APRIL 1966

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Walkabout

AUSTRALIA'S WAY OF LIFE MAGAZINE

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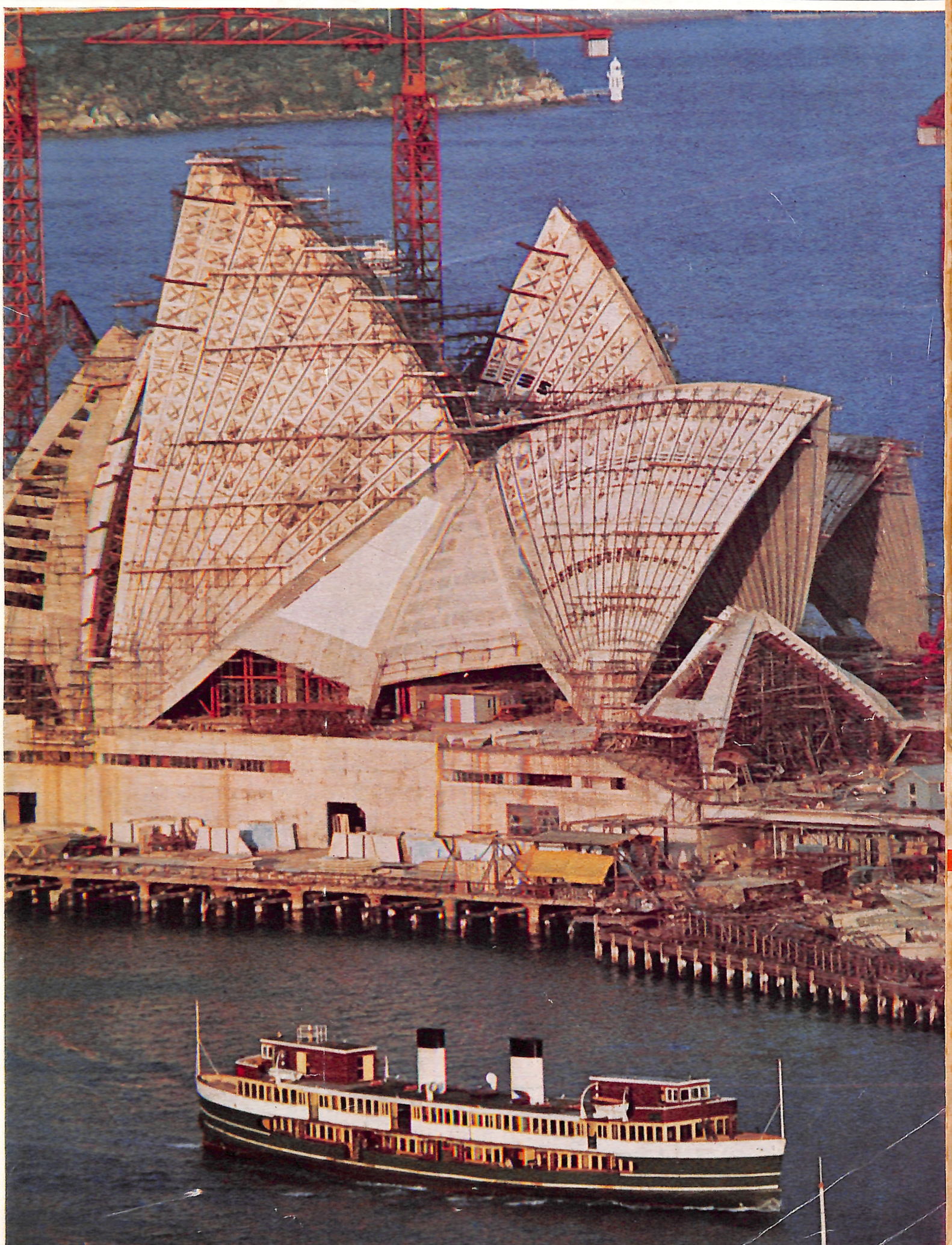

Walkabout

The title WALKABOUT signifies a racial characteristic of the aborigine, who is always on the move. The magazine takes readers on a walkabout through Australia and its territories.

