Creating the Burj Al Arab Dubai

By Tom Wright RIBA

In 1993 Atkins was commissioned to design and construction manage the Jumeirah Beach Resort Development. They were asked to provide architectural design, structural engineering design, building service engineering design and civil engineering design. This slide show follows the Burj Al Arab from sketch to reality.

The development site is on the sea side of the Jumeirah Beach Road and was once occupied by the Chicago Beach Hotel. The Hotel was demolished to make way for the Wild Wadi Aquapark. The service compound is situated on the other side of the road on less valuable land.

The Jumeirah Beach resort development is built 15KM from the centre of Dubai. At the time this appeared to be an unusual choice of site as it was still possible to drive from the the city centre to the site off road over the desert.

This picture was taken from the Dubai World Trade Centre in about 1988.

About 20 years later the same view shows the incredible speed of development. The Burj Khalifa can be seen half constructed on the left of the image. The Burj Al Arab in the distance on the right.

In the early nineties HH Sheikh Mohammed Bin Rashid Al Maktoum knew that Dubai's easily accessible oil would not last for ever.
His solution was to invest in the city itself with the intention to create a world wide tourist destination.

Although the oil was running out there was an abundance of sun sea and sand. The perfect ingredients for a holiday on the beach To kick start the project he decided to build a super luxury hotel the likes of which had not been seen before. The brief for the new hotel was deceptively simple. “Create the most luxurious hotel in the world. A building that would become an icon for Dubai.”

A series of totally unrelated events cemented by being in the right place at the right time found the British architect Tom Wright with two weeks to prepare a scheme for the new hotel. It was October 1993. But where to start? When designing in any country It is a good idea to start by having an understanding of it’s history and culture.

The Maktoum family, decendents from the nomadic Bedouin tribes, have played a key role in the development of Dubai since 1833. Dubai grew around the Creek a shallow but navigable inlet off the Arabian Gulf conveniently located to trade with Persia and India. Trade agreements with the British helped establish the city with pearl trading being the chief driving force in the economy. Between 1920 and 1960 the fragile economy took a downturn due to the great depression of 1930, the disruption of trade caused by the second world war and the emergence of artificial pearls. In 1960 Dubai looked like the photo below all of the buildings were low rise and many constructed from coral stone blocks with a organic mud render finish. Wind towers were used to cool the buildings by drawing air through the interior over damp cloths.

From 1960 oil, along with increased port trade due to the dredging of the creek, has driven the economy to new levels of prosperity.

Looking to the history of Dubai for architectural inspiration resulted in the wind tower which is fascinating but not dynamic and the shape of the traditional Dhow sail which is dynamic but had already been used for the Dubai Creek and Yacht Club deigned by UK architects Godwin, Austen and Johnson. The Bedouin tent, pearls and oil were also considered but once again did not inspire. Dubai is a city looking to the future so it was decided that the architecture of it's Icon should not look back to the past but should be aspirational and forward looking. A study of other buildings that have become world icons was undertaken…….

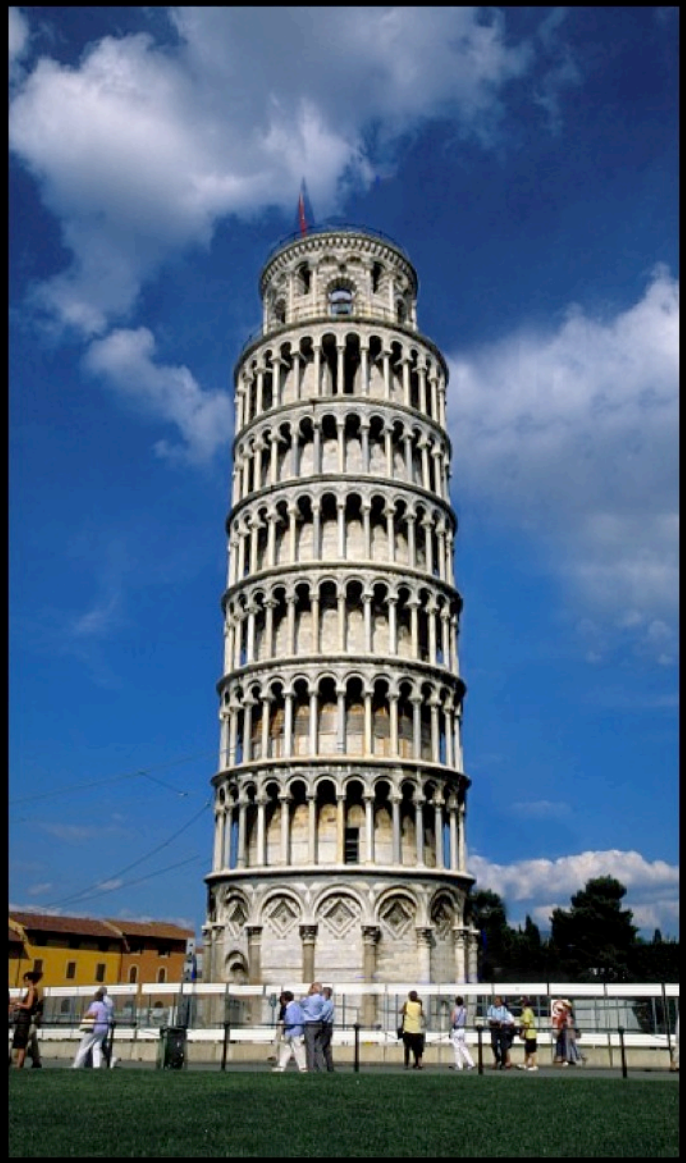
This could be any metropolis in the world……

Then the Sydney Opera House was built and suddenly the Australians were thought to be cultural, dynamic, modern and exciting.

Another anonymous city……

But then the Petronas Towers were built in Kuala Lumpur and the city emerged. Tallest in the world, and two of them, modern, financial clout, world city.

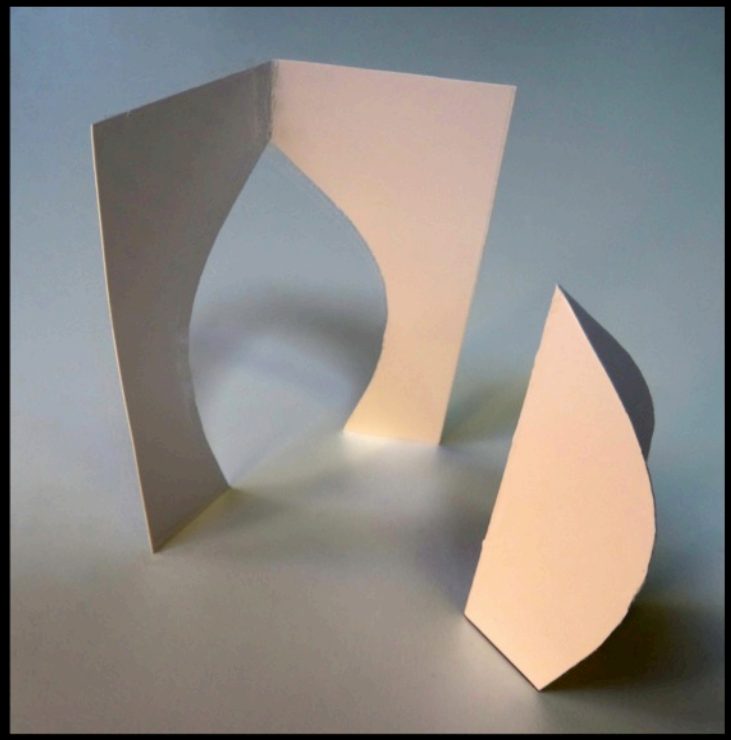
Another nation that wanted to announce to the world its modern engineering prowess.



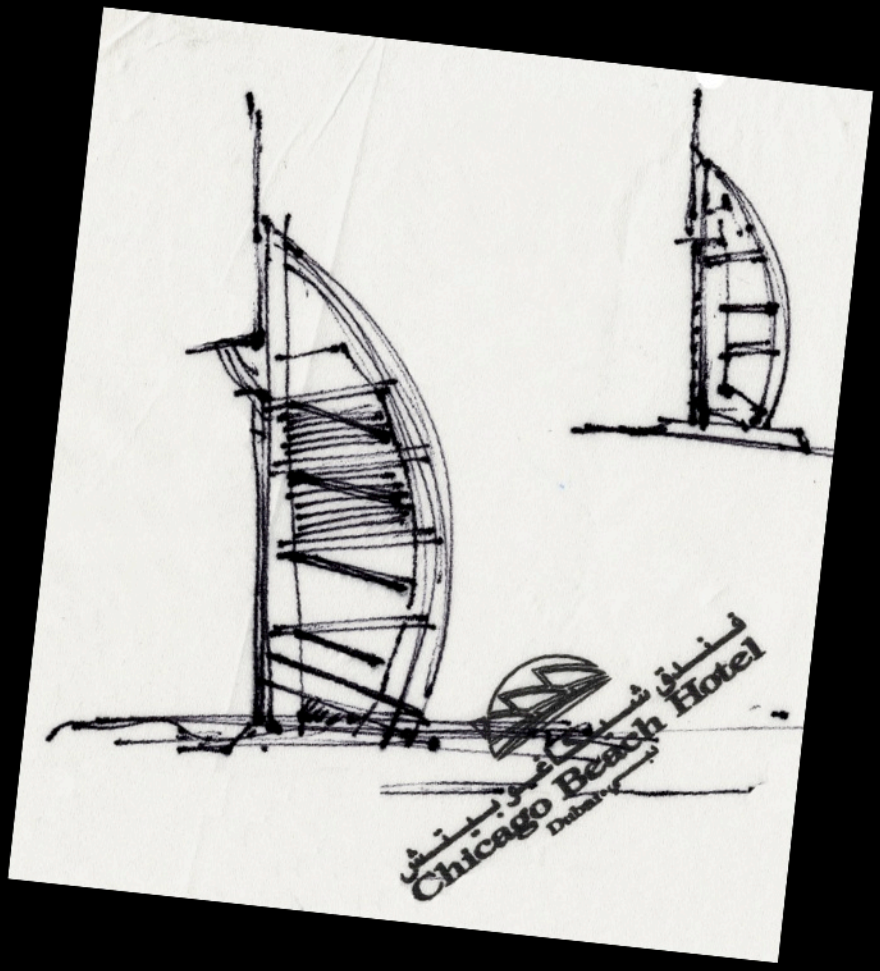
The image on the left shows just another marvelous historic building in Italy. The picture on the right however, shows an icon. Which leads to the rather obvious conclusion that iconic structures have one thing in common, a memorable uniqueness of form.

