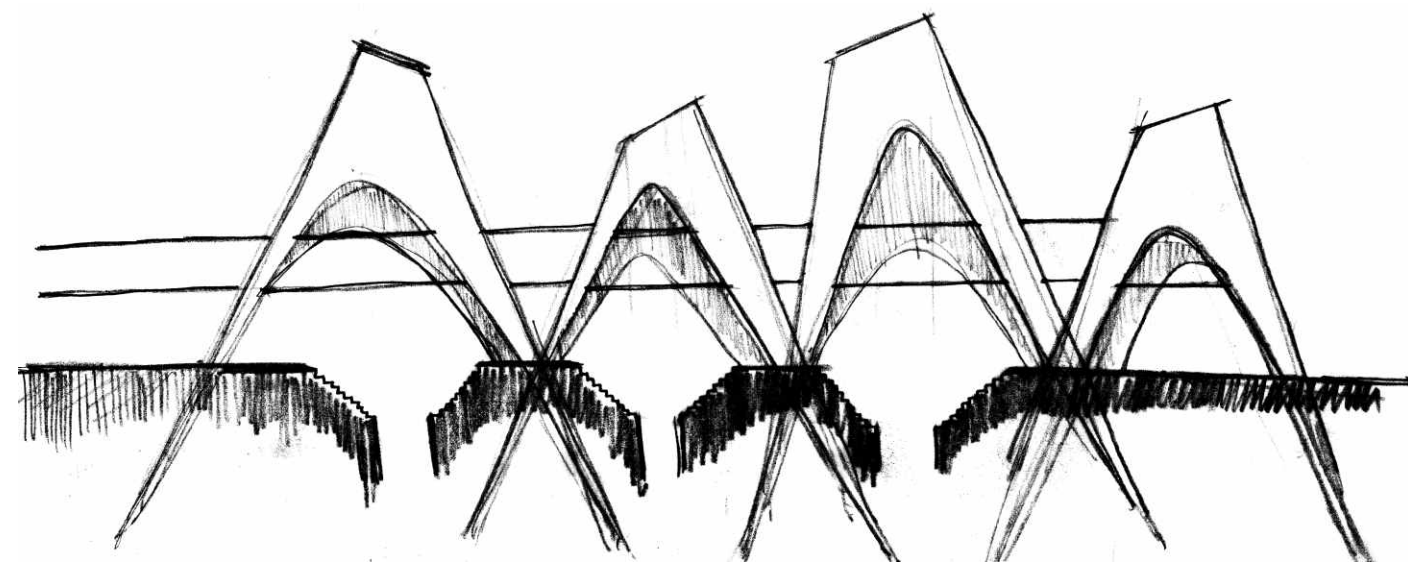


Water Transport Terminal

-Asif Ahmed Syed



Water Transport Terminal

Asif Ahmed Syed

Thesis submitted to the faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of
Master of architecture

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Patrick Doan

February 8, 2010
Blacksburg, Virginia

Keywords: Water transportation, conical building geometry
large ocean structure,

Water Transport Terminal

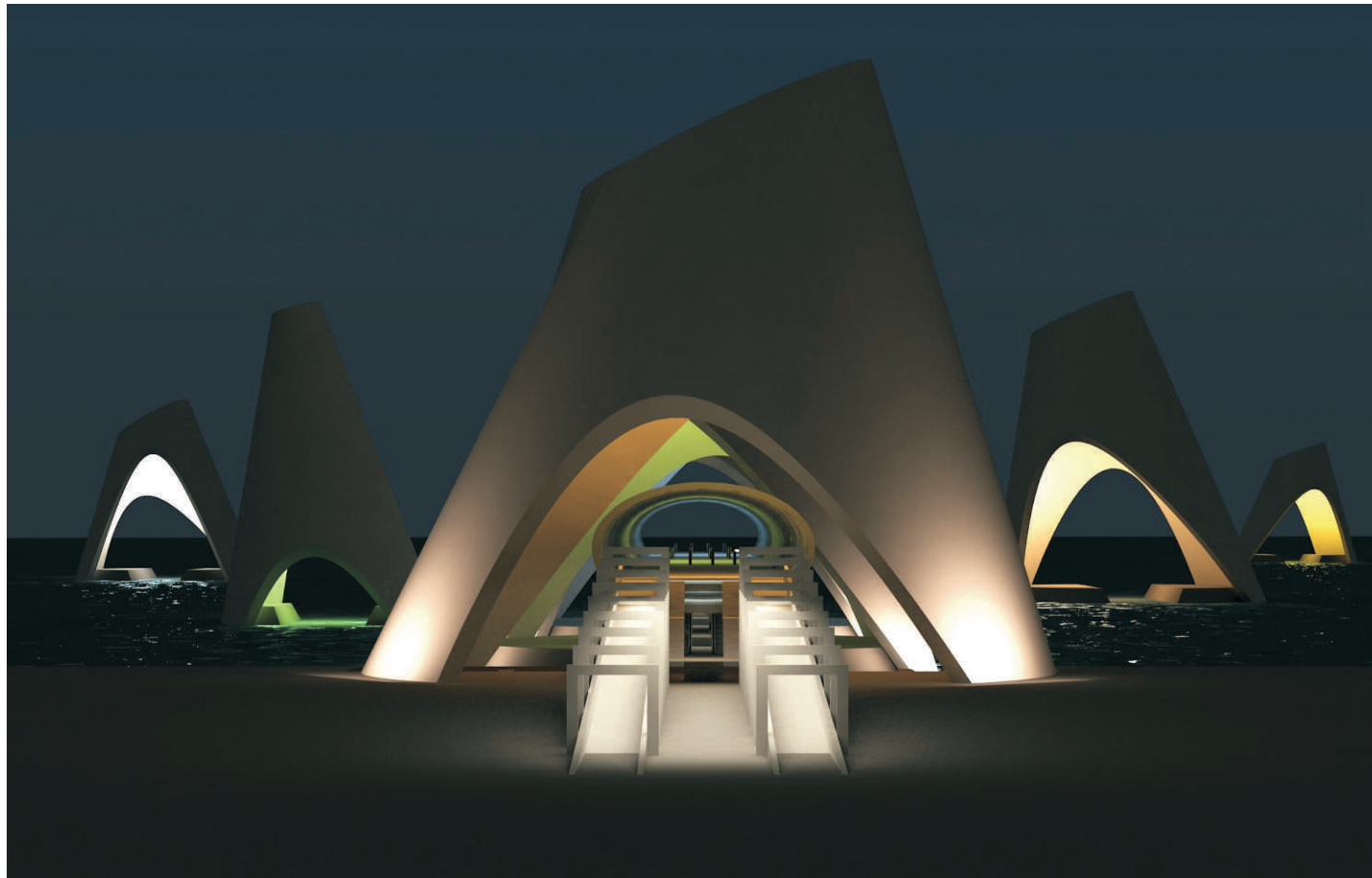
-Asif Ahmed Syed

Abstract

This thesis is an attempt in the exploration of an architectural idea of breaking away from a conventional column beam structure.

This idea led to a geometrical form which would be most stable, supported by itself, and also helps mitigate the lateral forces of wind and water in which it would stand. The conical form and scale achieved in the proposal would also help create a landmark to the city's growing skyline.

It also acts as the point of threshold between land and water, providing an opportunity to sense water in a variety of ways.



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Dedications . . .

To the *almighty* - for always watching over me.

To my *family* - for always being so supportive.

To my *friends* - for those innumerable fun filled moments.

"My humble contribution to architecture"

"Architecture itself is the most basic element: It is the spiritual enterprise trying to explain humanity to itself. No building is architecture; it is merely "an offering" to it. Architecture "can never be satisfied" because it is completely "insatiable," meaning that perfection will never be reached and "form" never realized, just as humanity will never fully understand itself. Nevertheless, it is humanity's destiny to try." (Robert Twombly explaining Kahn, 2003)

Acknowledgements

Firstly, I would like to thank my parents for believing in me and supporting me throughout.

I would also like to thank all my teachers for making me who I am.

Special thanks to members on my committee

Hans - for his guidance

Patrick - for all his time

Jim - for his critical inputs

Steve - for his co-operation

Secondly, I would like to thank all my friends here at Virginia Tech to make my stay in Blacksburg, a cherishable one.

Water Transport Terminal



Context



Fig 1

CHRONOLOGICAL DEVELOPMENT

- 0000 – 1650: MUMBAI: seven agrarian islands
- 1650 – 1853: MUMBAI: colonial mercantile town
- 1853 – 1947: MUMBAI: colonial industrial city
- 1947 – 1980: MUMBAI: port-independence commercial city
- 1980 – pres: MUMBAI: global city



Fig 2

The latest of the connections between the Islands

Maximum CITY

What is now recognized as Mumbai (formerly Bombay), originally consisted of seven discrete coastal islands. Over the span of five centuries, the seven islands have gradually physically united through land reclamation projects to form the city of Mumbai as it is today.

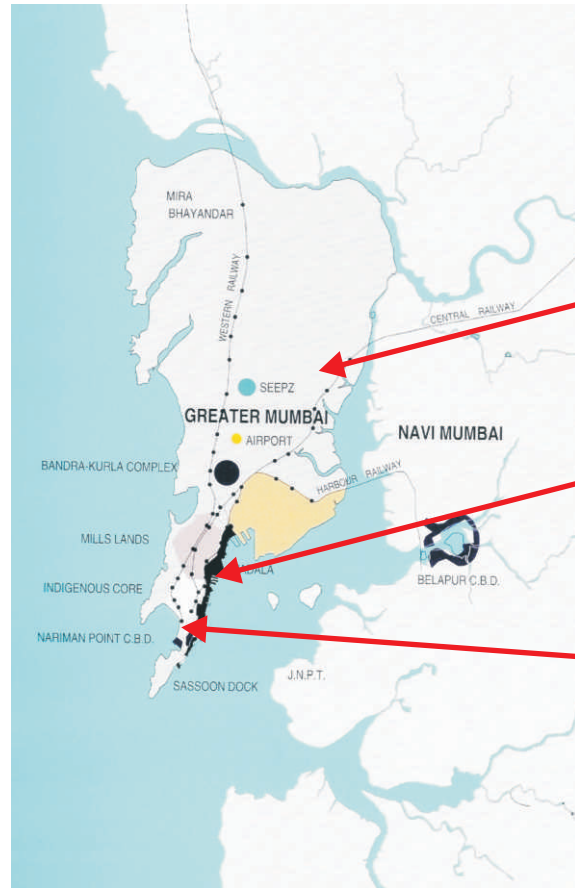


Fig 3

NORTHWARD EXPANSION

THE EASTERN WATERFRONT

THE URBAN PENINSULA



Fig 4

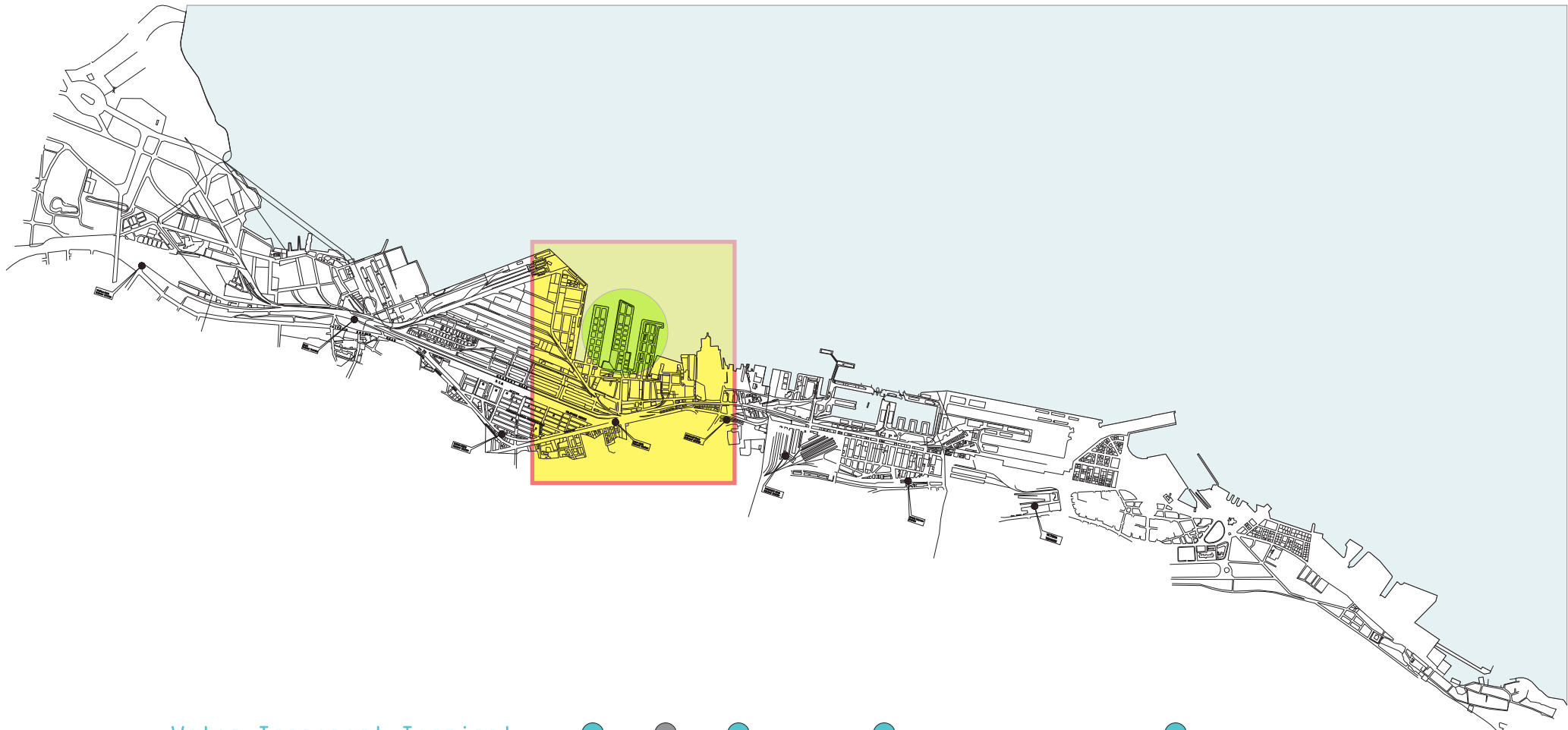
Land area = 1/8th of the metropolitan area

Waterfront length 20 miles

Eastern Waterfront

The Eastern Waterfront of Mumbai spans a length of about 30 km from Colaba in the south to Thane in the north. Within the island city, the waterfront area not only harbours the port activities of handling passenger and goods traffic, but also various defence uses, along with small and large-scale industries. Towards the north in Greater Mumbai, the area includes the Bhabha Atomic Research Centre, the oil refineries of Trombay, the mud flats, salt pans, and marshlands.