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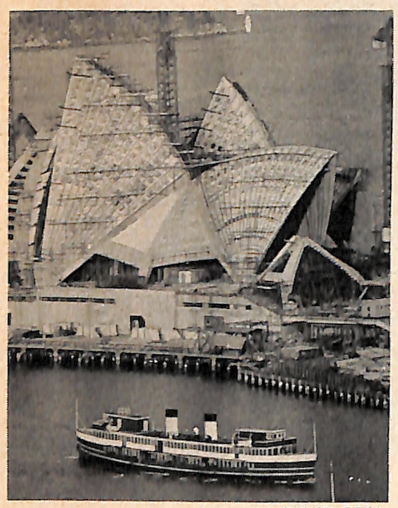

DAVID BEAL

Manly ferry passes shell of Sydney's controversial Opera House with its soaring design, which has aroused world-wide interest.

Gustav Weindorfer pioneered, almost single-handed, Cradle Mountain area, which is now one of Tasmania's wonders.

Junior children at Mount Scopus college draw on ancient Jewish legends for class art.

HERALD-SUN

Viscount Bruce of Melbourne sports light blue of Cambridge, his alma mater, *at boat race.*

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SYDNEY OPERA HOUSE

CAN YOU COST A DREAM?

BY EVA M. BUHRICH

PICTURES BY MAX DUPAIN

NEVER BEFORE has an Australian building created the stir and excitement that surrounds the Sydney Opera House even now, years before its completion. Almost daily there is some press reference to it, overseas architectural magazines publish regular progress reports, and people not normally interested in either opera or architecture debate its merits. Even *The New York Times* recently featured a story about it.

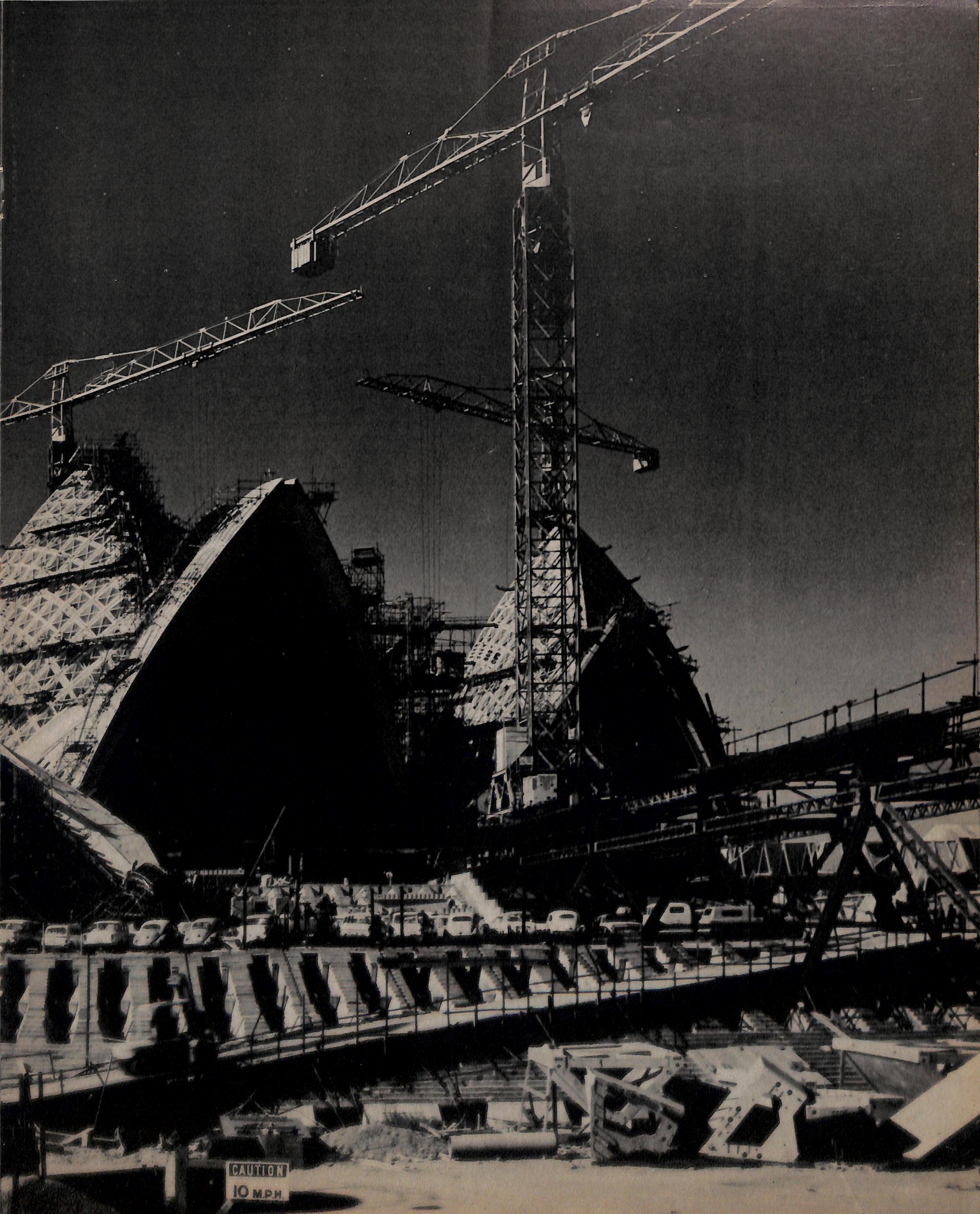
The reasons for interest are twofold: the spectacular design which stirs the imagination and the spectacular cost which staggers it. The two are of course linked, although no one realised it in 1958, when the results of the international architectural competition were announced.