We decided that a good test to determine the iconic nature of a building is if it can be drawn in 5 seconds and most people recognise it and the city it is synonymous with. There are surprisingly few structures in the world that pass this test.

The modern sail shape of the hotel was prompted by the desirable high end holiday associations of sailing as a sport and the success of the Creek Yacht Club design (also commissioned by the same client). The sail form was also totally different from any other known world building so had every chance of becoming an icon.



One of the world buildings that was looked during the study of iconic structures was the Arche La Defense in Paris. The idea of a gateway arch inspired one of the rejected concept options which was a similar arch building but with a traditional Arabic arch form. This option is only notable as the shape that was thrown away when the arch was cut out later became the form of the chosen idea. This might help explain why the Burj Al Arab feels so inexplicably Arabic.



Tom Wright's first sketch drawn in the Chicago Beach Hotel in October 1993.

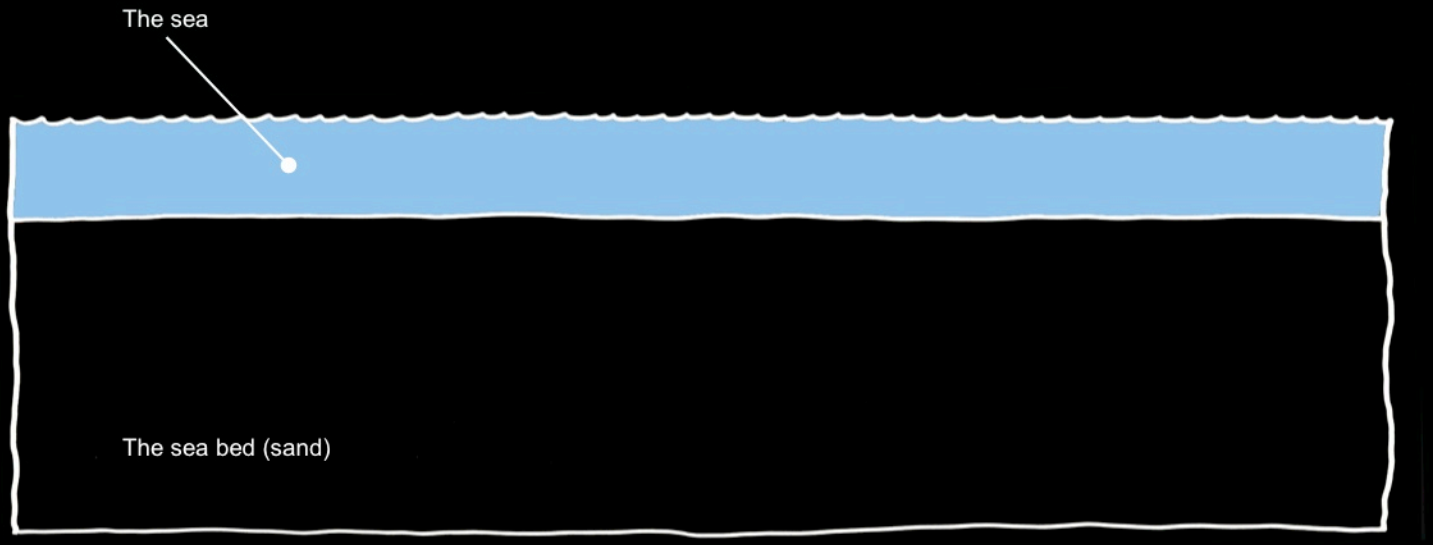
Two weeks after picking up the brief this pencil sketch and the simple card model shown on the next slide were presented to the client. At the end of the presentation the scheme was approved and construction was to start immediately.

The design team left the UK and moved their families to Dubai, the average age of the team was 32 years old, we were young and comparatively inexperienced but we made up for it with boundless energy and enthusiasm! We were responsible for the following aspects of the design, architecture, structural engineering, building service engineering, civil engineering, cost consultancy, project management, construction management. At the time the Jumeriah Beach Resort Development was the largest construction project in the world.

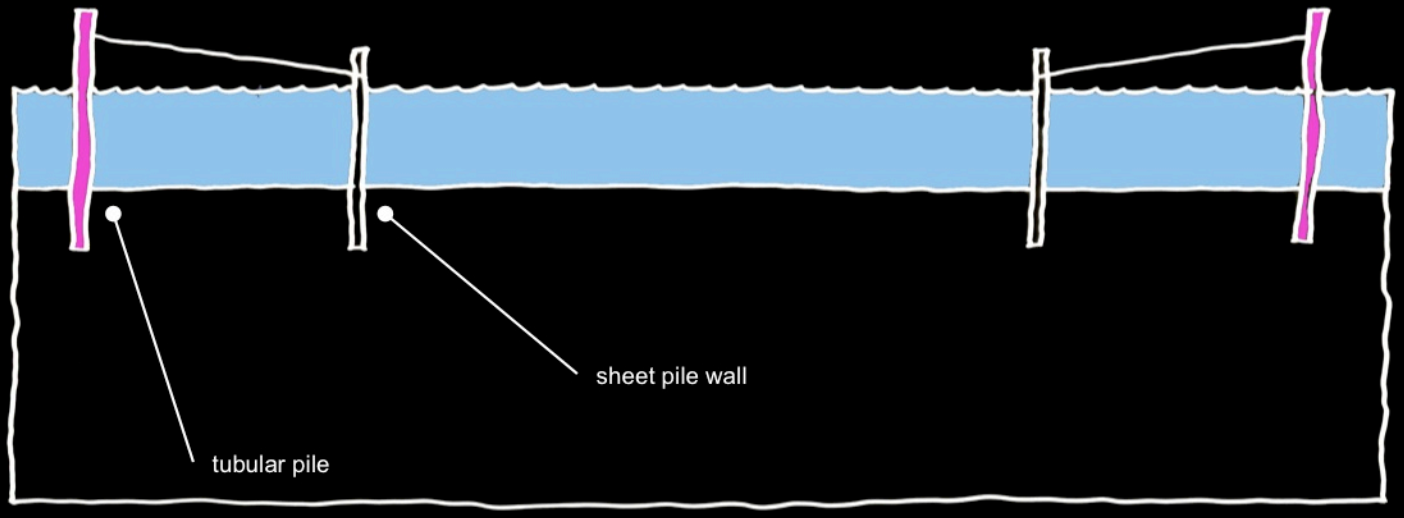
construction time line

1994 | 1995 | 1996 | 1997 | 1998 | 1999

The following sequence of slides show the construction of the Burj Al Arab. The start of the island construction early 1995.

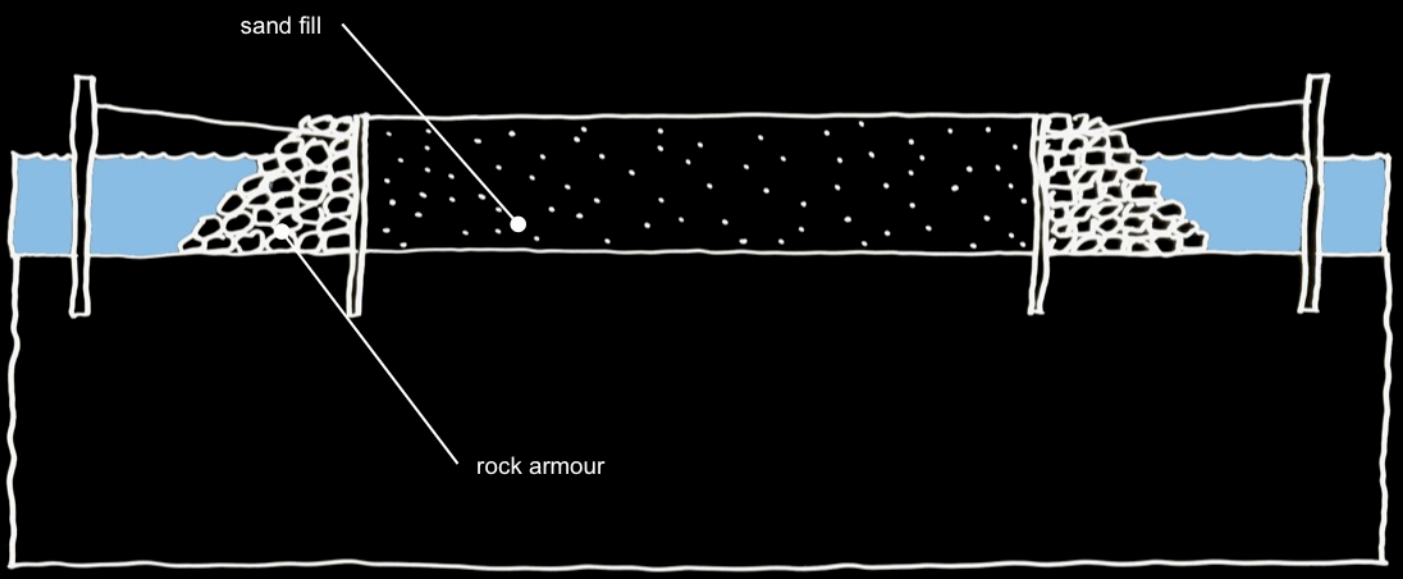


The island is constructed 300M off shore in 6M deep water.