The de-industrialization of Mumbai city and the specific changes in the port related activities of the Eastern Waterfront have become the prime concerns for its rehabilitation and improvement and open the land for public use.



The Site

The site extends out in the Arabian sea on the eastern edge of Mumbai. This is a very strategic location from the perspective of connectivity between the inner city and its ever-expanding periphery.





Fig 5



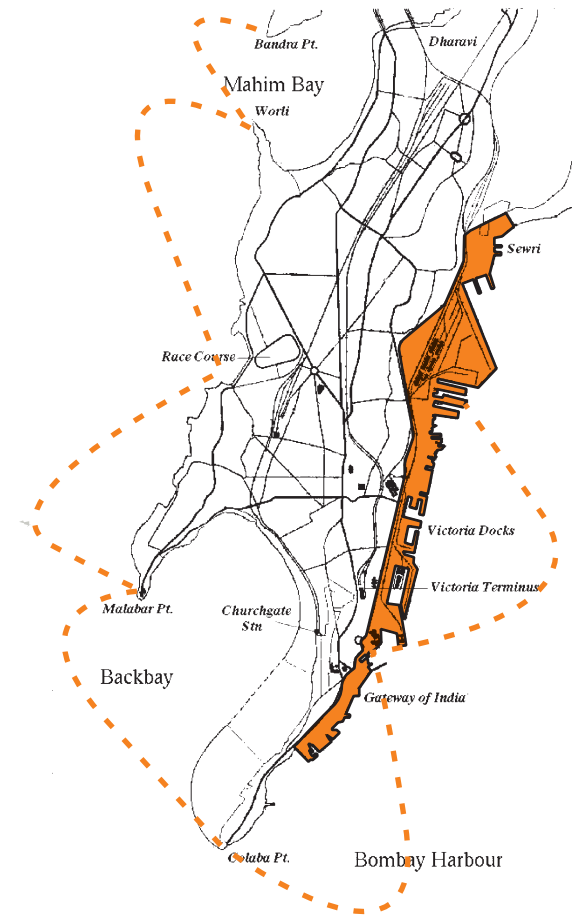
Fig 6

Daily Commute

The torturous daily commute is called the “super-dense crush load” - a breathtaking compression of 6.1 million commuters on electric trains, representing the world’s highest passenger density and more than half the daily passenger trips on the Indian Railway System.

During rush hours, the Mumbai Suburban Railway system carries more than 4,700 passengers on nine-car trains - the legal and safety capacity is only 1,700. This can mean 14-16 standing passengers per square meter of floor space.

On the roadways, bad congestion will be getting worse with the introduction of at least 30 new car models in 2004. The planned elevated Sky Bus Mass Road Transit System has not yet materialized.



The Proposal

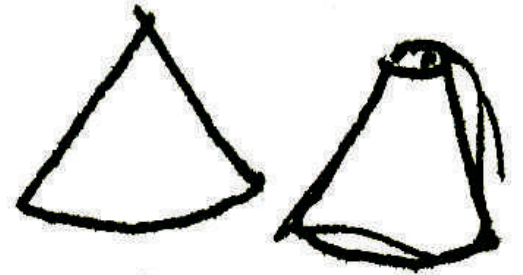
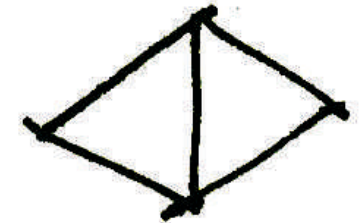
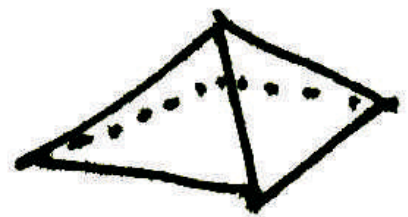
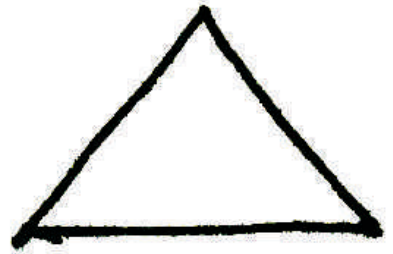
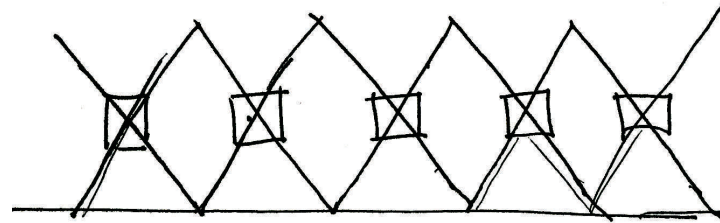
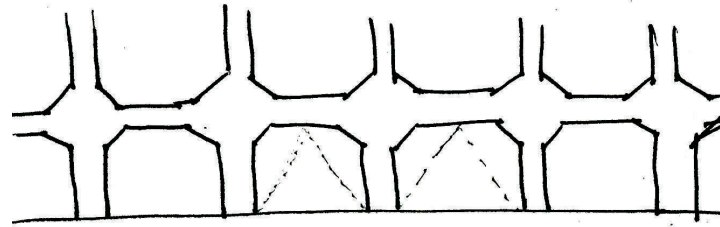
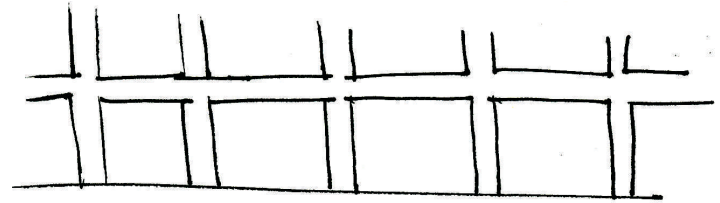
With the decline of the port activities, the entire area along the Eastern Water Front has been under used and misused. The geography of Mumbai city provides opportunities for various modes of transportation. Connecting the suburbs of Mumbai to Navi Mumbai.

The Water Transport Terminal would add to the diversity of existing transportation alternatives, thereby reducing the burden on the current modes of transportation. The creation of the Water Transit Terminal would spur economic activities and provide new room for development, which in turn would aid in revisiting the thriving atmosphere that once existed along the Eastern Water Front.

Water Transport Terminal



Conceptual Development



Breaking Free

The sketch on the left shows how the conventional building systems work.

In an attempt to break away from the column beam structure I arrived at a geometrical structure that is a cone. This is shown in the figure below.

Deriving The Form

The cones would also represent the industrial chimneys that line up the city's existing skyline.

They stand testimony to the changing times, having puffed away at 7 am every day to standing defunct, but still defining the skyline of a one-time textile hub, Central Mumbai.

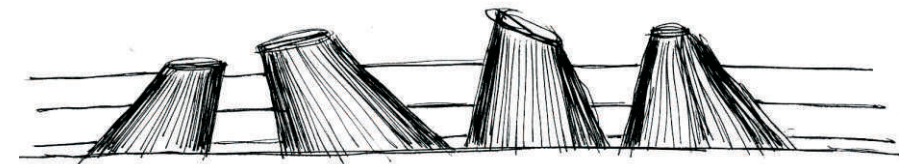


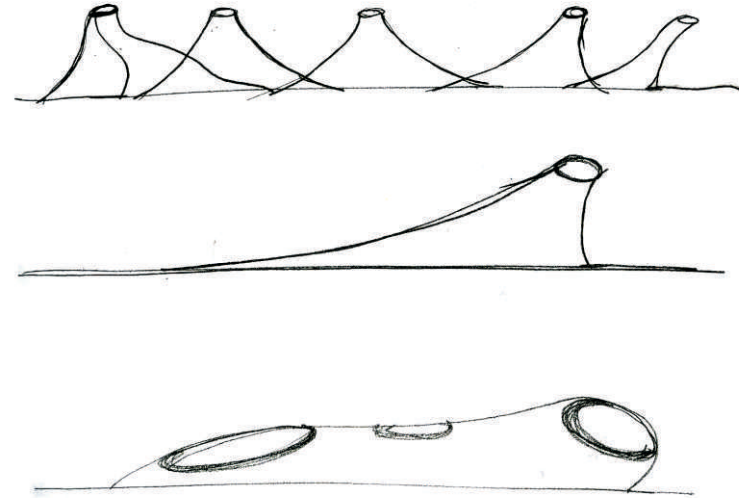
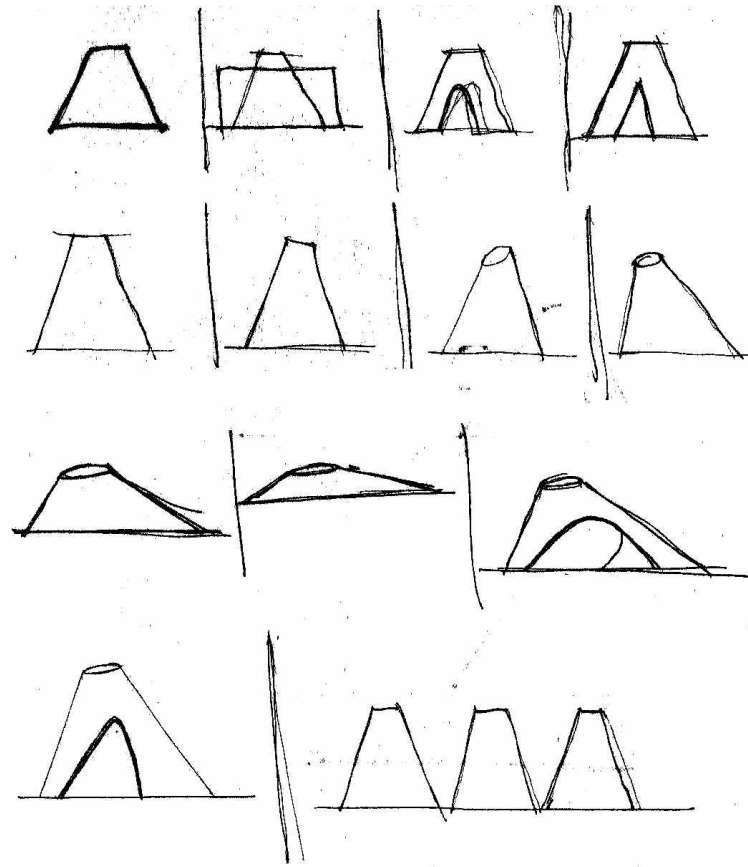
Fig 7

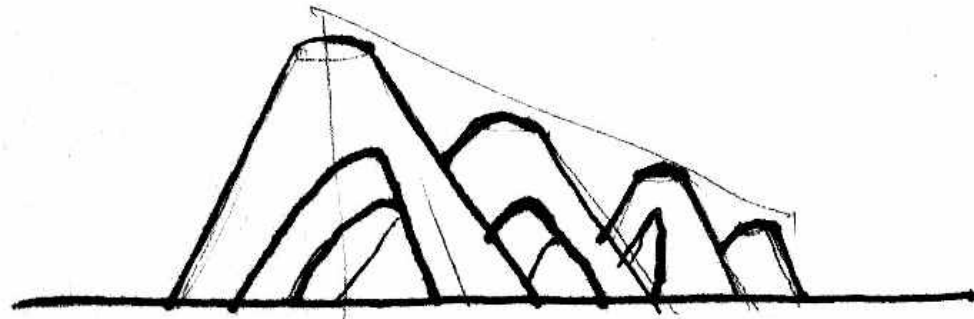


Fig 8

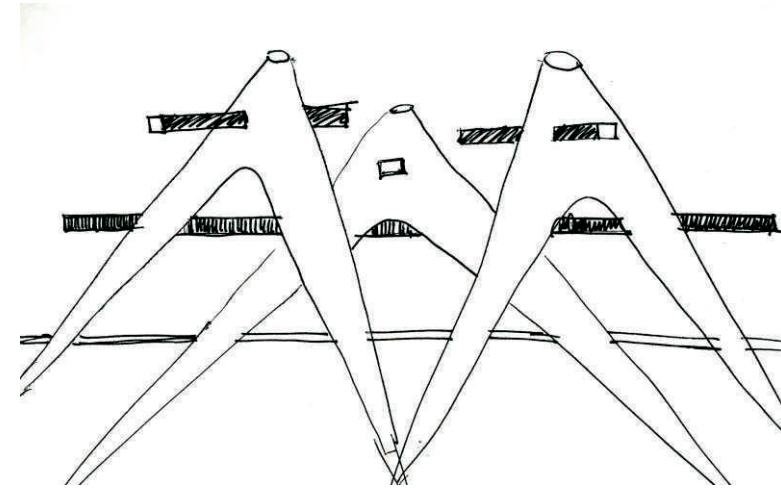


Fig 9





"The perspective from Land side."