The New South Wales Government gave what must be one of the most beautiful building sites in the world, surrounded on three sides by the blue waters of Sydney Harbour, visible from many points around the harbour, from the city and even from above. The site called for something extraordinary. Brilliant American architect, Eero Saarinen, convinced his fellow members of the jury that Utzon's unique design which treated the whole building like a piece of sculpture was the answer. It was an imaginative decision. Not only was Utzon's complicated design very difficult to understand and visualise from the drawings, but the drawings had been done in a hurry to meet the competition date, and had by no means been completed.

Still, the jury made its decision and employed an artist to make some sort of perspective, which the public would understand, and a quantity surveyor to give a quick estimate of the likely cost. The poor man was asked to do the impossible. Nobody at that stage could have had any idea of the final cost. There simply was not enough data on which to base a guess. How can you estimate the cost of a dream? Nothing like this building had ever been designed, let alone built. No one knew how the shells were to be constructed or what foundation conditions would be like.

CONTINUED OVERLEAF

Despite widespread criticism of costing techniques, construction on Sydney's massive Opera House complex is well advanced. This picture shows the podium steps in the foreground, the shell of the restaurant on the left, the major hall in the centre and the minor one on the right.


CAUTION
10 M.P.H.

CONCRETE SAILS ARE "EXPLODED SPHERE"

But everyone then was in a hurry. An election was looming and it was essential that the job should be commenced — if it were to be begun at all — before February, 1959. So the building was started without a single correct drawing.

Complications arose almost immediately. A sewer had to be diverted, the base had to be extended into the sea, a new theatre had to be added inside the base, foundations were difficult because of tidal effects and the unreliability of the sandstone. The size and location of the piers which were to support the superstructure had virtually to be guessed, for the superstructure was not calculated until four years later. No wonder that even at this stage cost went spiralling up.

Complicated though the Opera House building looks, its plan is one of ingenious simplicity: the two main halls, the major and the minor ones, are placed side by side but with ample space between them, allowing people to approach and leave at any point of their perimeters, thus avoiding all the complicated hallways and stairs of other large theatres. The halls are set on top of the great base which is designed almost as if it were part of the natural rock itself. The walls and podium floor are covered with precast panels with exposed aggregate of a pinkish granite.

The base contains a chamber music hall with 300 seats, an experimental theatre with 400, and about 50 dressing and 20 rehearsal rooms, as well as administrative offices.

In most theatres, the high scenery loft above the stage is a typical, rather awkward design feature. In Joern Utzon's design the lofts are tucked away under the highest shells and become part of the whole group rather than contrasting with the auditorium shape. This is one reason for the "sails", the other no doubt being the association with water and sailing which is familiar to most observers. Shell designs (briefly this means that a structure gains strength through its curvature and can hence be, relatively to it, as thin as an egg-shell) have been built in Europe, Mexico and the United States for years. But nowhere in the world has a shell construction of such complex free forms been undertaken.

When the time came to translate the design into practice, when the engineers appointed by the architect, Ove Arup and Associates, tried to find a way to build the shells, it proved impossible to calculate the stresses, and to build the shells economically. Several schemes were tried: first a single skin of concrete with ribs underneath; then two reinforced concrete skins, six feet apart and interconnected with a lattice of concrete beams. A completely different approach proposed steel frames with a sprayed-on concrete skin. This was unsatisfactory, so the engineers returned to reinforced concrete shells cast *in situ,* but braced by inter-connecting concrete walls.