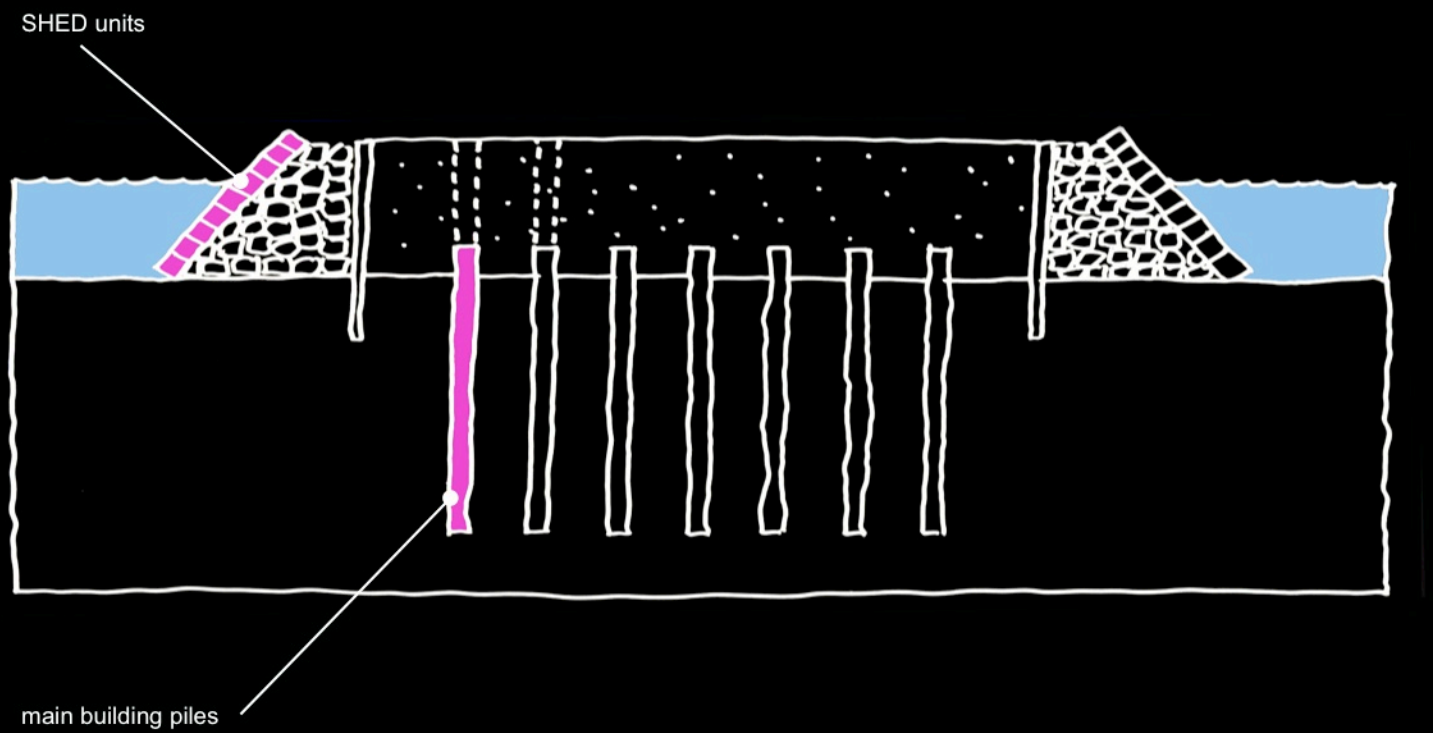


cross section through island

A ring of steel interlocking sheet piles was built that formed a wall the shape of the island. The wall was temporarily held up by tubular piles and cables.



Sand was used to fill up the island inside the sheet piles. Rocks were placed around the outside to protect the structure. Once the rocks were in place the temporary tubular pile could be removed.



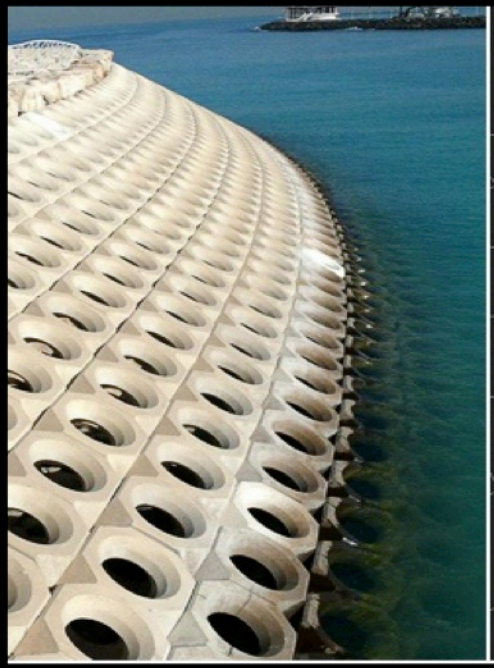
The sand fill was used as a working platform from which the main building support piles could be constructed. Sea defense SHED units were placed around the outside of the rock armour.

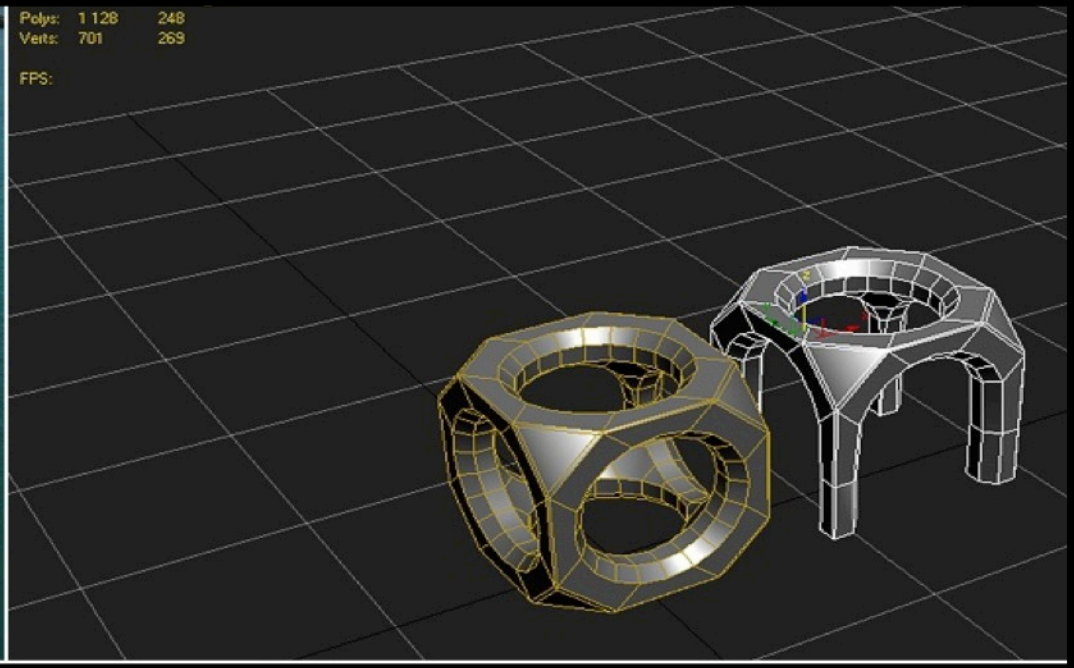
construction time line

1994 | 1995 | 1996 | 1997 | 1998 | 1999

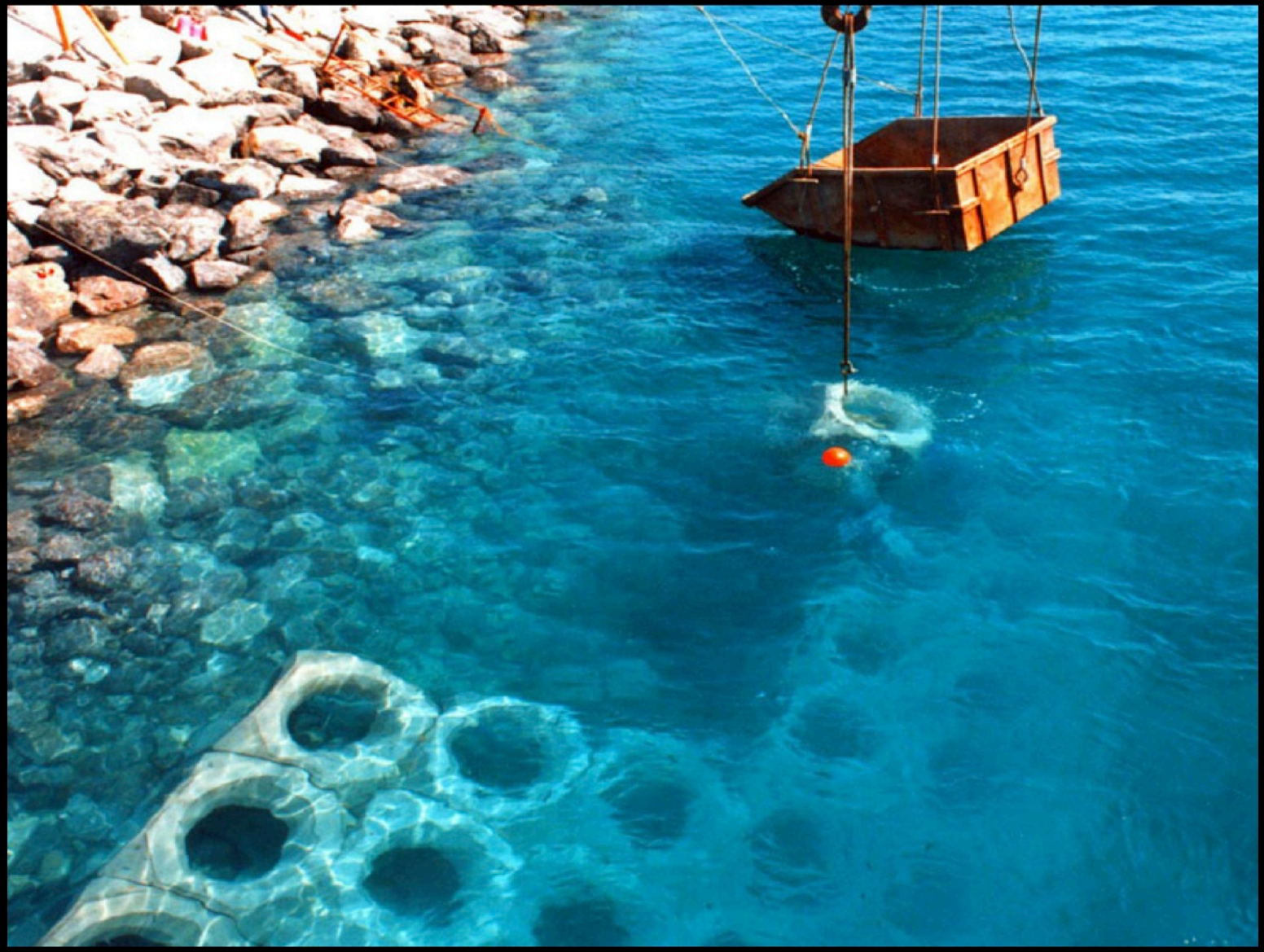
Showing piling rigs used to construct the main building piles. Rock armour surrounds the island.