"The cones reaching out to the bottom of the ocean."

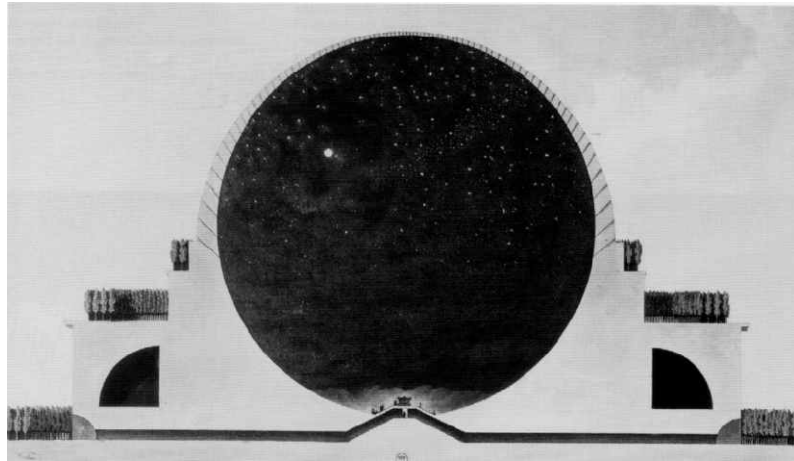
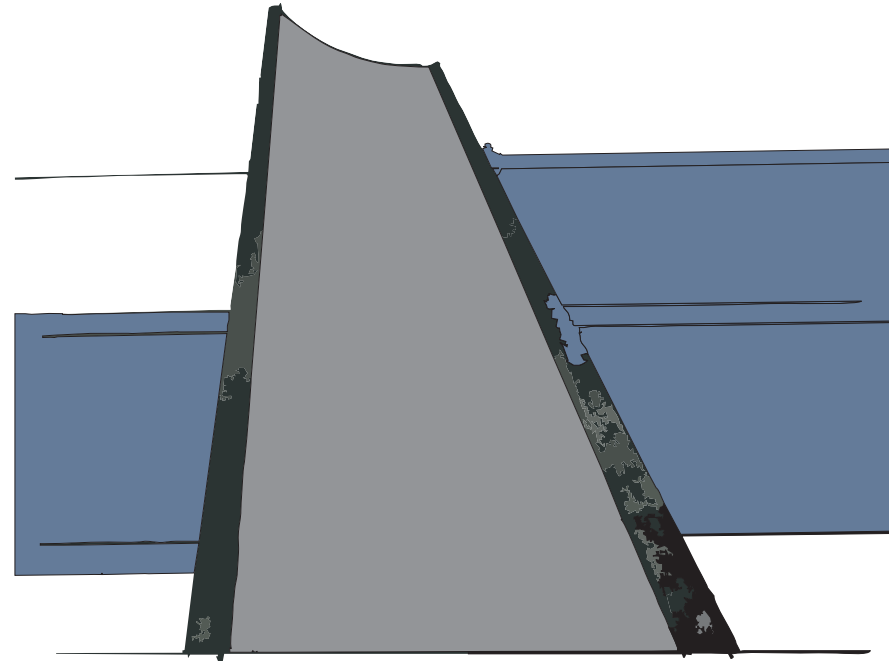
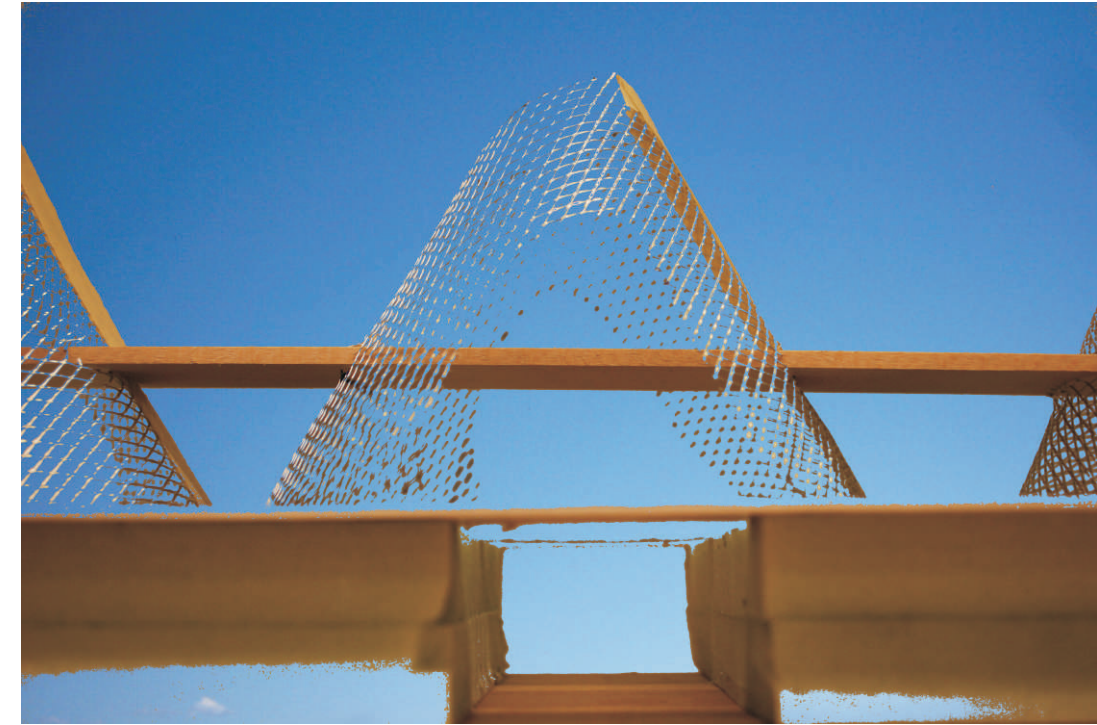


Fig 10 "Newton's Epitaph."



"The perspective from Land side."



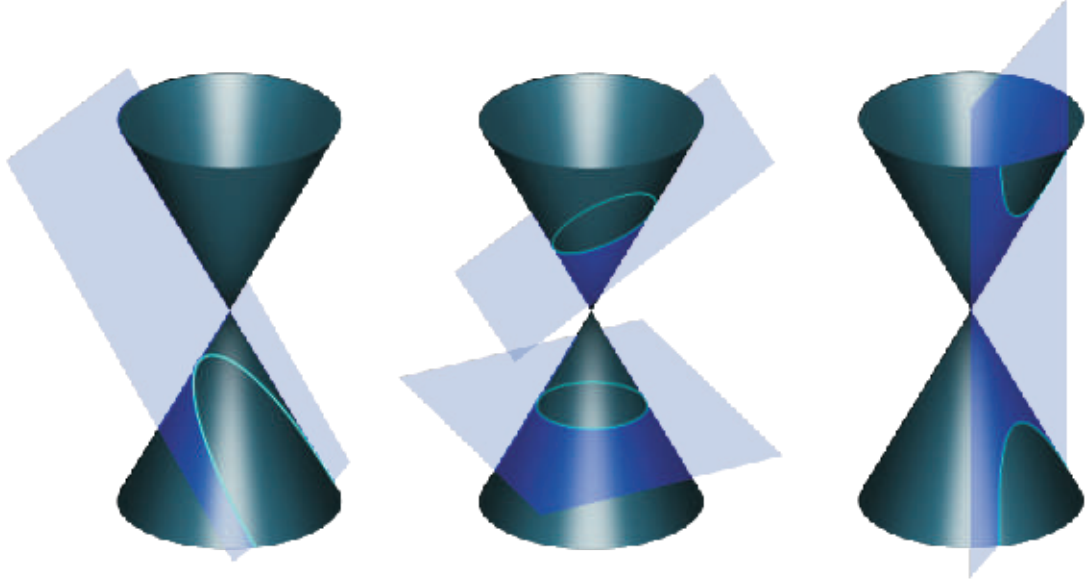
"Study Model showing the cutouts for the passage of water taxis."

Water Transport Terminal



Design Development

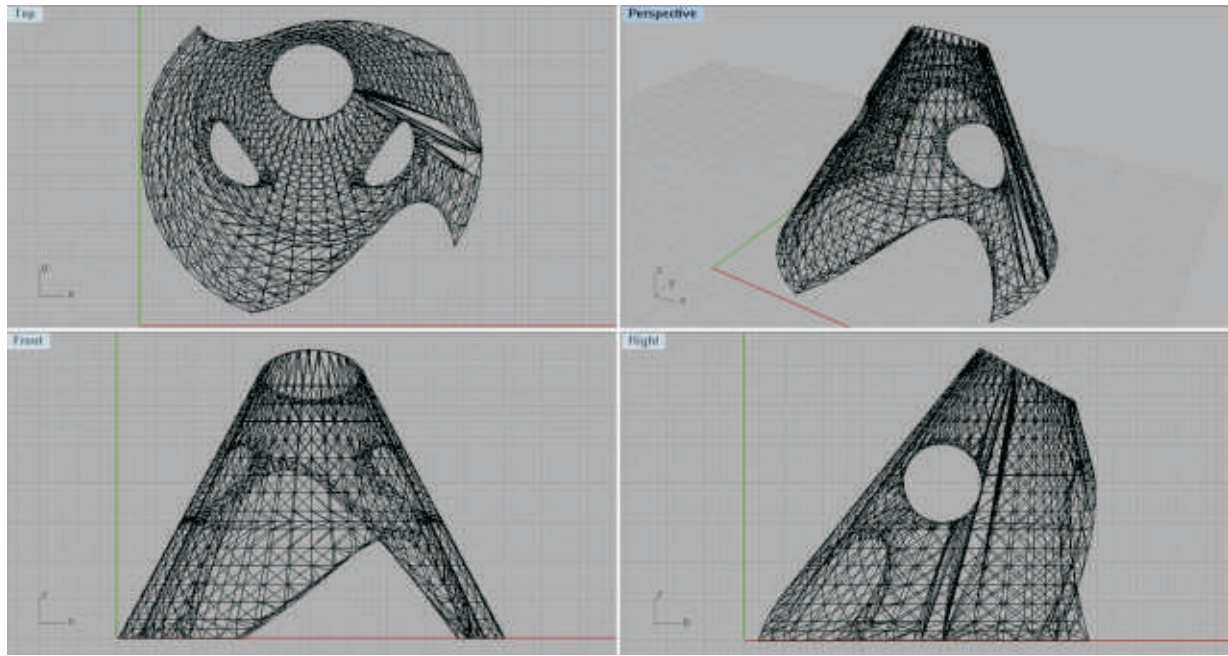




PARABOLA

ELLIPSE AND CIRCLE

HYPERBOLA



Derived geometrical form is a cone subtracted from a an truncated eccentric cone

Tidal Range

The tidal range is the vertical difference between the highest high tide and the lowest low tide. In other words, it is the difference in height between high and low tides.