While men and computers at the engineer's offices were kept busy for years with these schemes, Utzon himself also studied some shell schemes. When all other possibilities had been exhausted, he decided to re-think the whole problem on a new basis. He realised that the most economical construction would use precast elements rather than *in-situ* work; in other words he had to use machine-made components.

To make such machine work possible he had to find a simple geometric shape which would allow for the repetition of the elements. This he did by very subtly altering the free shapes of the shells so that they all became pieces of an imaginary sphere. As Robin Boyd put it: "Imagine that one huge concrete ball was dropped on Benelong Point and shattered into big bits; then the pieces were picked up and re-erected in sail form."

With this change it has become possible to construct the shells from identical parts, triangular concrete tubes or ribs which are visible from underneath but smooth and continuous on top. All these ribs follow spherical curves of the same radius, 246 feet. But although the curvature is identical, the shells vary in appearance and the ribs vary in length and are cut off at differing angles. Only one form, divided into shorter lengths by spacers, is actually necessary. The forms are movable to facilitate mass production and can be re-used several hundred times.

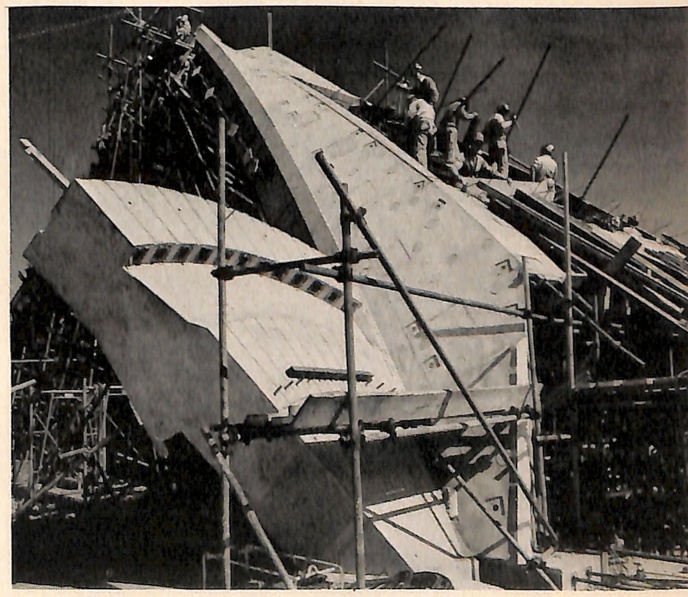
It is not easy to erect these weighty elements 100 feet up in the air. But a movable, telescopic erection arch, devised by the builders, M. R. Hornibrook Pty. Ltd., has overcome this problem. This arch is also made possible by the spherical geometry defining the shell shape, and enables the roofs to be erected without false work or scaffolding. Each rib is stressed as it is erected. Finally the whole shell is post-stressed; that is, reinforcing steel is threaded through the ribs and stressed so that the whole shell acts as a continuous structure.

The shells, in contrast to the rough-textured pink-coloured base, will be covered with white ceramic tiles. The tiles are integrally cast with concrete elements, called tile lids, which are bolted to the structure. Glossy tiles cover the main area of each lid, and white matt tiles line the edges, allowing for the curvature and at the same time emphasising the construction lines of the ribs below. Once again the spherical shape of the shells simplifies manufacture: all the tile lids can be made with one set of forms, re-used several times.

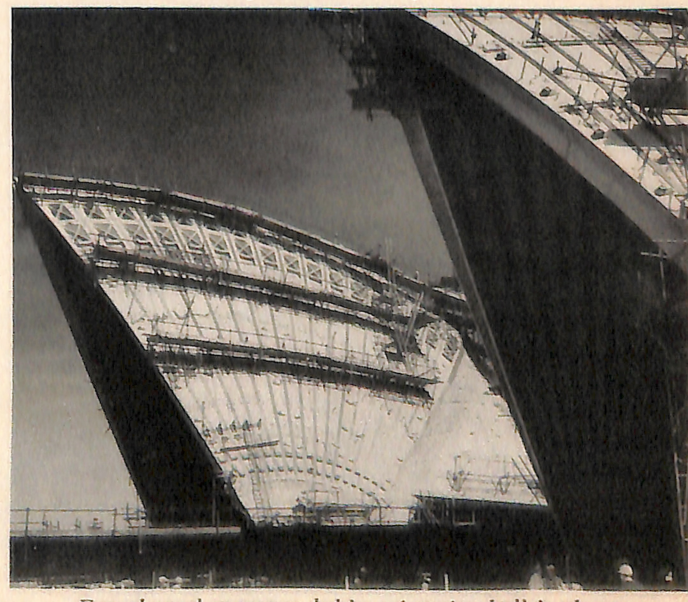
In the original competition design, the ends of the shells had been enclosed with strongly horizontal louvre walls. Utzon is a perfectionist, always ready to revise his ideas, no matter how much work has gone into them, if a better solution presents itself. This approach is rare anywhere and unheard of in the country of "she'll do". When the shell shape was altered, for example, all the mechanical services, stage towers, hall interiors, tile lids which had been worked out previously, had to be re-designed.

