates will be available at a cost of \$30 each (post free) and may be obtained by calling at the Department's Head Office, 309 Castlereagh Street, Sydney, or by forwarding a remittance to:

Sydney Harbour Bridge
50th Anniversary Plate,
P.O. Box 198,
HAYMARKET, N.S.W. 2000.

THE SWITCH THAT SAVED THE DAY

Once the ribbon had been cut by the Premier, a complex system of wiring and relays was to unfurl a row of banners and transmit a signal for the firing of a battery of guns.

Yet the premature slashing of the ribbon by De Groot did not set these events into operation. This was due to the forethought of Ernest Barnes-Hedley, an engineer with the then N.S.W. Department of Railways.

Barnes-Hedley instructed the foreman electrician to wire a master double-pole switch, near the ribbon, but in an inconspicuous place. He stood next to the switch, with its current broken, and closed the circuit only when he saw the Premier actually cutting the ribbon. This small action saved the Government from a considerable amount of embarrassment.



A certificate was issued to many of those who walked across the Bridge on opening day.

SOUVENIR

COMMONWEALTH OF AUSTRALIA
Postmaster-General's Department.
SYDNEY HARBOUR BRIDGE

TELEGRAM



This message has been received subject to the Post and Telegraph Act and Regulations.

MRS A B ALCOCK
53 LEONARD ST BANKSTOWN
POST SYDNEY HARBOUR BRIDGE

BRIDGE CELEBRATIONS VERY NICE WRITTEN UNDER BRIDGE PYLONS

JACK

POST OFFICES ON THE BRIDGE

To celebrate the occasion on the bridge's opening, the then Department of Posts and Telegraphs operated special post offices at the bridge pylons for a period of two weeks from the opening day. Souvenir hunters, according to early reports, besieged the offices throughout the afternoon and evenings of 19 March 1932.

Queues formed outside the offices as the staff inside dealt with the thousands of customers. A total of £600 worth of special stamps was sold, 1400 registered letters sent and 3000 telegrams despatched. In addition, thousands of unregistered letters were processed.

A telegram sent from the North East Pylon on opening day and a letter marked with the Sydney Harbour Bridge cancellation, posted 22 March 1932.

15 MAR., 1932.]

NEW SOUTH WALES GOVERNMENT GAZETTE, No 34.

983

SCHEDULE.

	s.	d.
Motor cars and motor cycles with side cars attached	0	6 each.
Bicycles, tricycles and motor cycles without side cars	0	3 "
Sulkies and four-wheeled buggies and light carts hand propelled or drawn by one or more horses	0	3 "
Empty or loaded vans, lorries, drays, waggons or other vehicles, the tare weight of which does not exceed 2 tons	1	0 "
Empty or loaded vans, lorries, drays, waggons or other vehicles, the tare weight of which exceeds 2 tons but does not exceed 3 tons	2	0 "
Vehicles not otherwise specified	3	0 "

Where a second vehicle is attached to any of the above-mentioned vehicles, double the specified rates will be charged.

Persons riding in or on any vehicle (other than the person driving such vehicle)—

Adults	0	3 "
Children	0	1 "
Horse and rider	0	3 "
Horses or cattle (loose stock) per head	0	2 "
Sheep or pigs per head	0	1 "

Vehicles, the property of the Board of Fire Commissioners of New South Wales, the Commissioner of Police, and ambulances, will be exempt from payment of toll charges.

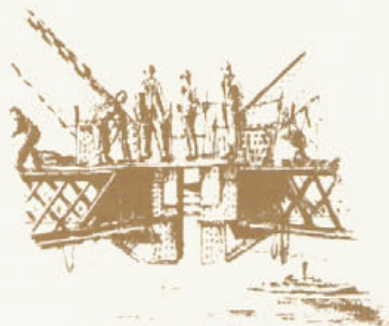
The original Schedule of Tolls, reproduced from the New South Wales Government Gazette, 15 March 1932.

COSTS FOR THE BRIDGE

Payments to Dorman, Long and Co. Ltd.	£4,810,516
Interest on loan during construction	1,494,988
Bridge and approaches (Public Works Department)	2,321,430
Acquisition of land	1,339,028
Other minor works	91,208
	£10,057,170



One of the many medallions issued to commemorate the bridge opening.



CHRONOLOGY OF EVENTS

28 July 1923. Turning of the First Sod was performed by the Hon. R. T. Ball, M.L.A., at North Sydney.

24 March 1924. The tender of Dorman, Long and Co. Ltd. of Middlesbrough, England was accepted.

28 July 1924. The tramway was diverted from Alfred Street along Dind Street to Glen Street and the complete transfer of traffic from Milsons Point Station to the new station, involving railway and ferry change over, tramway deviation, street widening and incidental works was successfully completed (at night).

5 January 1925. The excavations for the foundations of the main bearing and approach span piers were commenced.

26 March 1925. Foundation stones of the southern abutment tower at Dawes Point were set by His Excellency, Sir Dudley De Chair, K.C.B., M.V.O., Governor of New South Wales and the Hon. R. T. Ball, M.L.A., Secretary for Public Works and Minister for Railways.

September 1926. The erection of the approach spans steelwork was commenced.

26 October 1928. The western truss at Dawes Point was placed in position.

26 October 1928. The erection of the main arch was commenced.

7 November 1928. The eastern truss at Dawes Point was placed in position.

1928. Hornsby-Milsons Point Railway line was electrified.

26 November 1929. Erection of record tonnage of 607 tonnes in one day.

19 August 1930. The arch was closed, the two half arches were permanently linked.

10 September 1930. The arch trusses were completed.

March/April 1931. The deck was completed.