(National Institute of Oceanography, Dona Paula, Goa 403 004, India
Current Science, Vol. 96, No. 9, 10 May 2009)

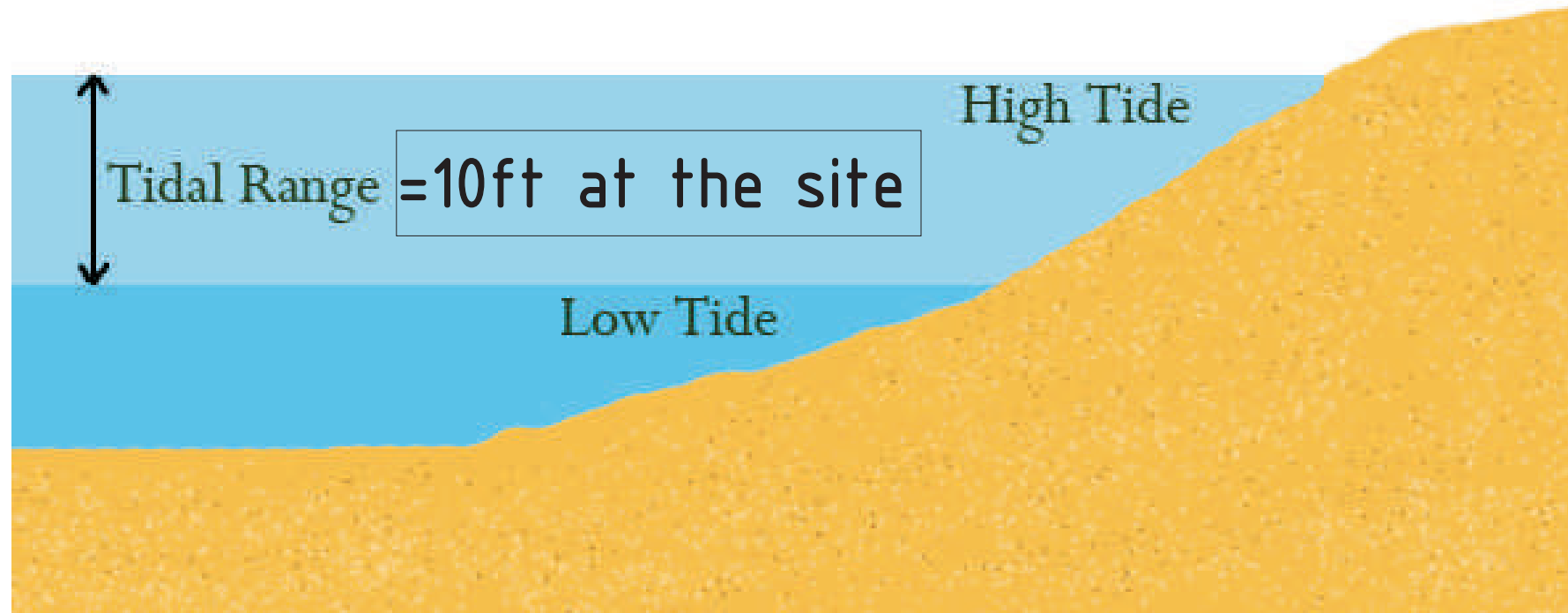


Fig 11

Distance to the Horizon

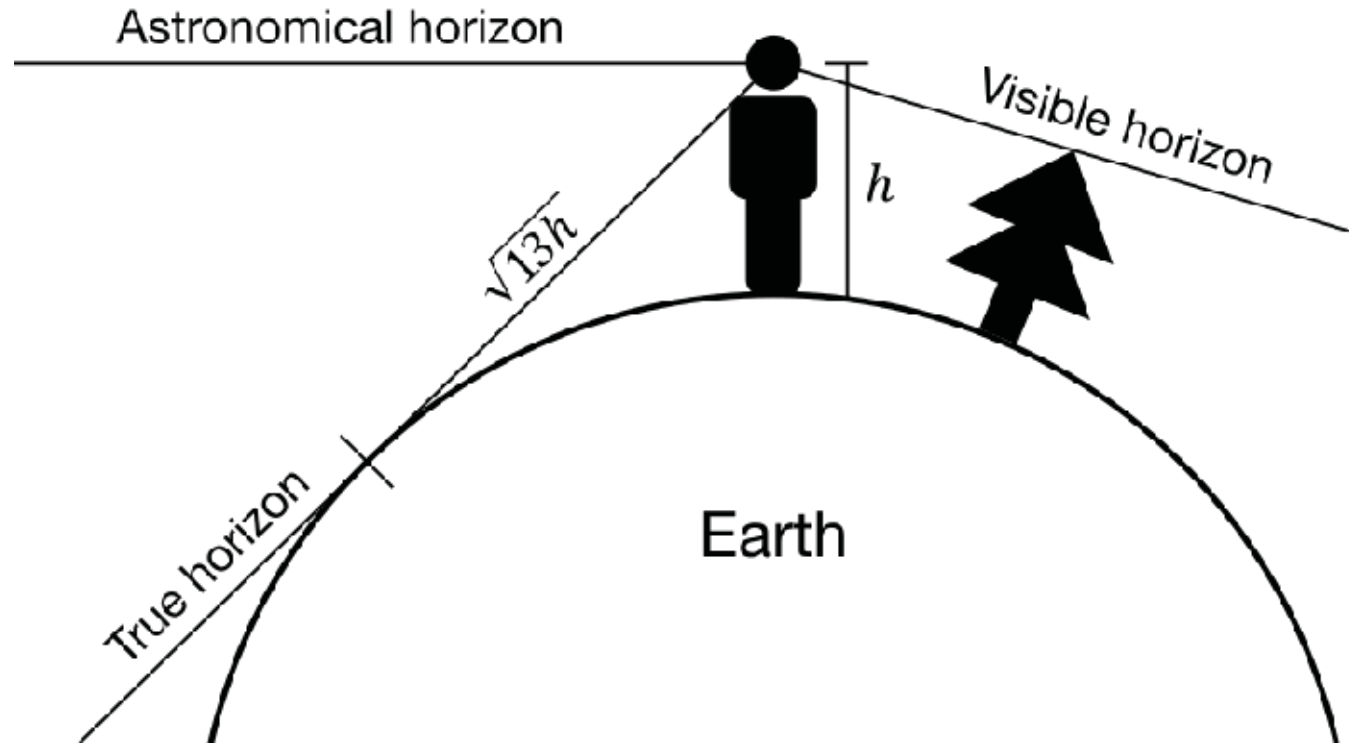


Fig 12

Approximate formulas

In SI units, the straight line of sight distance d in kilometers to the true horizon on earth is approximately $d = \sqrt{13h}$

where h is the height above ground or sea level (in meters) of the eye of the observer. Examples:

- * For an observer standing on the ground with $h = 1.70$ m (average eye-level height), the horizon is at a distance of 4.7 km.

- * For an observer standing on a hill or tower of 100 m in height, the horizon is at a distance of 36 km.

For Imperial units, 13 is replaced by 1.5, h is in feet and d is in miles. Thus:

$d = \sqrt{1.5h}$

Examples:

- * For observers on the ground with eye-level at $h = 5$ ft 7 in (5.583 ft), the horizon is at a distance of 2.89 miles.

- * For observers standing on a hill or tower 100 ft in height, the horizon is at a distance of 12.25 miles.

These formulas may be used when h is much smaller than the radius of the Earth (6371 km), including all views from any mountaintops, airplanes, or high-altitude balloons. The metric formula is accurate to about 1%; the imperial one is more accurate still.

(source: <http://en.wikipedia.org/wiki/Horizon>)



Fig 13

Vehicles on Water

A water taxi or water bus is a commuter passenger boat used to provide public transport. Service may be scheduled with multiple stops, operating in a similar manner to a bus, or on demand to many locations, operating in a similar manner to a taxi. A boat service shuttling between two points would normally be described as a ferry rather than a water bus or taxi.

A ferry (or ferryboat) is a form of transportation, usually a boat, but sometimes a ship, used to carry (or ferry) primarily passengers, and sometimes vehicles and cargo as well, across a body of water.

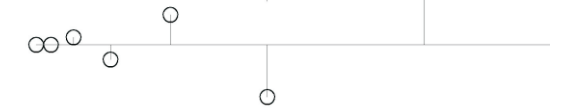
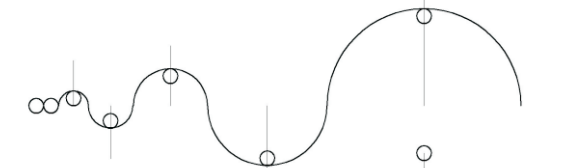
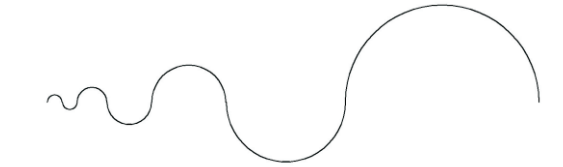
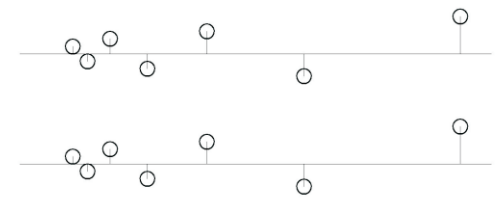
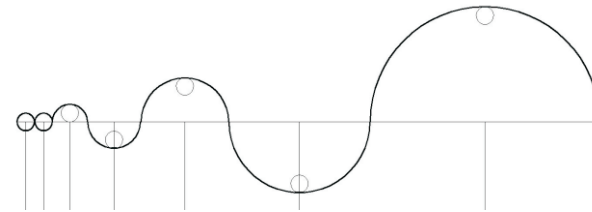
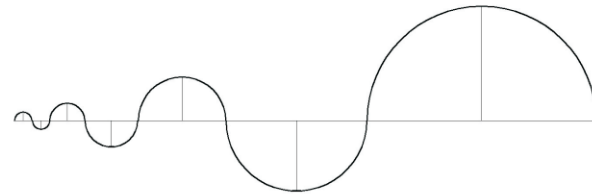
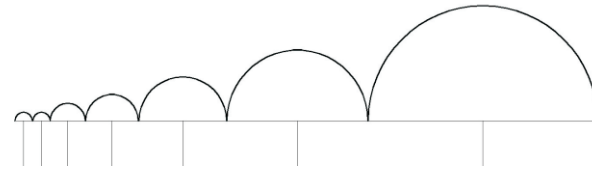
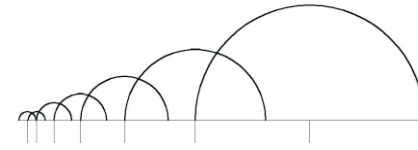
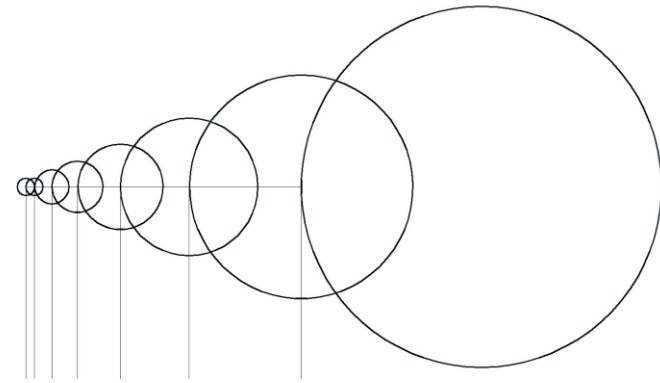
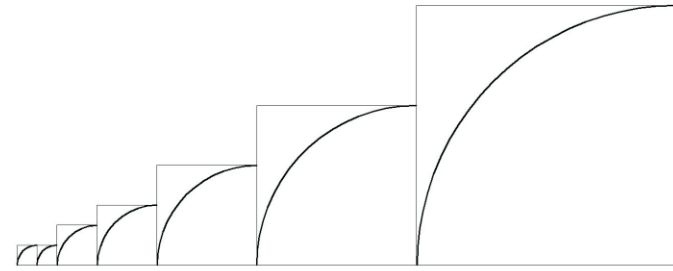
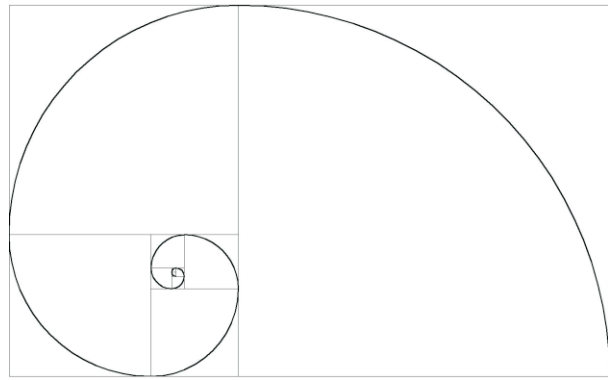
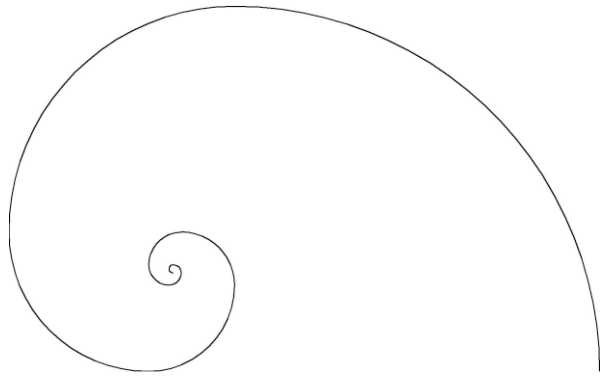
Ferries form a part of the public transport systems of many waterside cities and islands, allowing direct transit between points at a capital cost much lower than bridges or tunnels. However, ship connections of much larger distances (such as over long distances in water bodies like the Mediterranean Sea) may also be called ferry services, especially if they carry vehicles.