This is pile testing rig was used to determine the ability of the pile to hold up the weight of the building, The Burj al Arab is built on sand so the support piles rely on the friction between the concrete pile and the sand. There are 230 piles each 45M long and 1.5M in diameter.

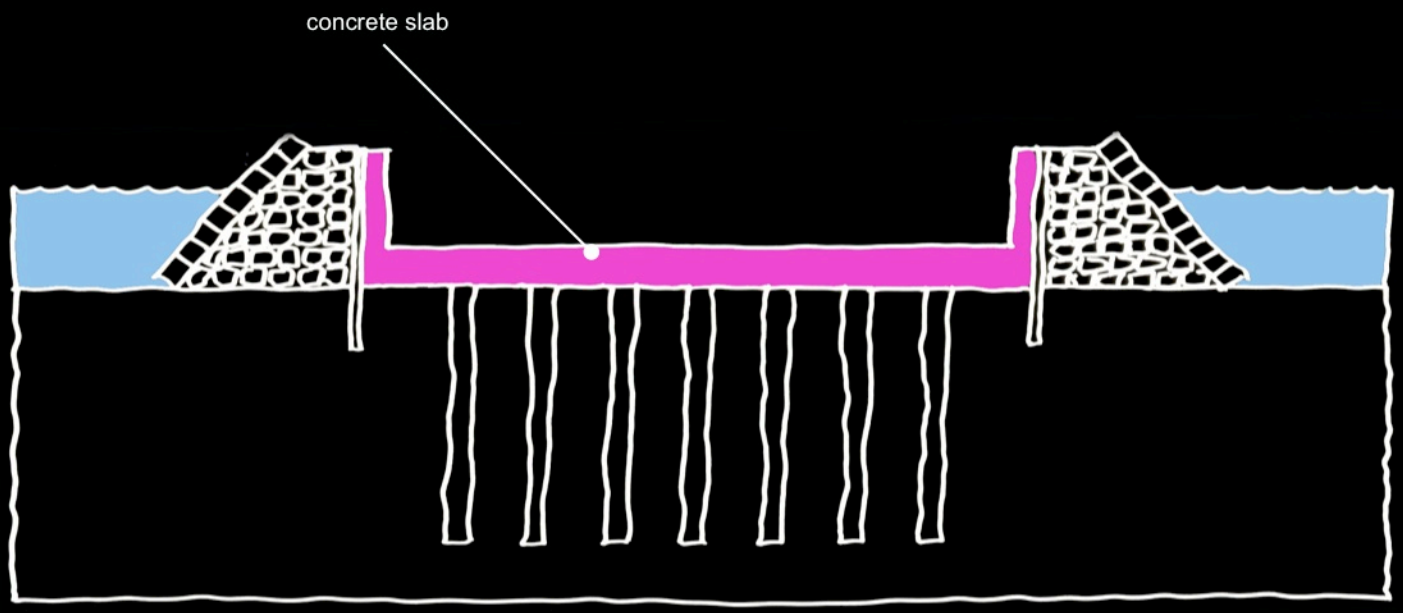




SHED units were used to dissipate the action of waves hitting the island. The island sits 7M out of the water and is designed to protect the lower floors of the building from a hundred year storm.



Divers direct the SHED units that are being lowered underwater by crane.



The sand fill was then removed and the ends of the piles exposed. A two meter thick waterproof concrete slab and concrete side walls were constructed. The top of the slab is 7 meters below sea level.

Sand fill being removed by digger in the background. The main building pile caps exposed and being broken down to the slab level in the foreground. The interlocking steel sheet piles hold back the water until the concrete basement wall is constructed.

construction time line

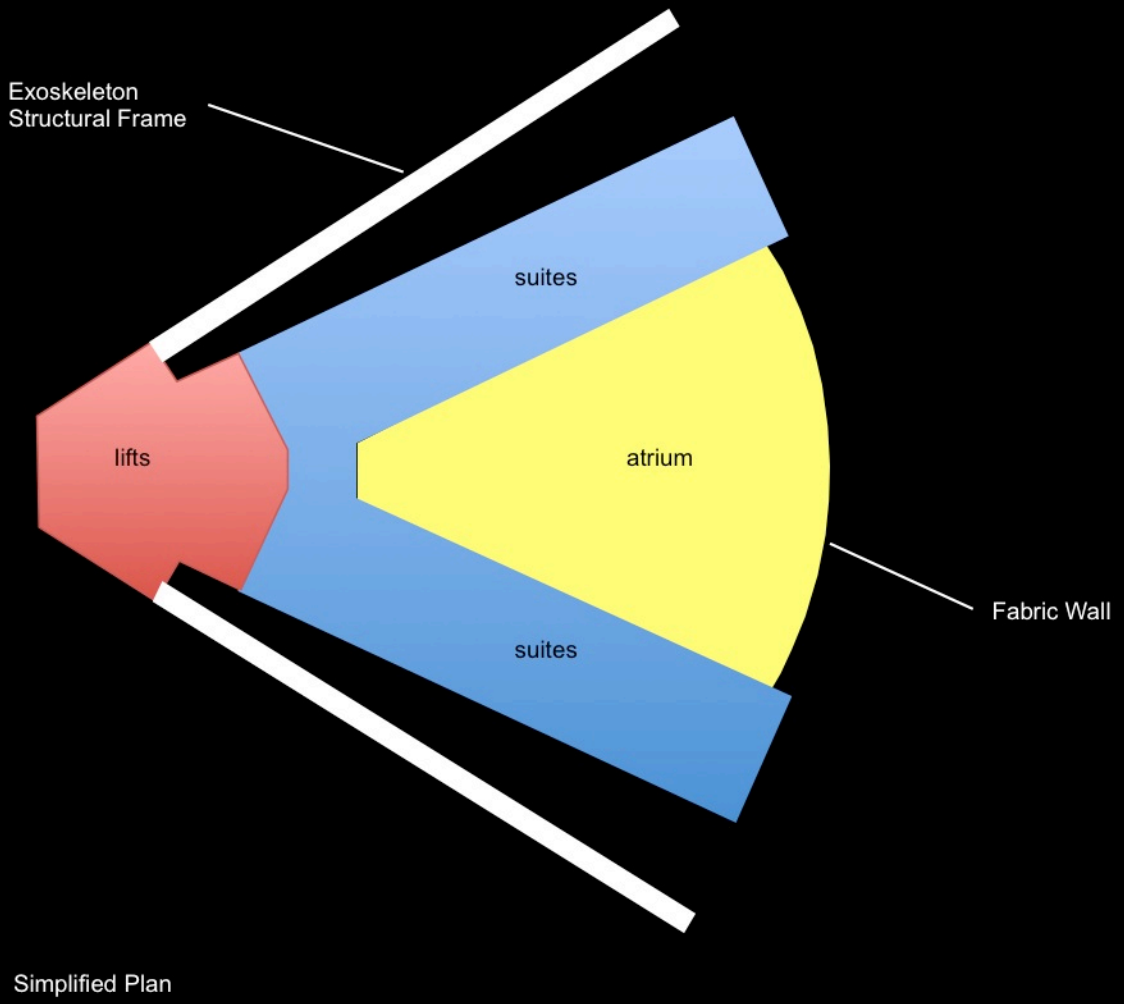
1994 | 1995 | 1996 | 1997 | 1998 | 1999

The island is now waterproof and the basement floors are under construction. The SHED units are complete.