16 January 1932. The last stone was set in the upper parapet of the last pylon.

28 February 1932. The Town Hall and Wynyard Underground Railway Stations were opened for traffic.

19 March 1932. The bridge was declared open for traffic by the Hon. John T. Lang, M.L.A., Premier and Colonial Treasurer for New South Wales. His Excellency, Sir Phillip Woolcott Game, C.B.E., K.C.B., D.S.O., Governor of the State of New South Wales presided at the opening ceremony and named the structure the "Sydney Harbour Bridge" and the roadway linking the city with the northern suburbs the "Bradfield Highway".

9 September 1932. Sydney Harbour Bridge (with exception of areas occupied by rail and tram tracks) was handed over to the Department of Main Roads.

29 June 1958. Trams replaced by buses and the area previously maintained by the Department of Government Transport was handed over to Department of Main Roads to convert it to road use.

2 July 1959. The two additional traffic lanes on the eastern side of the bridge were declared open by the Hon. J. B. Renshaw, M.L.A., Minister for Local Government and Minister for Highways.

13 July 1966. Ban on lane-changing abolished (by the Cabinet Standing Committee on Road Safety). From this day motorists could change lanes at any time.

FACTS AND FIGURES

Length of arch span: 503 metres.

Height of top of arch: 134 metres above mean sea level.

Height to top of aircraft beacon: 141 metres above mean sea level.

Width of deck: 49 metres.

Clearance for shipping: 53 metres.

Height of pylons: 89 metres above mean sea level.

Base of each abutment tower: 68 metres across and 49 metres long (two pylons rest on each abutment tower).

Total length of bridge: 1149 metres including approach spans.

Bearing pins: each of the four pins measure 4.2 metres long and 368 millimetres in diameter.

Thrust on bearings: under maximum load approximately 20 000 tonnes on each bearing.

Number of rivets: approximately 6,000,000.

Largest rivet: weighed 3.5 kilograms and was 395 millimetres long.

Longest hanger: 58.8 metres.

Shortest hanger: 7.3 metres.

Total weight of steelwork: 52 800 tonnes including arch and mild steel approach spans.

Weight of arch: 39 000 tonnes.

Rock excavated for foundations: 122 000 cubic metres.

Concrete used for bridge: 95 000 cubic metres.

Granite facing on pylons and piers: 17 000 cubic metres.

Allowance for deck expansion: 420 millimetres.

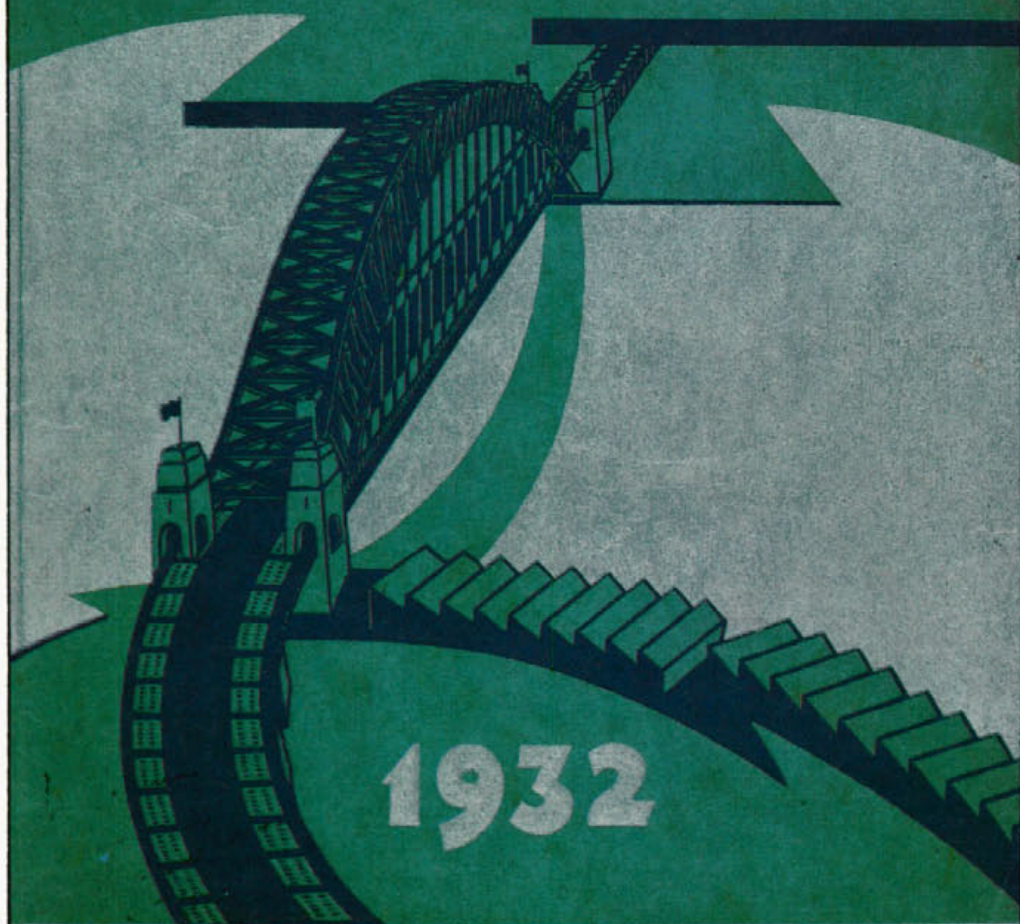
Allowance for arch expansion: the arch may rise or fall 18 cm due to heating or cooling.

Number of panels in arch: 28, each 18.28 metres wide.

Record tonnage erected: 607 tonnes of steelwork was erected on the arch in one day on 26 November 1929.

Paint required: 272 000 litres of paint were required to give the bridge its initial three coats.

SYDNEY BRIDGE CELEBRATIONS



1932

ART IN AUSTRALIA LIMITED