Initial photomontages to comprehend the geometry and scale

Geometry & Scale

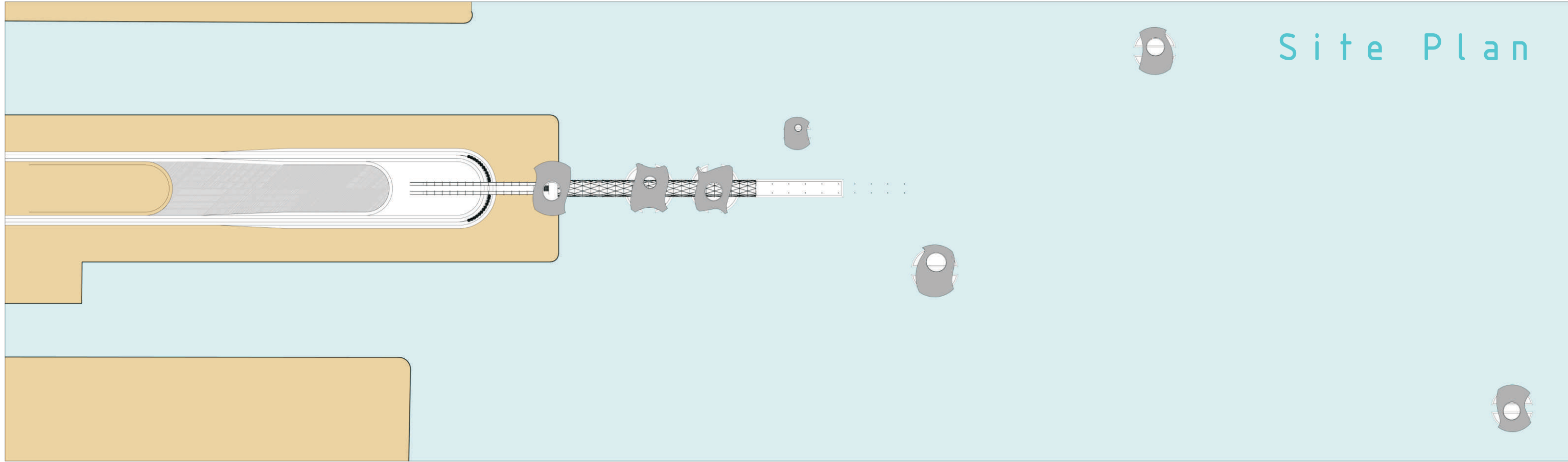






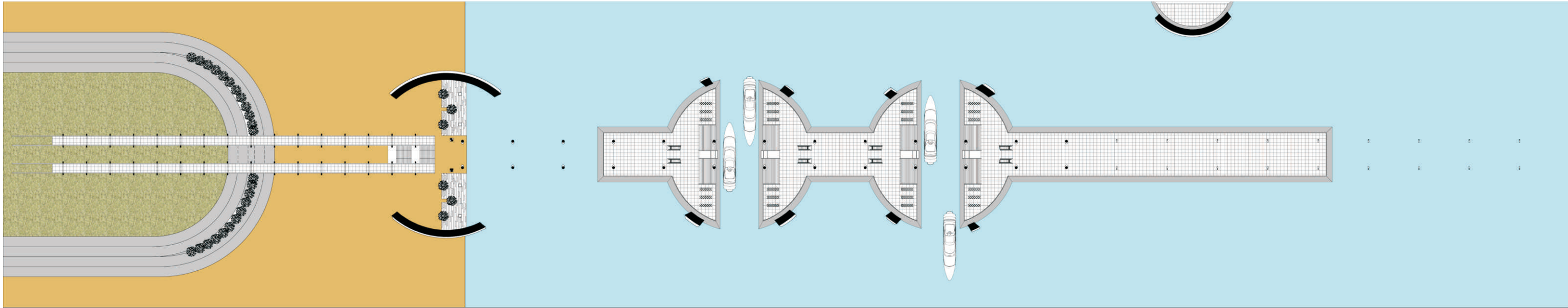
Design Illustrations

Site Plan

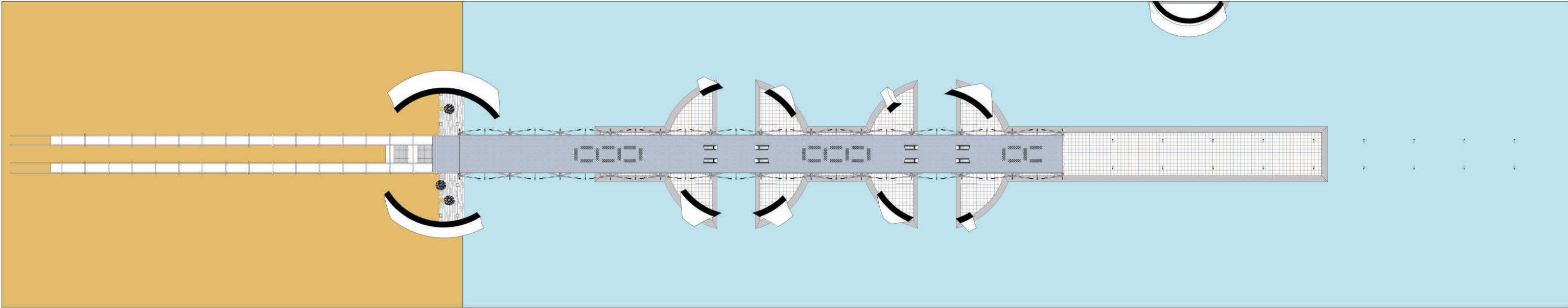


Water Transport Terminal

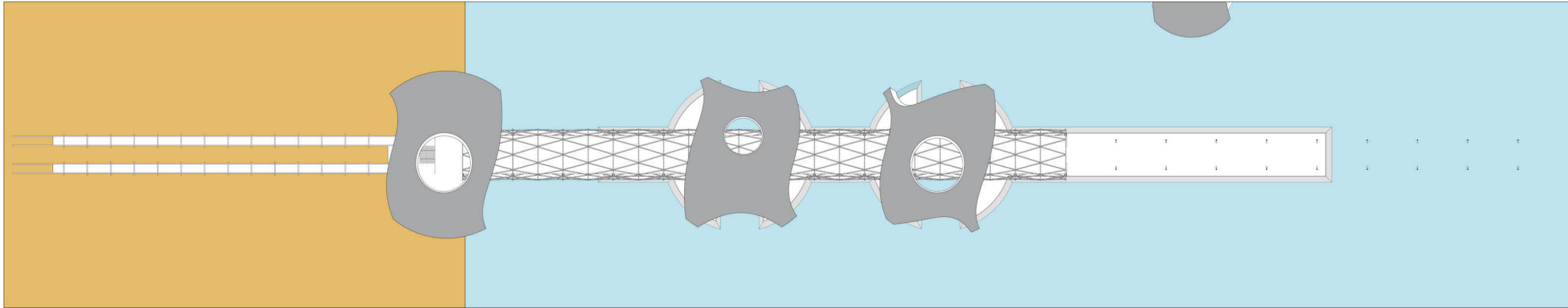
Jetty Level Plan



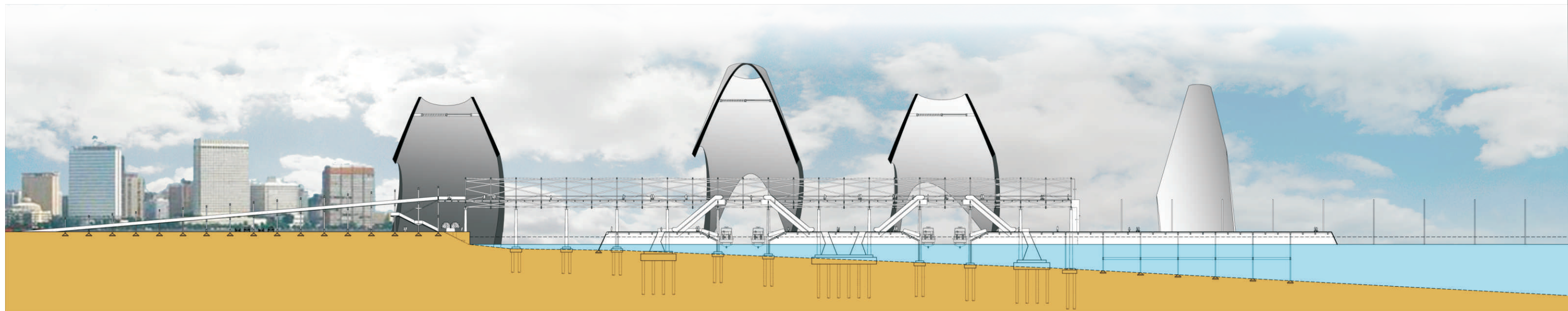
Bridge Level Plan



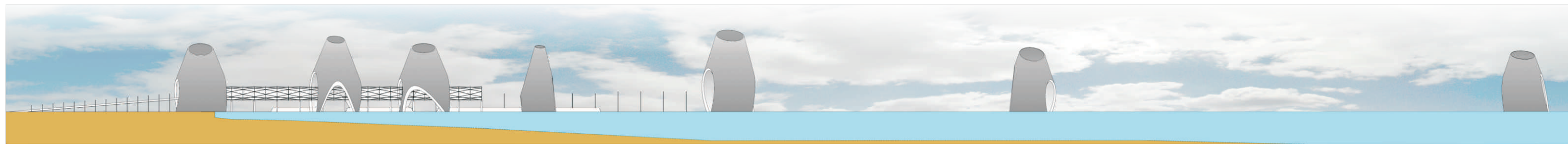
Roof Plan



Longitudinal Section

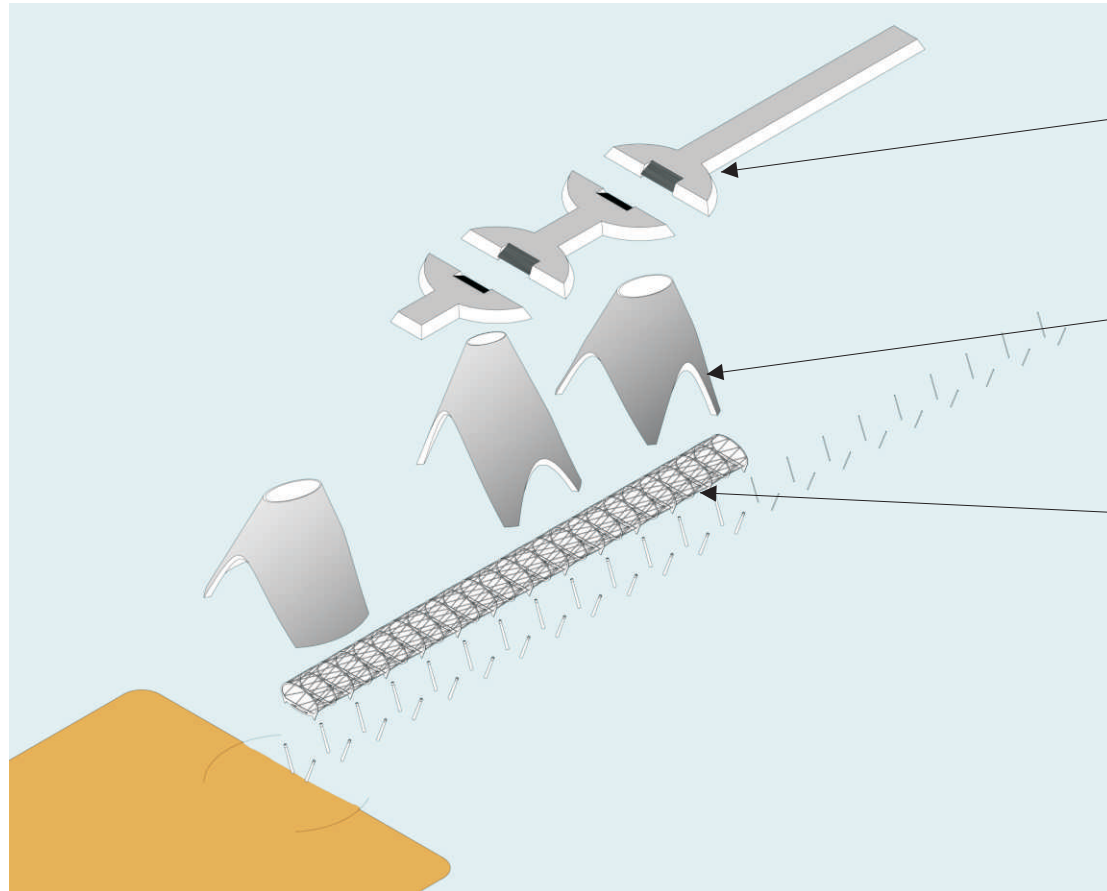


North Elevation