Now the horizontal end walls were changed into glass walls which are hung from the shell

Builders have evolved a telescopic erection arch (black diagonal girders) which is used to place weighty concrete rib elements in precise position. These are prefabricated in workshop.



This close-up shows pedestal of restaurant shell. So-called "octopus beam" is poured on the site.



Fan-shaped entrance lobby of major hall is shown with minor hall entrance in foreground. Intricate design with many basic elements can be seen.

structures like curtains and swing out gently from a vertical to a diagonal position at the bottom. At about three-feet centres are mullions, all differing in shape, built up from moulded plywood, with a hot-bonded skin of bronze on the exterior. The glass is attached in overlapping positions, as in a glasshouse or in giant louvres.

Beautiful, exciting, spectacular, or whatever the outside appearance of the building, it would make little sense if the halls were not perfect from a theatrical and acoustical point of view. In spite of some nasty jibes by visiting celebrities who have obviously not bothered to find out the facts, the acoustics in the halls will be excellent, because the design of the halls is quite independent of the structure and is completely governed by acoustical requirements.

Acoustical conditions in a hall are affected by many physical factors, in particular the amount of sound-reflecting and sound-absorbing surface areas. Reflecting surfaces make the sound brilliant but may create echoes; that is a situation in which you hear a new sound simultaneously with one that has been made previously. This is, of course, most disturbing and sound-absorbing surfaces must be increased to prevent it. When the surfaces of a room — the walls and ceiling — have to follow a given structural shape then echoes are often difficult to avoid.

At the Opera House, where hall shapes are completely free from structural restrictions, it has been possible to have very large reflecting surface areas. Thus we will have brilliant sound, equally good from almost any seat and with the intended reverberation period for each type of sound — speech, song or instrumental. The highly specialised work for this was done by Dr. L. Jordan, in Copenhagen, and Professors Cremer and Gabler in their acoustical laboratories in Berlin-Charlottenburg. These men were acoustical consultants for many of the new theatres and opera houses in Germany, including the Berlin Opera House, which are recognised for their excellent sound conditions. Most of the work is done on one-tenth scale models. The Sydney music critic, Roger Covell, who has recently visited the Berlin laboratories and observed the tests, was deeply impressed and is very optimistic about the musical and theatrical prospects of the two halls.

Ceilings and walls of the minor hall are stepped plywood reflectors, hung from the shells, and fan out so that all lines concentrate on the stage. The ceiling elements are all curved and (as in the shells) they are based on one and the same circle, yet are totally different in appearance. The minor hall has 1,200 seats arranged in steeply rising curved rows, as in an amphitheatre. One of the reasons for this arrangement is that spectators can see and have more contact with one another. Exit and entrance doors are invisible and hence the theatre appears closed and concentrated even when the doors are open.

The major hall has 2,800 seats for concerts and either 2,200 or 1,800 (depending on the required stage opening) for opera. Approximately half these seats are on the balcony, the remainder in the stalls.