construction time line

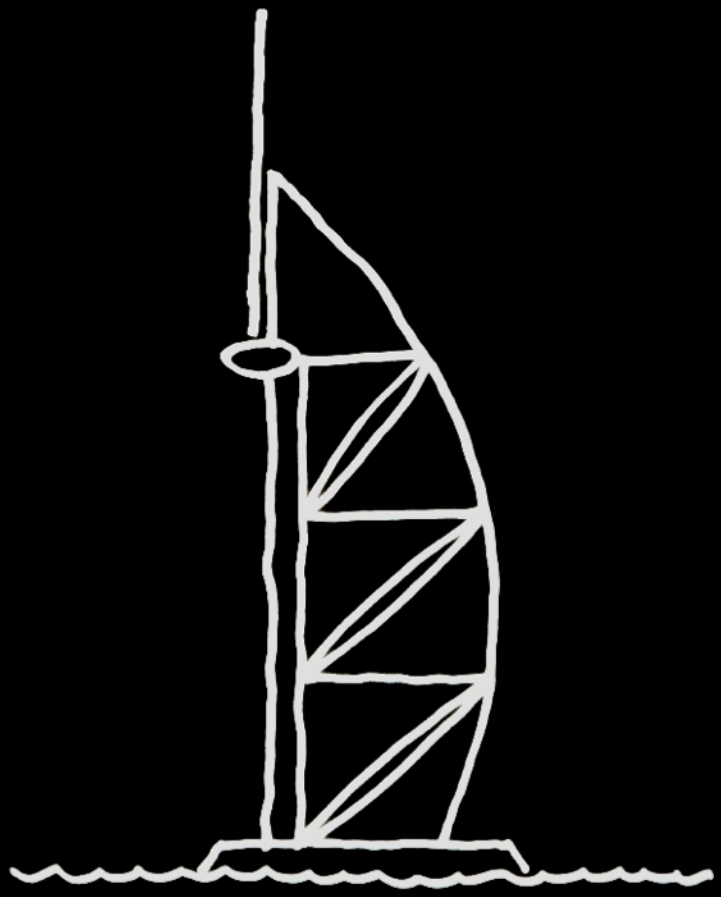
1994 | 1995 | 1996 | 1997 | 1998 | 1999

January 1996, it has taken a year to build the island. The superstructure of the hotel has been started. In the background of this photo the construction of the Jumeriah Beach Hotel is well advanced and the old Chicago beach hotel is still open for guests! The design team meanwhile has been busy creating the superstructure design.



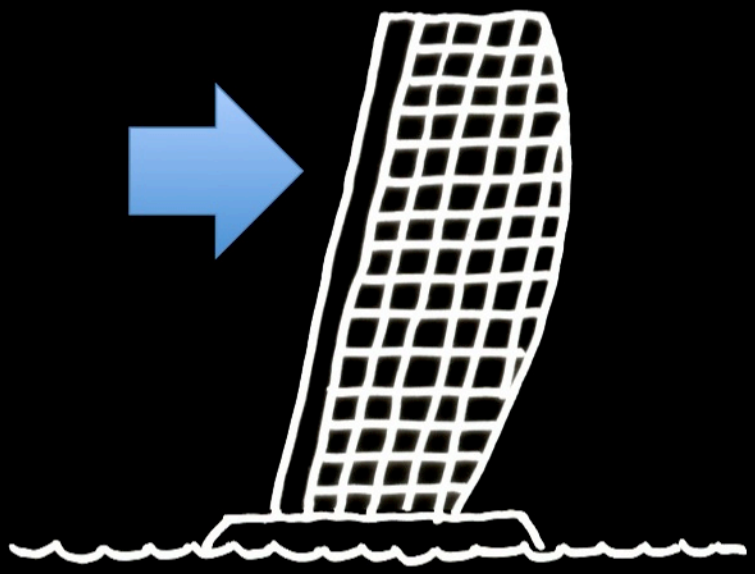
Simplified Plan

The plan of the hotel comprises two wings of suites either side of a triangular atrium. A PTFE fabric wall encloses the third side of the triangle. The lifts form a solid structural element at the corner where the suite wings meet. The structural exoskeleton frame ties into the lift core.

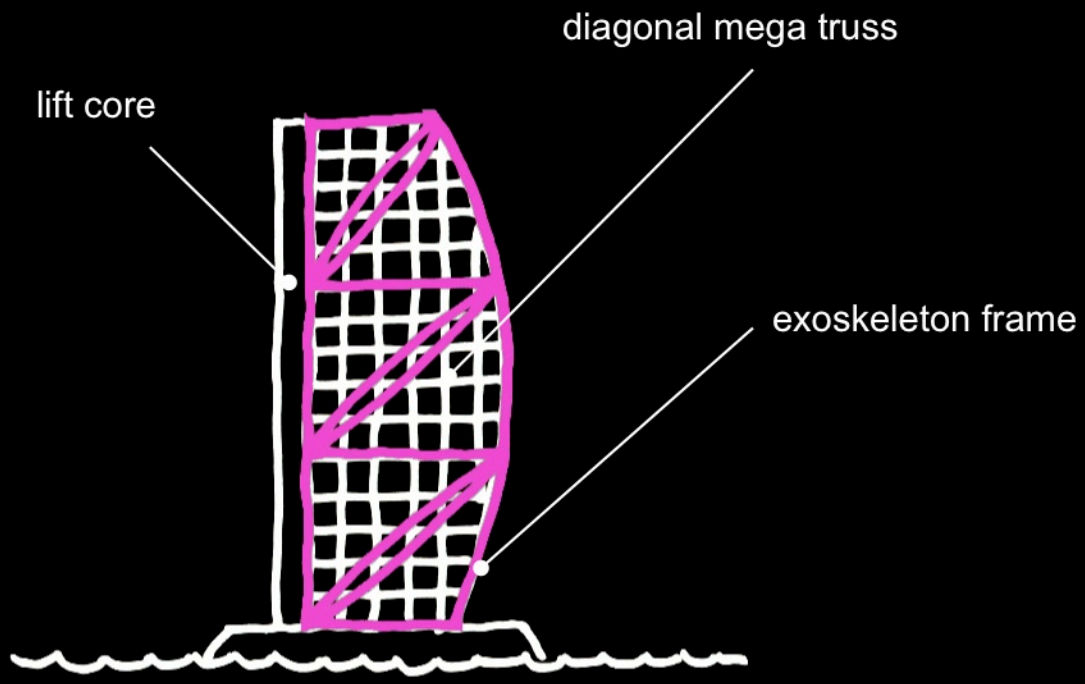


Much of the architectural expression of the hotel comes from the main structural bracing which is expressed on the outside of the building in the form of an exoskeleton frame.

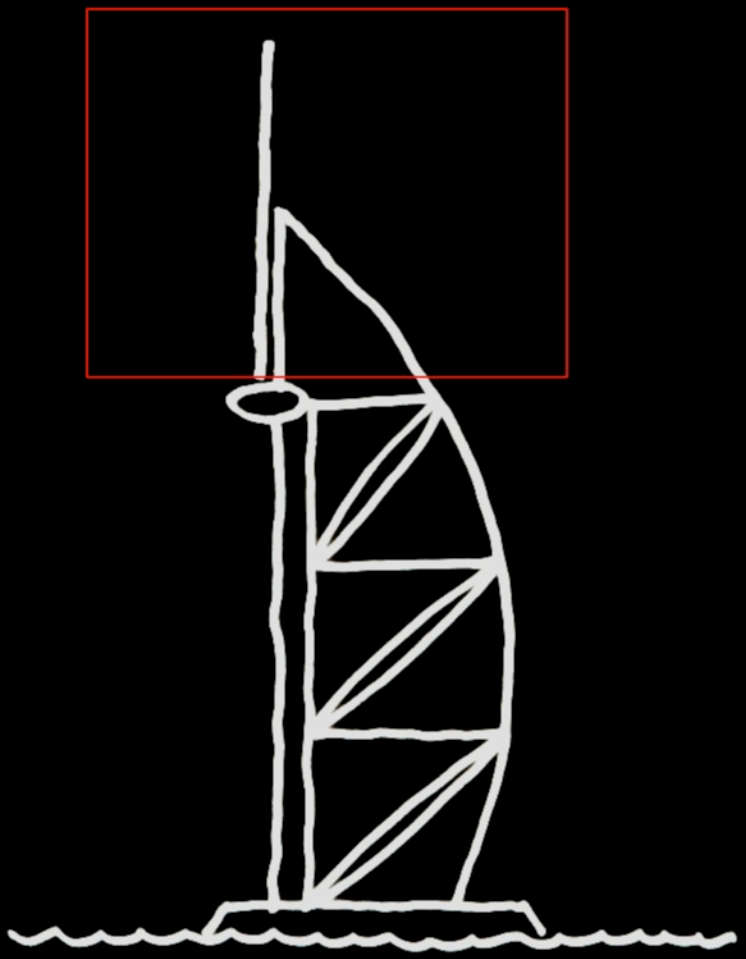
The concrete floor slabs and vertical sheer walls are partially stiffened by the main lift core.



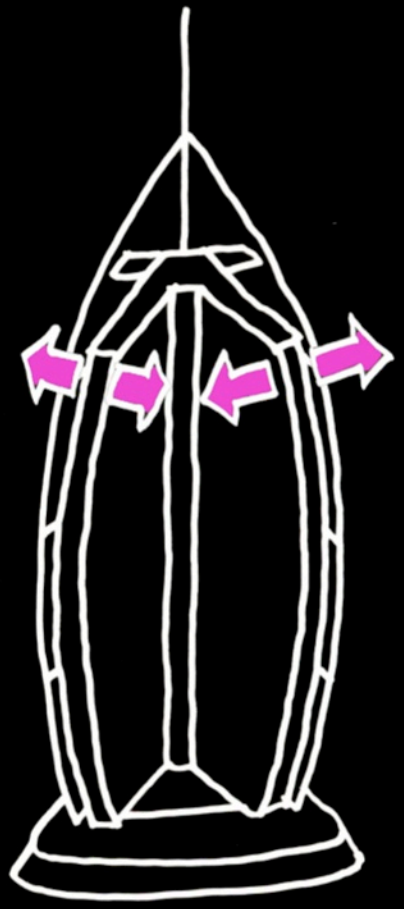
However when the wind blows in storm conditions the building would rack without cross bracing to stiffen it.