Water Transport Terminal





JETTY

CONICAL CONCRETE STRUCTURE

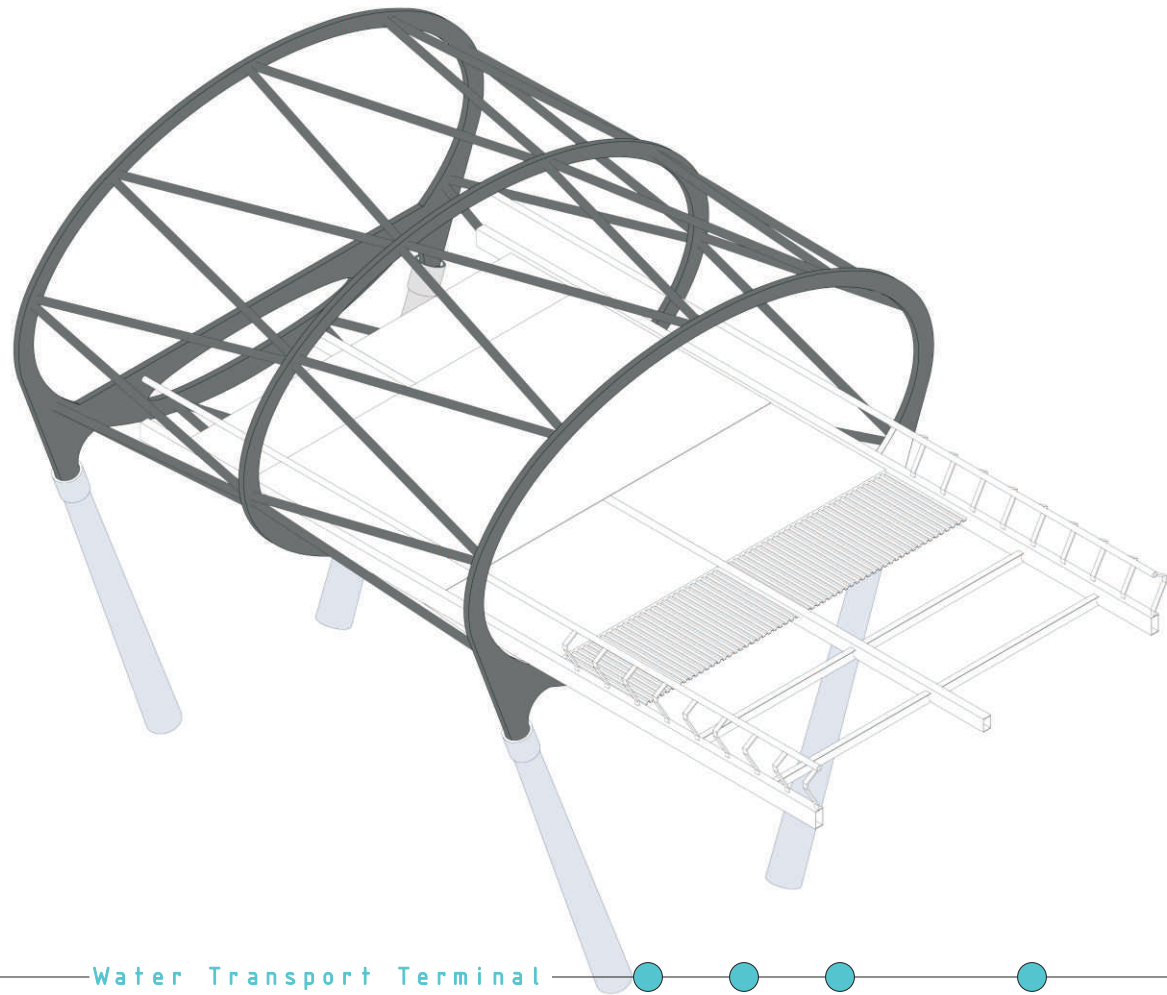
BRIDGE

Independent Structures

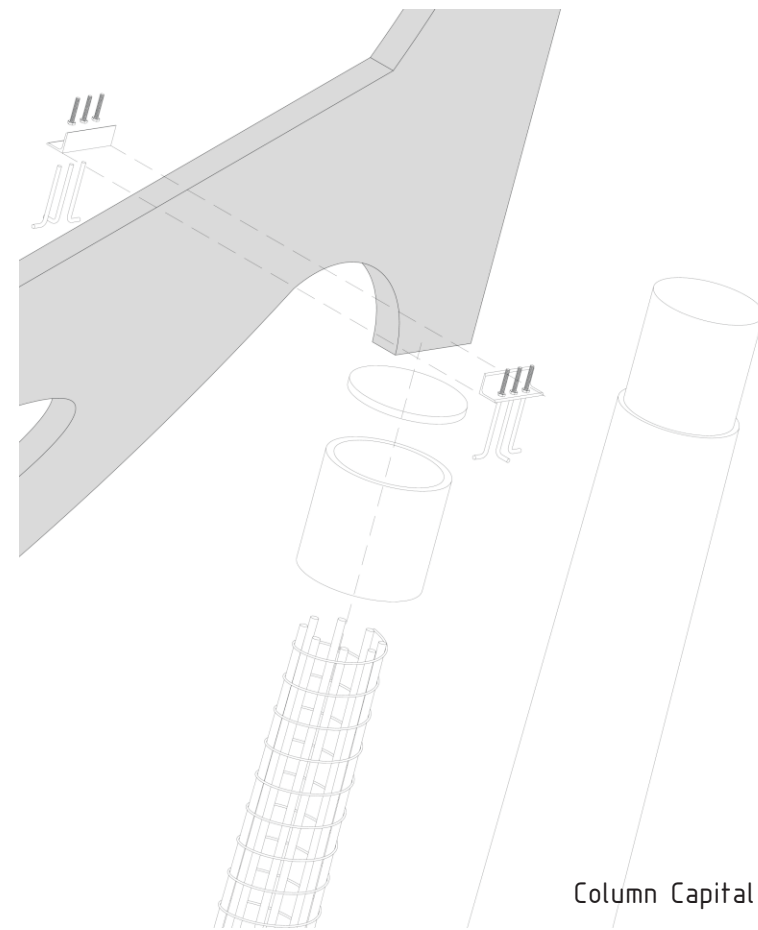
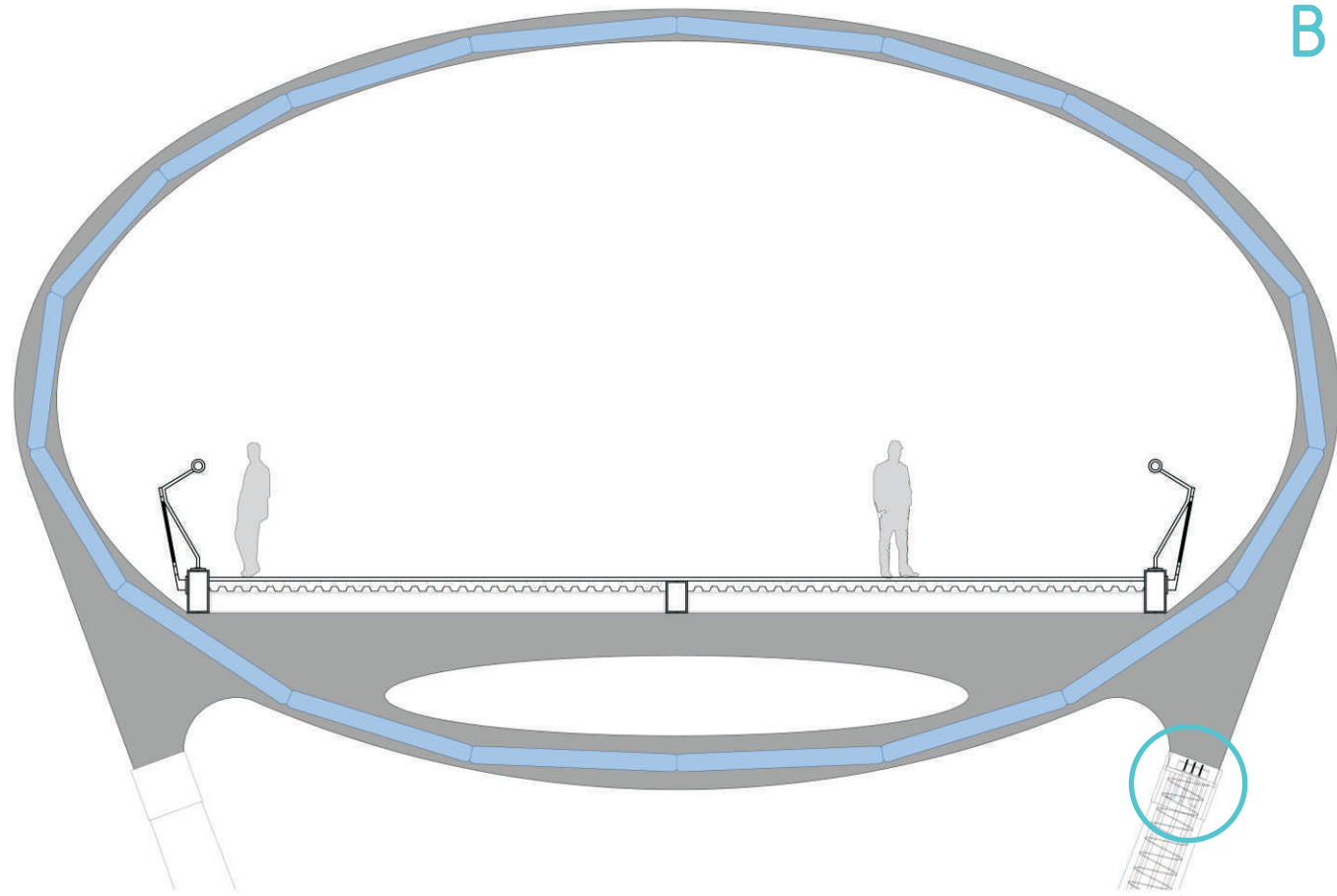
The three parts to the building are the jetty, the conical concrete structures and the bridge.

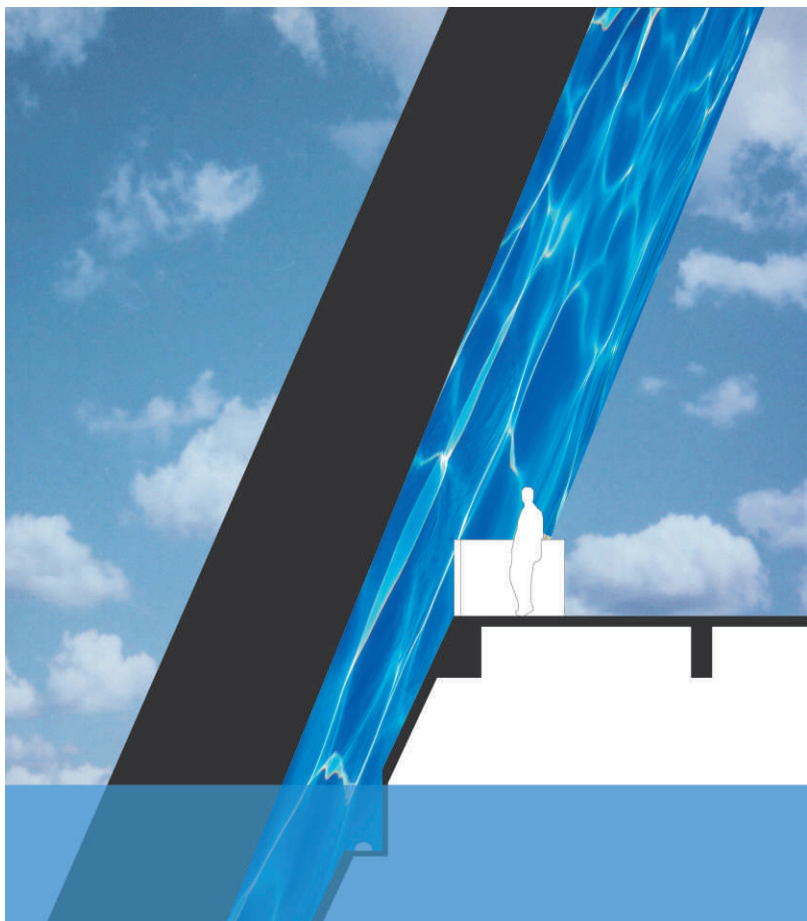
All three of them are independent of each other.

Bridge



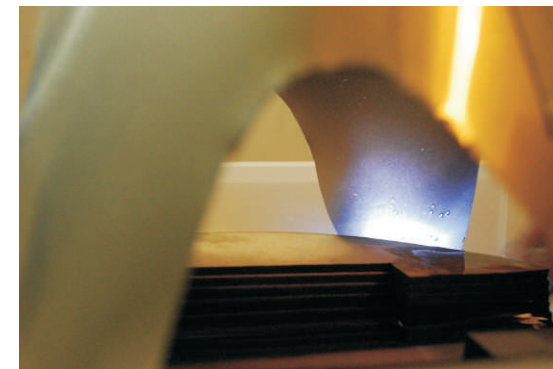
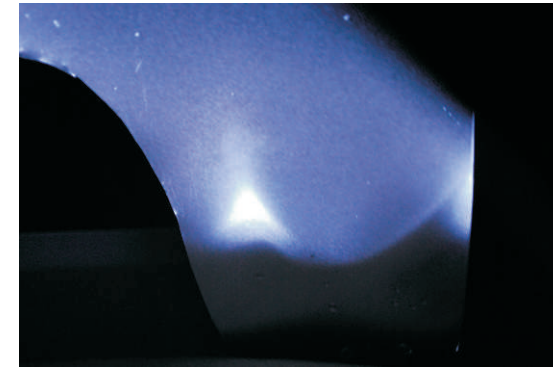
Bridge Details