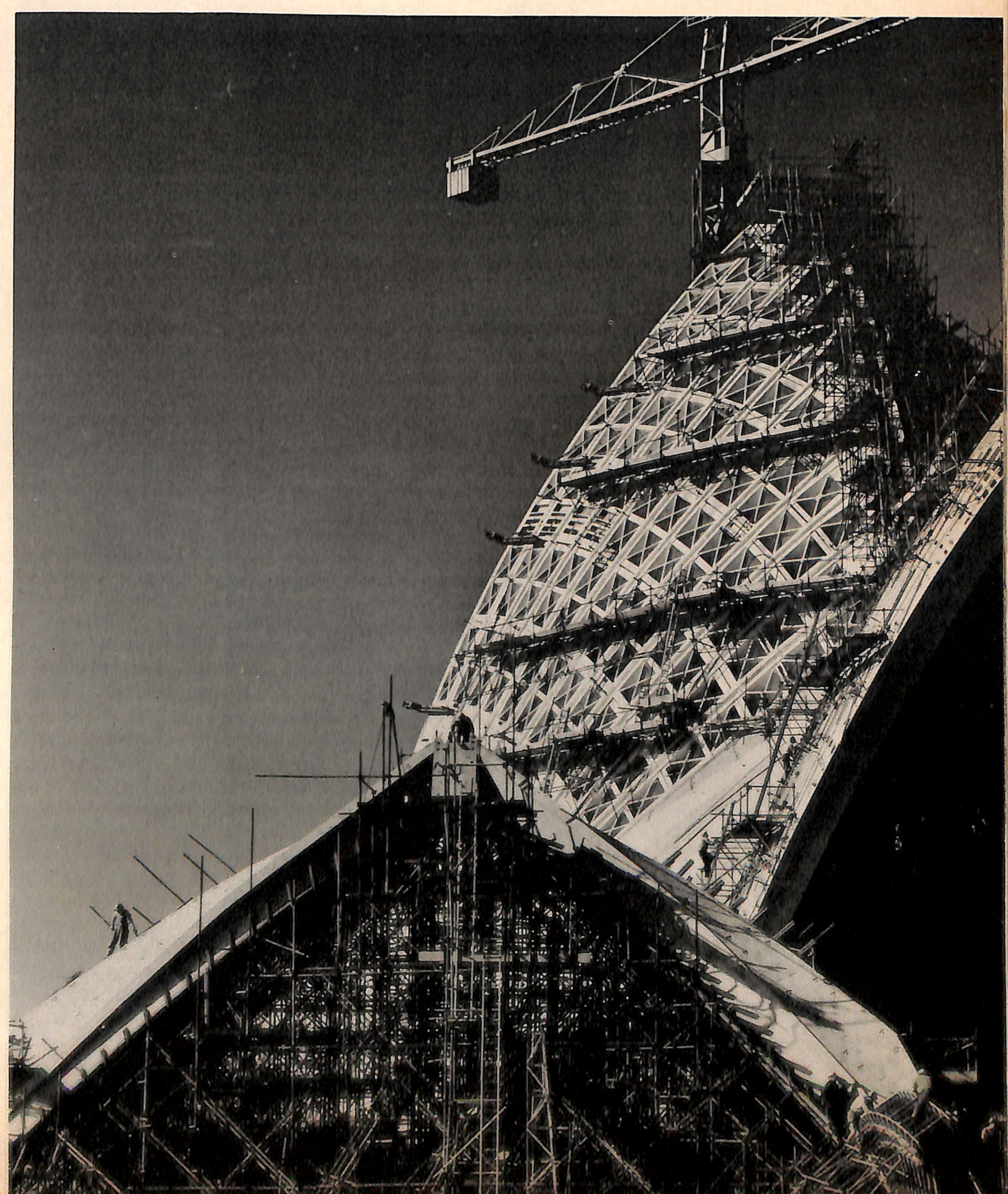
Since the site at Benelong Point was restricted and the halls are placed side by side, it was not possible to introduce side stages. In the minor hall a revolving stage with two built-in platforms overcomes this problem and makes quick scenery changes possible. In the major hall the problem has been solved by dividing the whole stage area into sections, 50 feet by 12 feet in size. A set can be made up from between one and four of these sections on a lower level behind the stage area. It is then moved by stage trucks under the stage and raised vertically by electrically driven winches. This makes it possible to arrange for extremely fast changes of scenery.

A great deal of the stage machinery which was built in Austria has already arrived and is stored, where necessary, in air-conditioned rooms. It was ordered early, to forestall price rises.

Stage lighting involving as much as 850 kilowatts for the major stage and 650 for the minor (apart from lighting for the auditoria and the rest of the building) is being manufactured partly in Germany and partly in Australia.

It is difficult, at this stage, to forecast an exact finishing date. This is mainly because almost any part of the building covers new ground, solves completely new structural, functional and aesthetical problems which are thoroughly studied and investigated by architects and consultants on drawings, models and full-scale mock-ups.