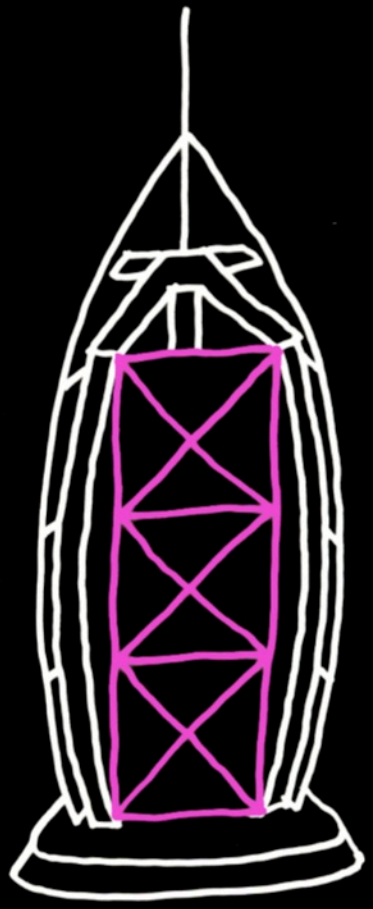
On two sides of the building three steel mega trusses are used to brace the structure. The trusses are connected to a steel exoskeleton which is attached to the main lift core. These components act together to stiffen the lift core and thus the whole building.



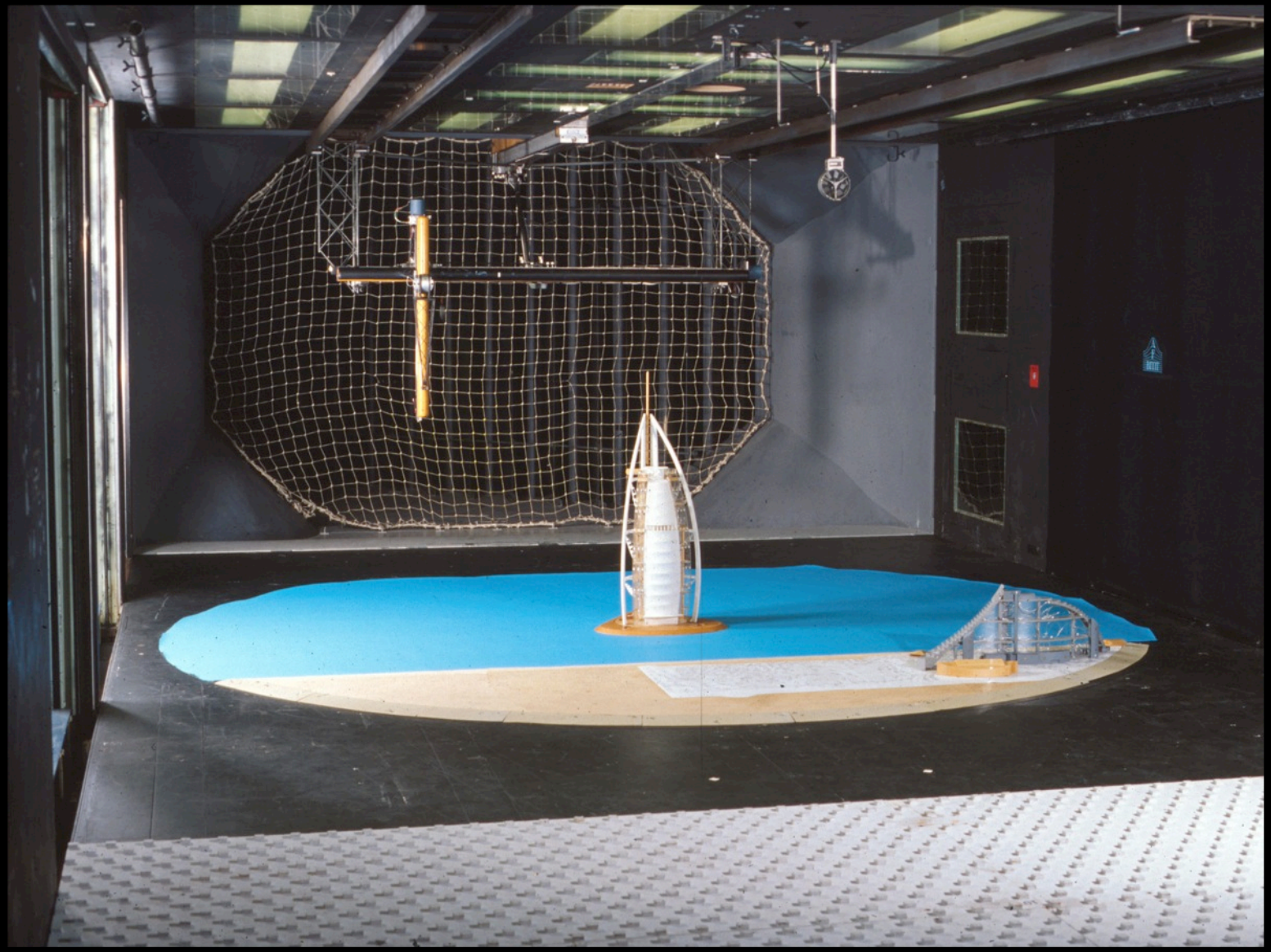
The top part of the structure supports the mast. Supporting the mast gives the top part of the structure something useful to do other than look good!



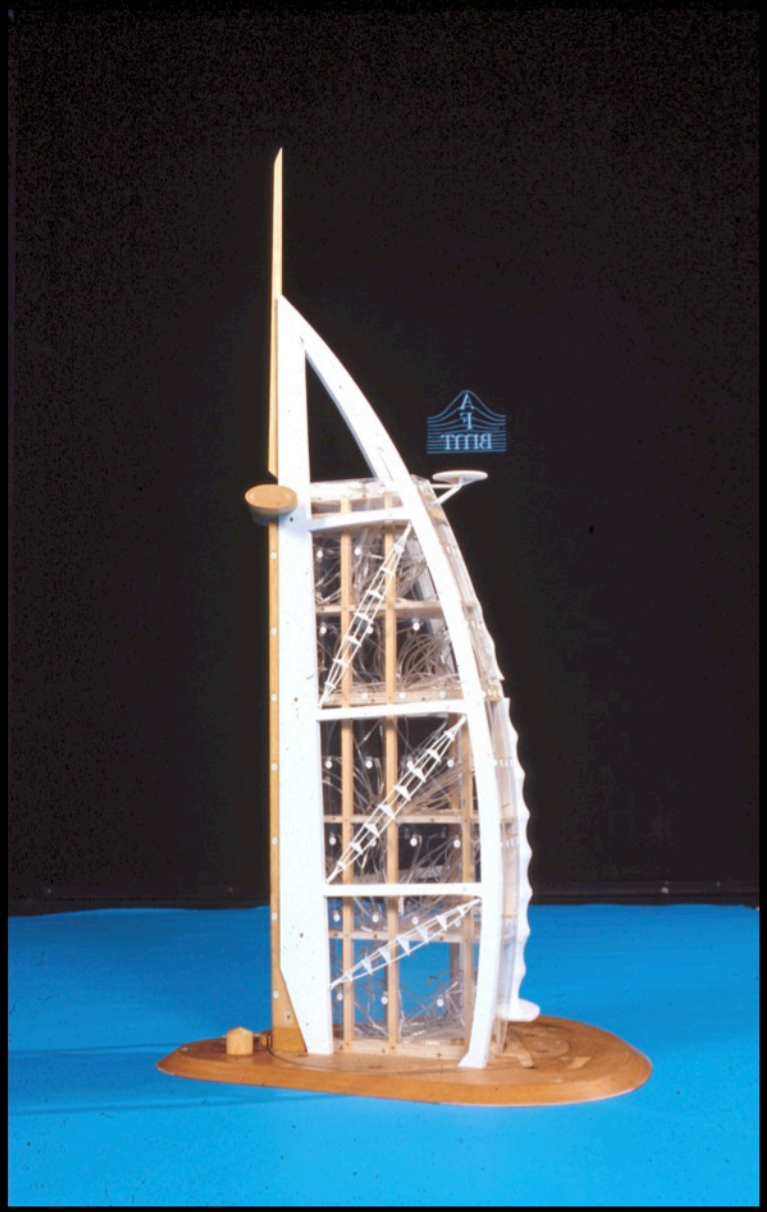
The two accommodation wings also require bracing in the other direction.



Huge cross braces are fixed inside the atrium behind the fabric wall to tie the whole structure together.



This image shows the hotel undergoing wind tunnel testing.



This is the scale model constructed for the wind tunnel tests the pressure sensor holes and tubes can be seen.

One of the many scale models constructed during the design process.

construction time line

1994 | 1995 | 1996 | 1997 | 1998 | 1999

The concrete sheer walls are constructed using reusable steel formwork resulting in a quicker construction time and less wastage of materials compared to traditional timber formwork.

construction time line

1994 | 1995 | 1996 | 1997 | 1998 | 1999

The lower bracing and first diagonal mega truss has to be installed to stiffen the structure before the building gained too much height.

The centre piece of the lower cross brace is lifted into place.

The longest mega truss is 85 meters long and weighs 165 tonnes. They were constructed in Jebel Ali 15 Km from the site and transported in one piece on giant 40 axel trailers that had to be imported from South Africa specially for the job. The top truss was lifted into place using strand jacks, the top truss took a day to lift.

The trusses are pinned into place with a tolerance of less than 10mm. The hole the pin fitted through was off centre so that it could be turned to allow 100mm of adjustment should the truss have expanded or contracted in the heat of the sun.