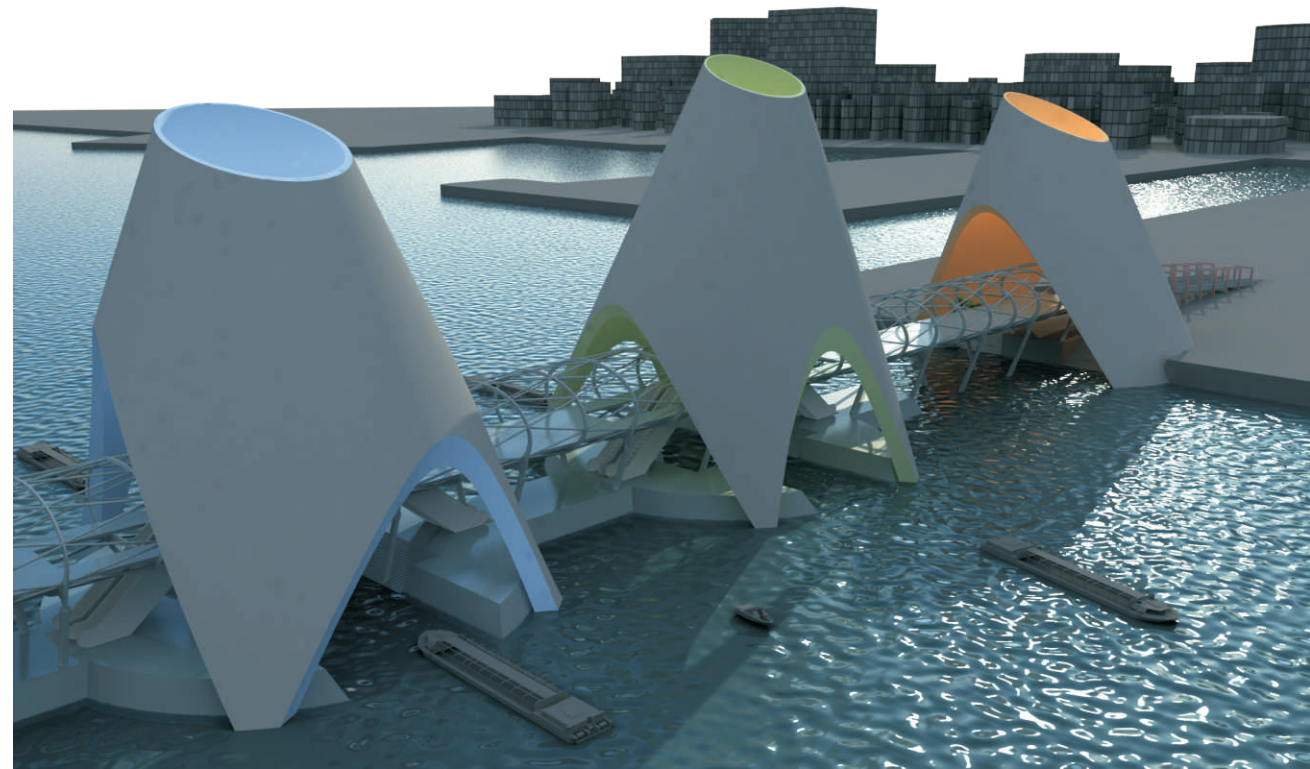
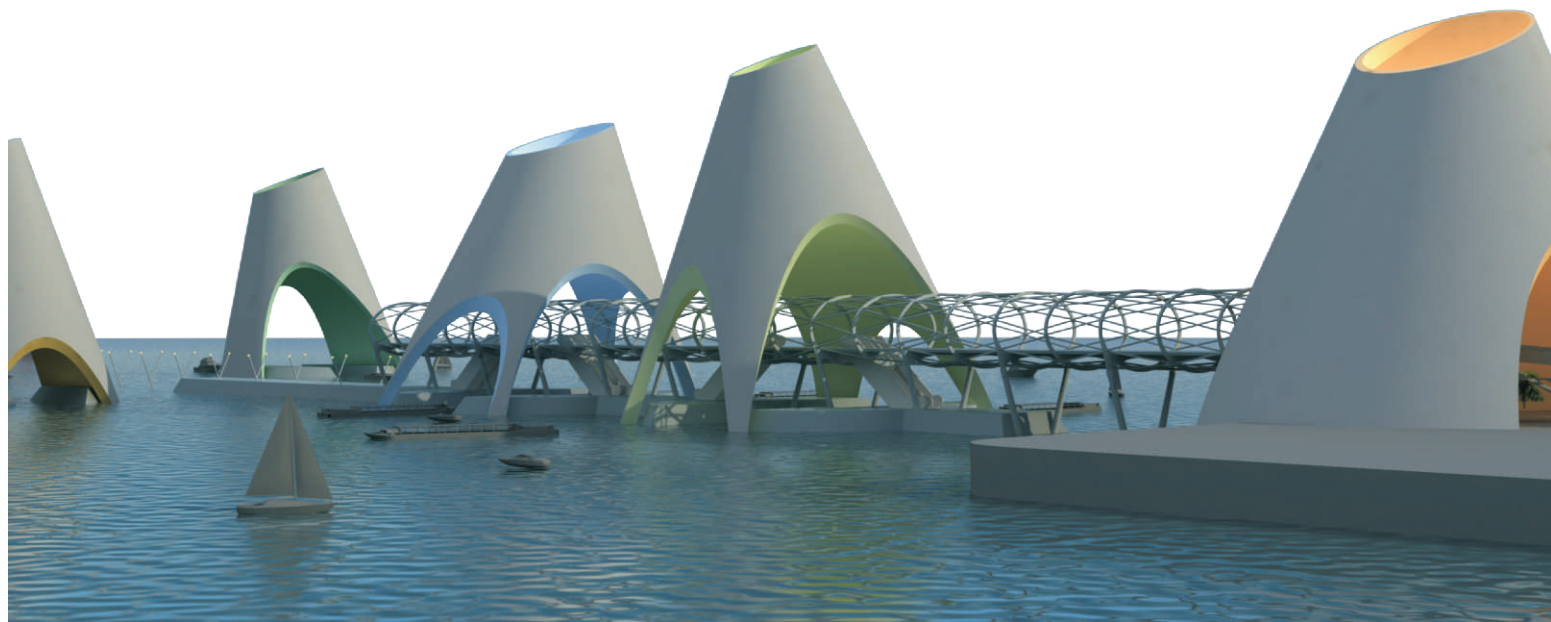


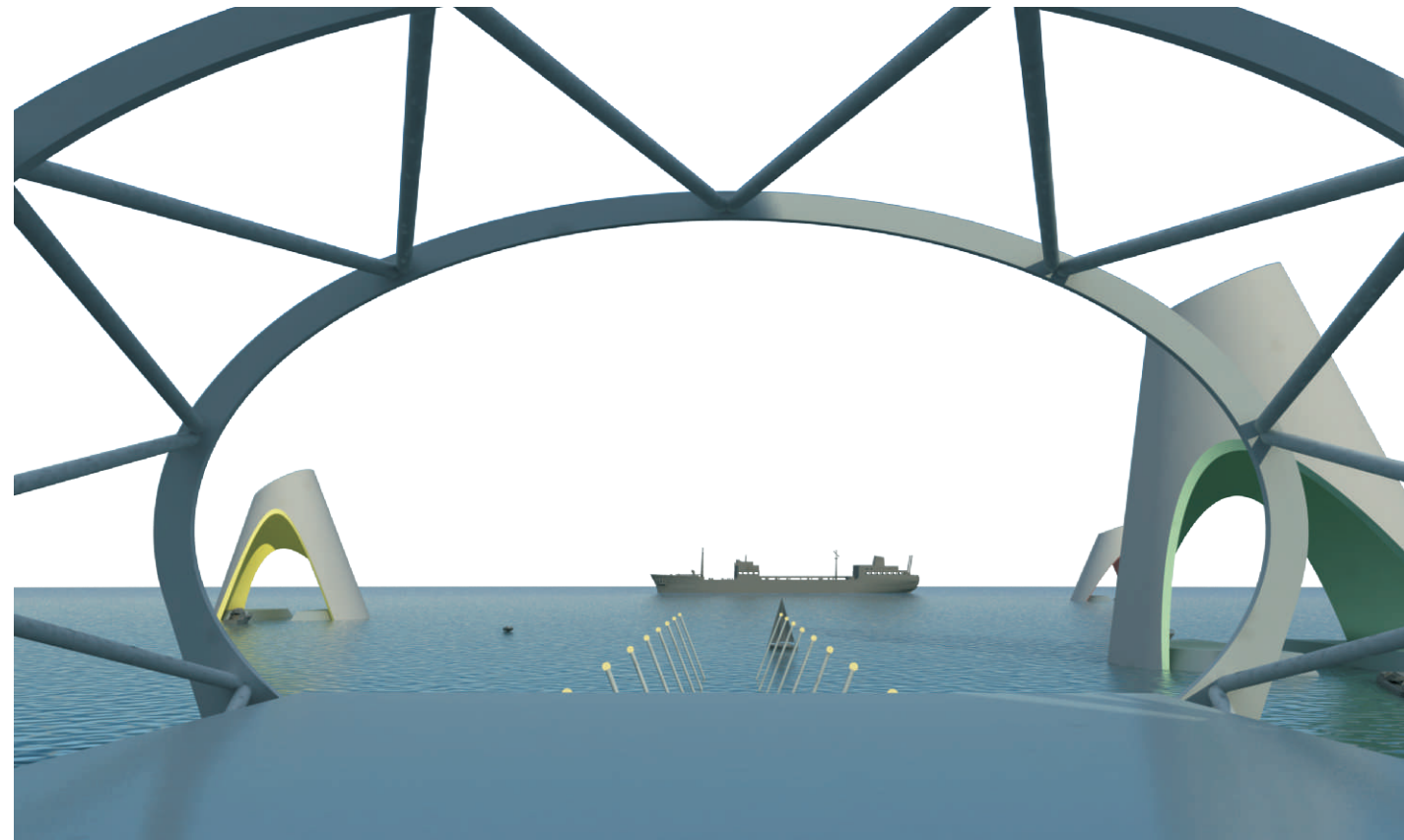
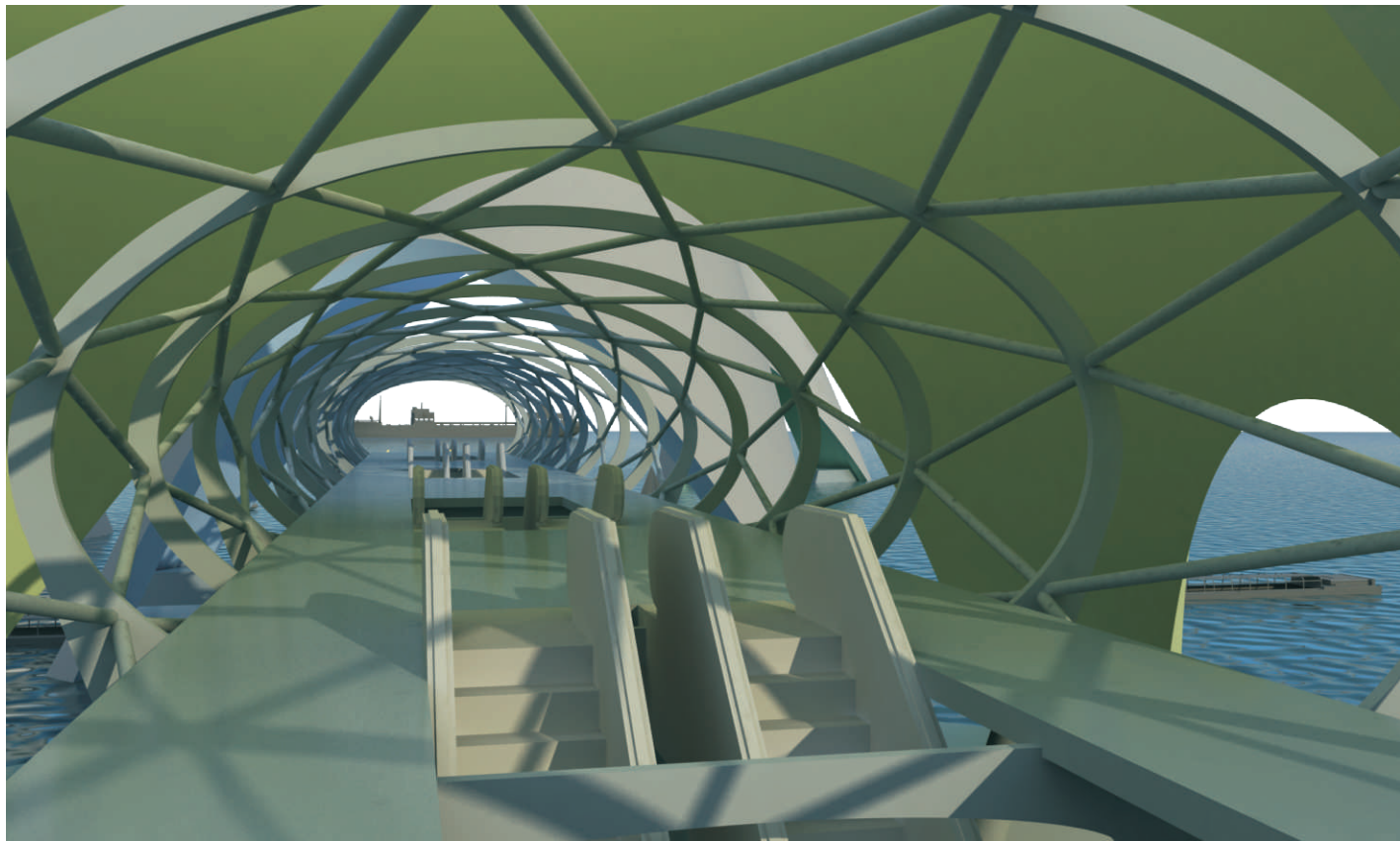
Detail of the light showing its reflection off the wall