But once the building is finished, there is no doubt that Sydney will be immeasurably richer; it will possess a building which will not only be a unique architectural concept, renowned in the whole world (and hence quite likely a tourist attraction), but also a very important cultural centre. It will replace the antiquated Town Hall with its poor acoustics, and give Sydney the kind of theatres a large metropolis needs and deserves. In four different halls it can simultaneously accommodate, say, a symphony concert or an opera, a chamber music concert or recital, a play and a lecture. With its six-language simultaneous translation system it will also be suitable for international conventions and conferences. It is, perhaps, an anticlimax that one of the first bookings for this exciting building should be for the World Congress of Dairy Farmers, in 1970.



Unlike most modern buildings, Sydney's Opera House preserves its beauty even in the throes of construction. Ugly scaffolding cannot obscure the sweeping contours.

THE WEST IS BOOMING

BY MALCOLM UREN

THE CINDERELLA STATE it has been called, and, more recently, The New California. Neither name is apt. Western Australia would resent being regarded as a less favoured sister among the Australian States; and, while there are some slight similarities in geographical situation and sudden development between the American and the Australian western states, details of their development show few points in common.

Events of the past five years have given to Western Australia a new image. But its contours are not yet clearly defined, because so much has taken place in so many ways in so many regions. Quite suddenly a primary producing State has greatly widened its economic base by secondary effort, yet, at the same time, has expanded its traditional role of gaining wealth from the soil.

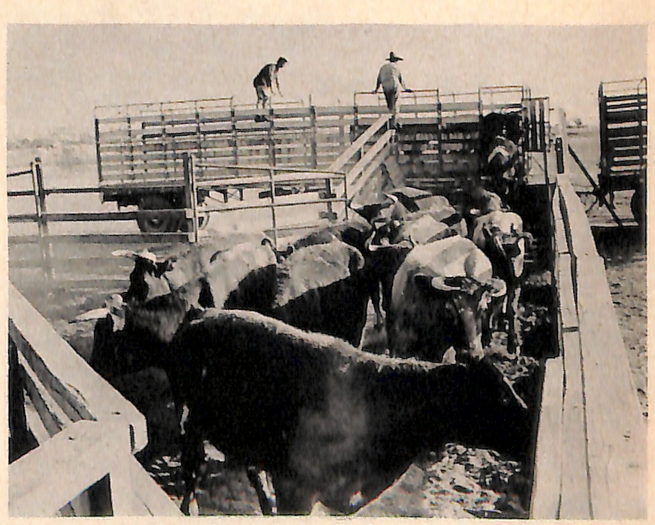
To attempt to set down in detail the developments of the past decade would produce a long and very impressive list of new industries established in the State and of old industries expanded, but the overall story can best be told regionally from north-west to south-east.

The sudden, spectacular development of the north-west region (which represents about one-seventh of Australia's total area) has attracted attention all over the world. This was the most neglected part of the Australian continent; neglected because it was thought to be difficult to handle. It was situated in a sub-tropical zone; living conditions were unattractive because of the discomforts and inconveniences of isolation; and much of it was rough country good only for open range cattle raising on stations of up to 1,000,000 acres.

Because of the discovery of massive deposits of iron ore (rich in quality and of such extent that development can be planned at least two decades ahead by treating only the ore in sight and not worrying about what lies underneath), between $450 million and $500 million is now being injected into this region for mining it. Export earnings from it will probably exceed $2,600 million during the next 25 years.

Almost overnight, construction camps have been set up in the Pilbara district to carry out the essential work for the big overseas consortiums providing the bulk of the money.

This great region which could only be properly developed by big projects involving millions of dollars is now being propelled ahead with amazing speed and over a wide face. At least four new towns and perhaps six will burgeon; three new ports are being built and three others improved; over 500 miles of railways will carry some of the largest ore trains in the world, from mines with the most modern plant to ports where cargo-handling devices will be installed to fill ore-carriers of at least 45,000 tons (and later up to 100,000 tons), so that the turn-round of the carriers in terms of hours sounds unbelievable.



These cattle have been brought by road train to Derby from outlying Kimberley stations. They will be shipped to Hong Kong on the hoof. RICHARD WOLDENDORP

Prawn fishermen unload their catch at Monkey Mia in the Shark Bay area. A new and lucrative prawn industry is being developed here and at Carnarvon.

Aerial view of Mount Tom Price shows early progress which has been made in building access roads to the immense deposits of iron ore which are to be extracted and railed to Port King.