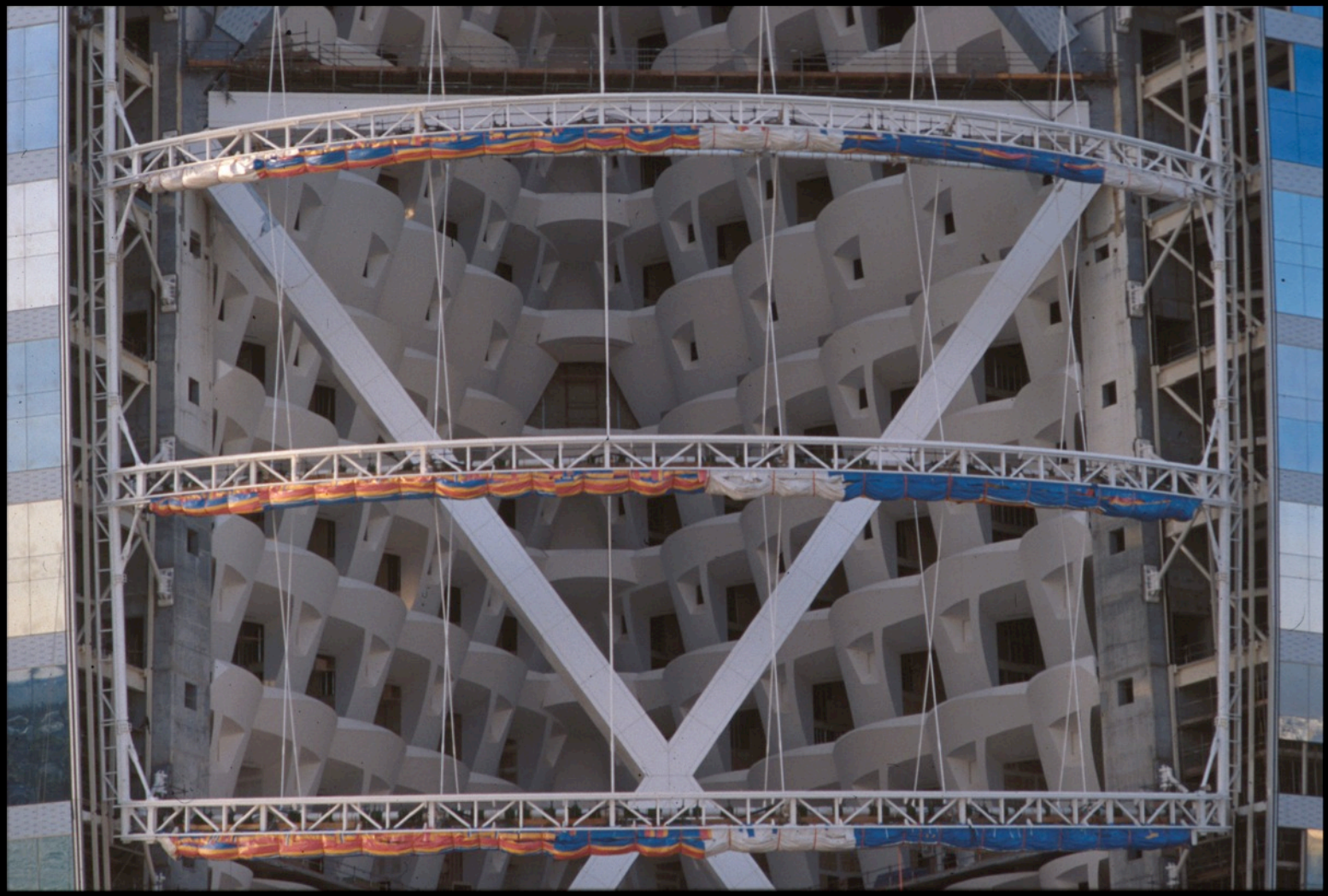
One of the exoskeleton arms crosses the bridge on two giant trailers. The photo right shows the base of the exoskeleton.

construction time line

1994 | 1995 | 1996 | 1997 | 1998 | 1999

The two lower cross braces are in place and the light weight wing end suites are being constructed. Inside the atrium the first curved suite end walls are being installed.

The two storey high suite end walls are fabricated in one piece in a specially built factory that is situated across the Beach Road adjacent to the site.



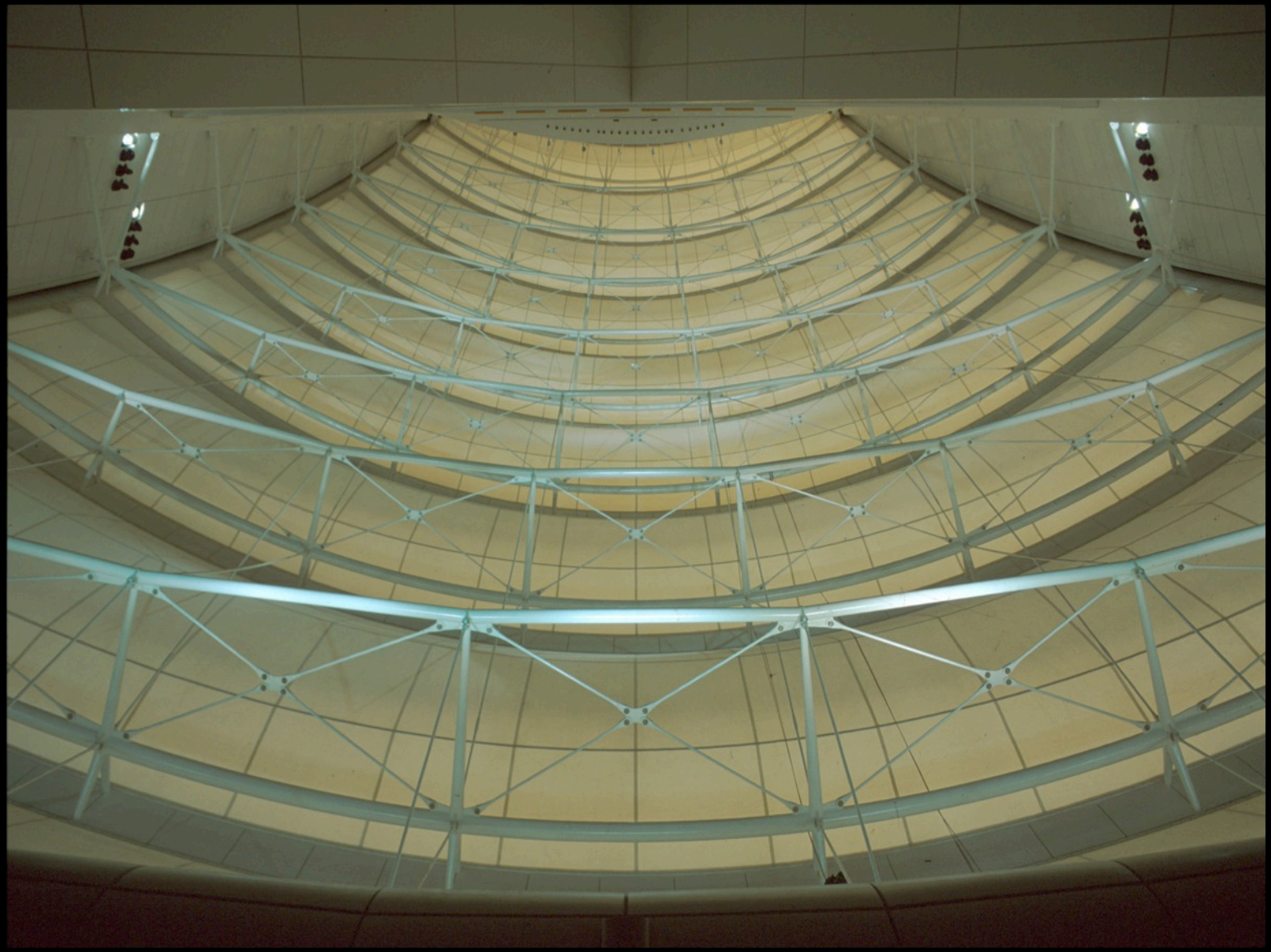
The ETFE fabric wall is shown here furled on it's support trusses like giant square rigger sails. The support trusses are hung from the top of the atrium on cables which are tensioned into the ground next to the main entrance.

When we started to realise we were building something special. Awsome view looking up the atrium under the diagonal cross brace.

construction time line

1994 | 1995 | 1996 | 1997 | 1998 | 1999

Well under way, the glass façade is near completion and the aluminimum cladding is being fixed to the steel exoskeleton.



The twin skin fabric wall unfurled and tensioned.

Final fixing of the fabric was achieved by abseiling. The workers put the enormous size of the fabric wall into perspective.

The mirror glass is specially chosen to be as flat as possible so that the exoskeleton would be reflected to best effect.