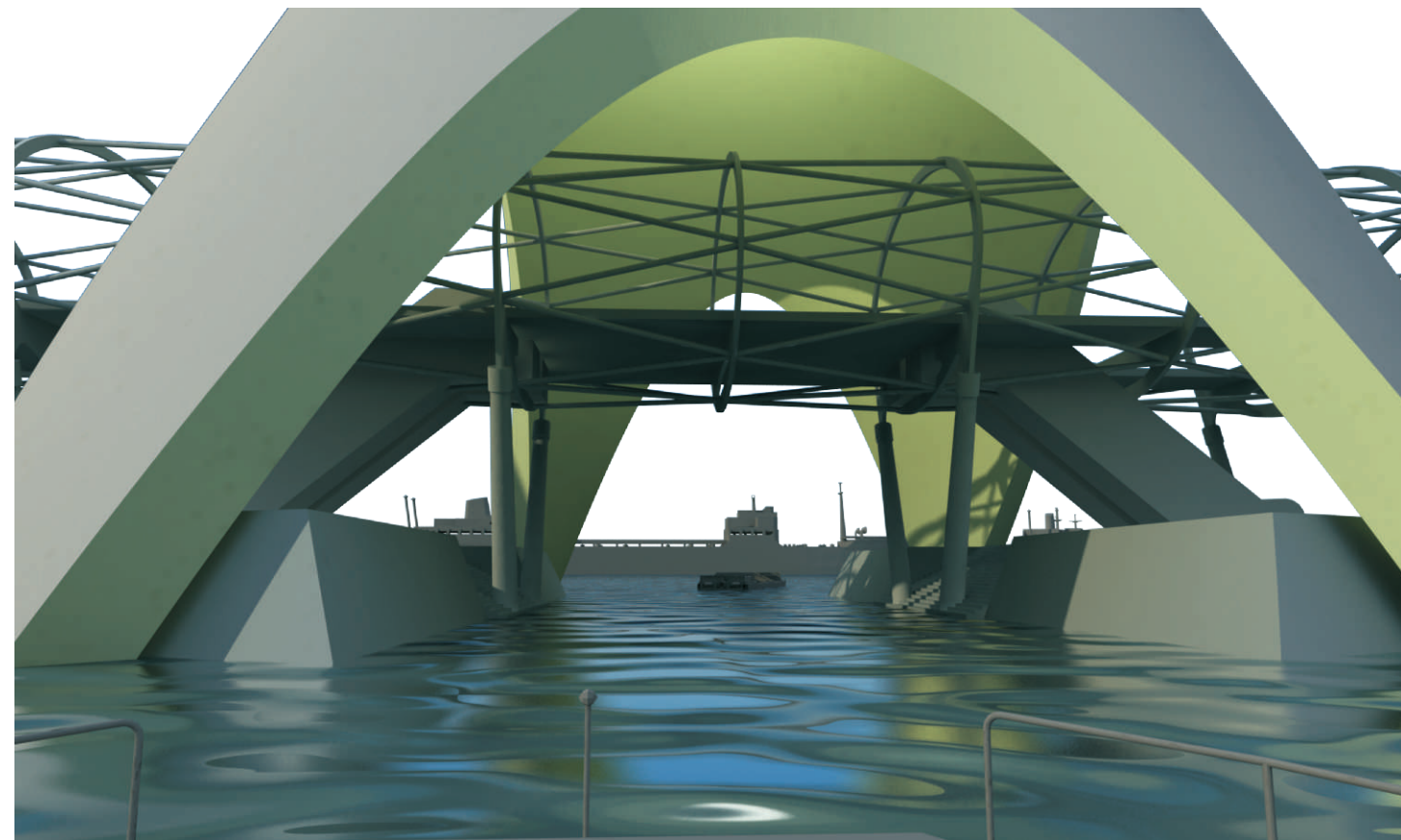
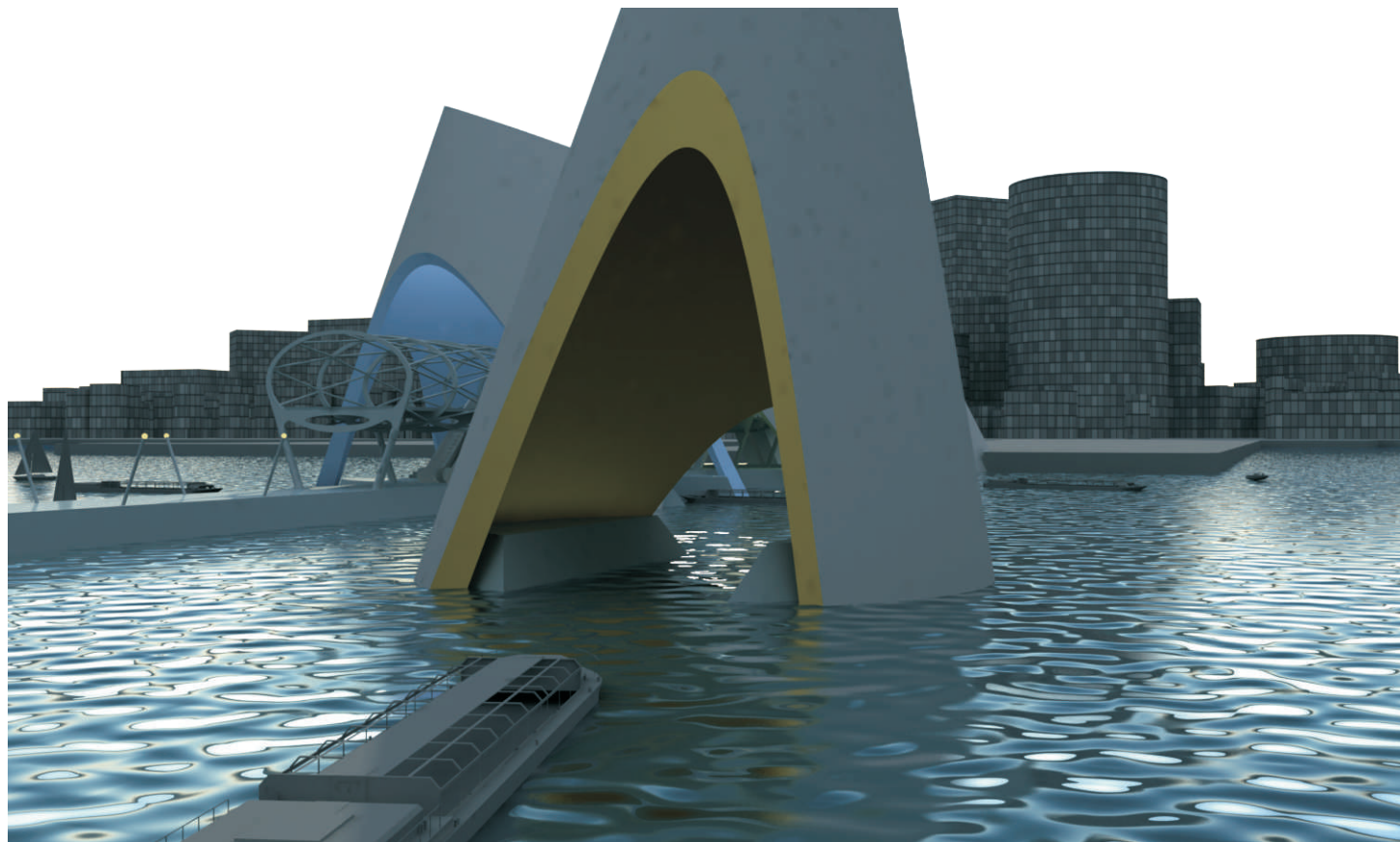
Orchestrated Caustics

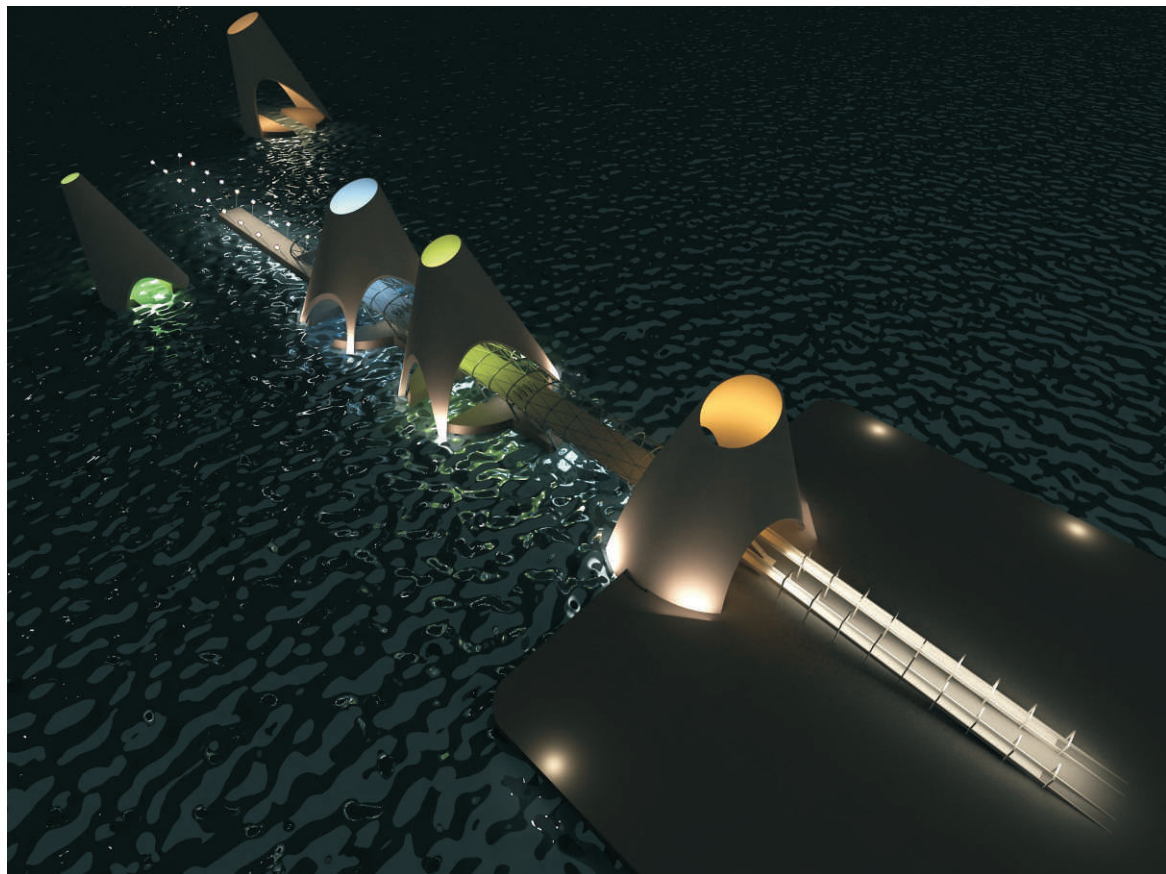


Study of Light on a model and its reflection on the wall and ceiling









List of Figures

All images are by the author unless noted otherwise.

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Pg#	Fig #	Title	Date Retrieved	Source/URL
Pg2	Fig 1	The Seven Islands of Mumbai.	November 14, 2009.	< http://en.wikipedia.org/wiki/File:Seven_Islands_of_Bombay_en.svg >
Pg2	Fig 2	Mumbai Sealink.	November 17, 2009.	< http://joesaward.files.wordpress.com/2009/10/mumbai-bridge.jpg >
Pg3	Fig 3	Map of Mumbai.	2005.	"A Study of the Eastern Waterfront of Mumbai".
Pg3	Fig 4	Now you sea it, Now you don't.	June 27, 2005.	Times of India.
Pg5	Fig 5	Trains in Mumbai.	November 14, 2009.	< http://enchantingchallenge.files.wordpress.com/2009/03/mumbai.jpg >
Pg5	Fig 6	Road traffic in Mumbai.	November 15, 2009.	< http://www.newsandreviews.in/media/blogs/Home/mumbai%20traffic.jpg >
Pg8	Fig 7	The Chimneys of Mumbai.	September 24, 2009.	< http://www.thehindu.com/fline/fl2219/stories/20050923002304300.htm >
Pg8	Fig 8	The defunct mills of Mumbai.	September 24, 2009.	< http://www.hinduonnet.com/fline/fl2022/images/20031107004303001.jpg >
Pg8	Fig 9	Mills of Mumbai.	September 24, 2009.	< http://meterdown.files.wordpress.com/2009/07/mill-chimney-street.jpg >
Pg10	Fig 10	Newton's Epitaph.	October 02, 2009.	< http://s280726524.mialojamiento.es/dibex/Boullee_Newton-e.htm >
Pg13	Fig 11	Tidal Range.	September 26, 2009.	< http://en.wikipedia.org/wiki/Tidal_range >
Pg14	Fig 12	Distance to Horizon.	September 26, 2009.	< http://en.wikipedia.org/wiki/Horizon >
Pg15	Fig 13	Water Taxi.	February 01, 2010.	< http://en.wikipedia.org/wiki/Water_taxi >

Sources

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