The helipad support framework can take a 7.5 tonne helicopter

construction time line

1994 | 1995 | 1996 | 1997 | 1998 | 1999

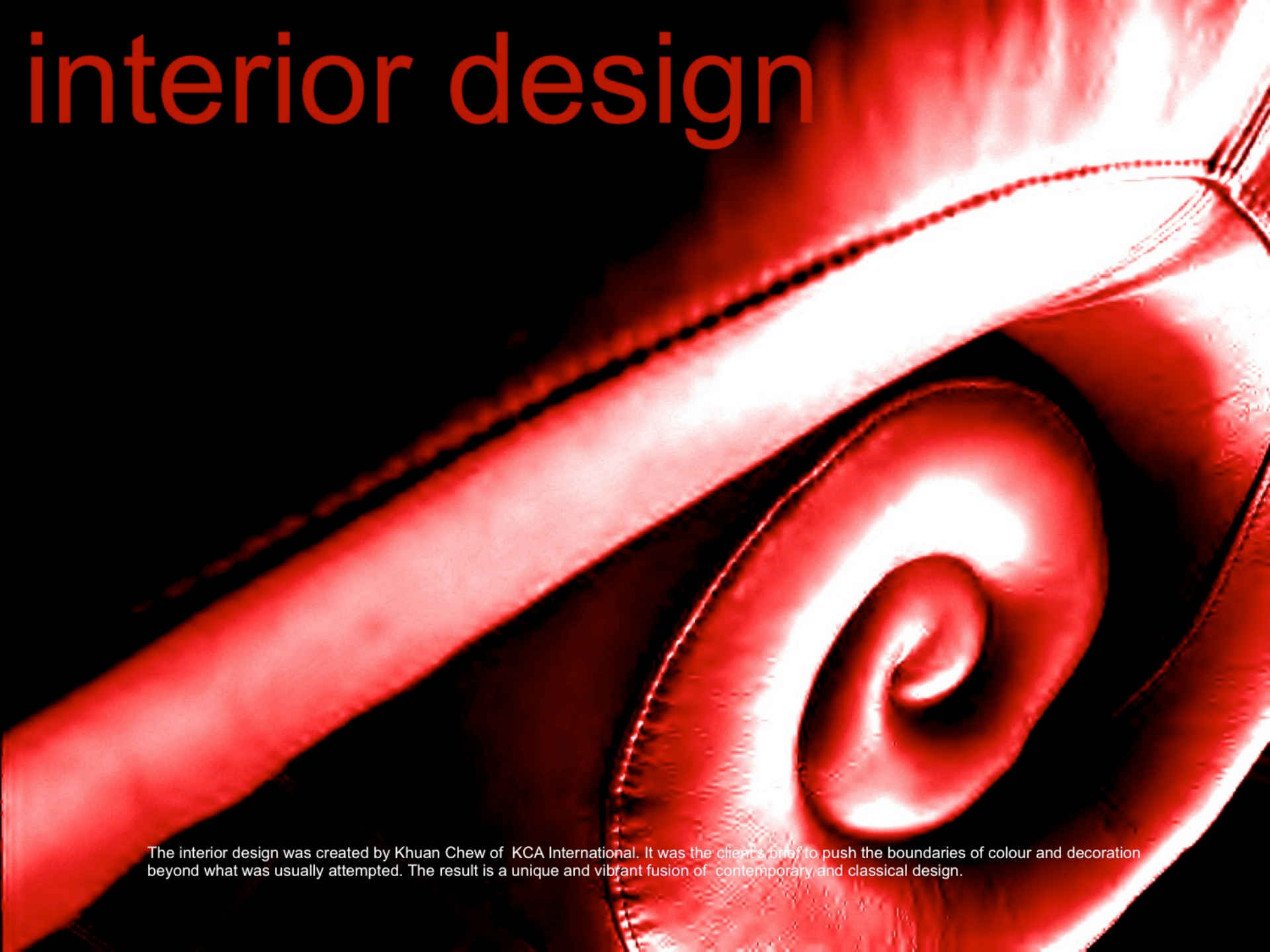
Almost air tight. The interior fit out can start in earnest once the temperature and humidity is reduced by the air conditioning. The new bridge replaces the temporary construction bridge.

construction time line

1994 | 1995 | 1996 | 1997 | 1998 | 1999

Topping out the building with the last piece of the 60 meter long mast.

interior design



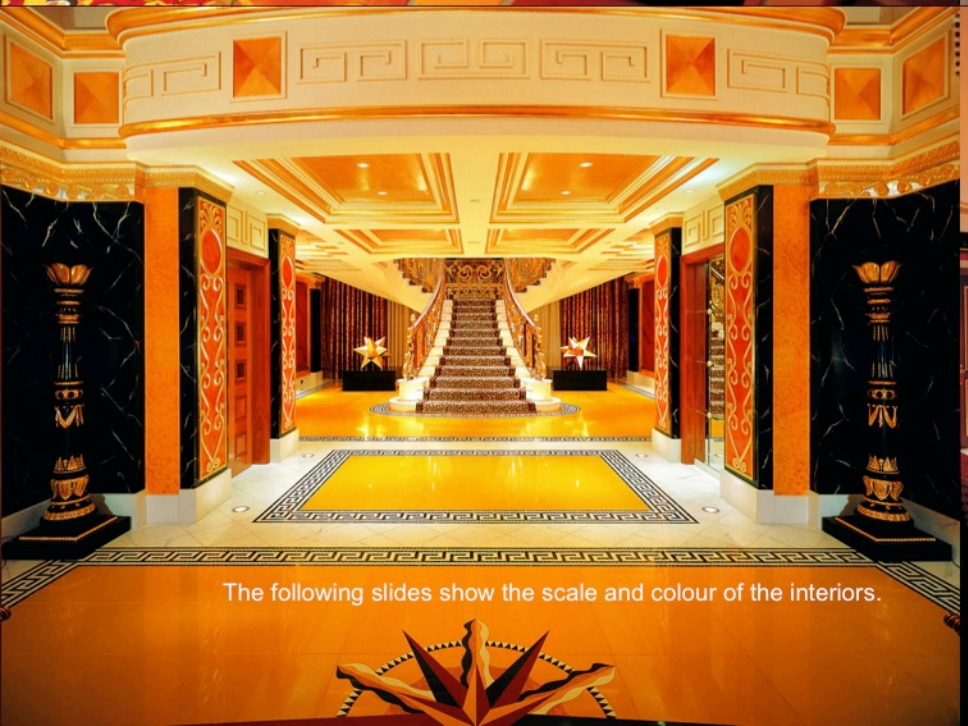
The interior design was created by Khuan Chew of KCA International. It was the client's brief to push the boundaries of colour and decoration beyond what was usually attempted. The result is a unique and vibrant fusion of contemporary and classical design.

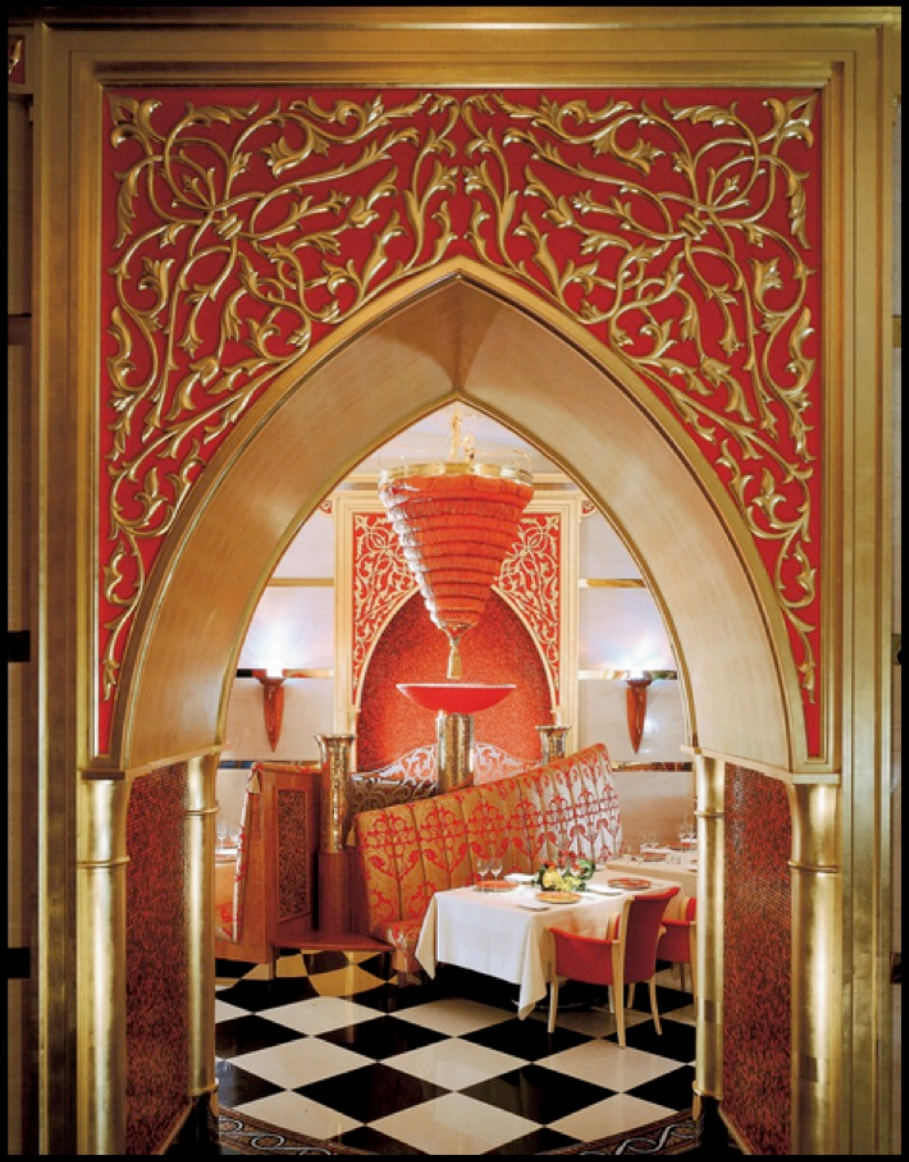
The hotel foyer with the entrance on the left and the escalators to the atrium on the right.

The giant curved sofa in the foyer.

The Burj Al Arab has 201 suites each on two floors. This image shows the entrance hall of the smallest type of suite which has one bedroom and an area of 175 square meters.

This is the living room of the one bedroom suite.


The following slides show the scale and colour of the interiors.



One of the tallest atrium in the world.

construction time line

1994 | 1995 | 1996 | 1997 | 1998 | 1999

….and open in time for the millennium celebrations 2000.

A helicopter can bring guests direct from the airport to the cantilevered helipad suspended 212 meters above the sea.

The helipad has also been used as a tennis court.

If you have a lot of balls……..

…and another man with balls to spare.