*the future of the past:*

# INHERENT ATMOSPHERES

Dissertation Report

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Submitted in partial fulfilment of the degree of Master of Architecture (Professional)
University of Cape Town, 2017

Faculty of Engineering and the Built Environment

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## ACKNOWLEDGEMENTS

Before beginning this dissertation, I would like to acknowledge those individuals who have been fundamental in this journey.

Firstly, all honour must be given to God, the Creator who has inspired my passions and guided my wandering heart. My words fall short of expressing my gratitude towards my parents, Leslie and Sheree Hobbs, who have sacrificed so much of themselves for our family and for me to have this opportunity. You are the reason I strive to be a better person, because your love and support knows no bounds. One day, I will build you a house with your own sewing room, mom.

To my siblings, Kylie, Aimée and Ben, thank you for your support and encouragement of my passion. I am grateful to the support and guidance of Professor Nic Coetzer and Kevin Fellingham. I apologize for my stubbornness, and I thank you for persevering.

I am grateful to Jo Noero and Evandro Schwalbach for having the patience and kindness to teach me more about the world of architecture. Thank you for taking the time to teach, it is truly humbling to be mentored by you. I thank all those friends and family who have journeyed with me on this endeavour.

I am because you are.

Ad dominum, imperium, in aeternum.

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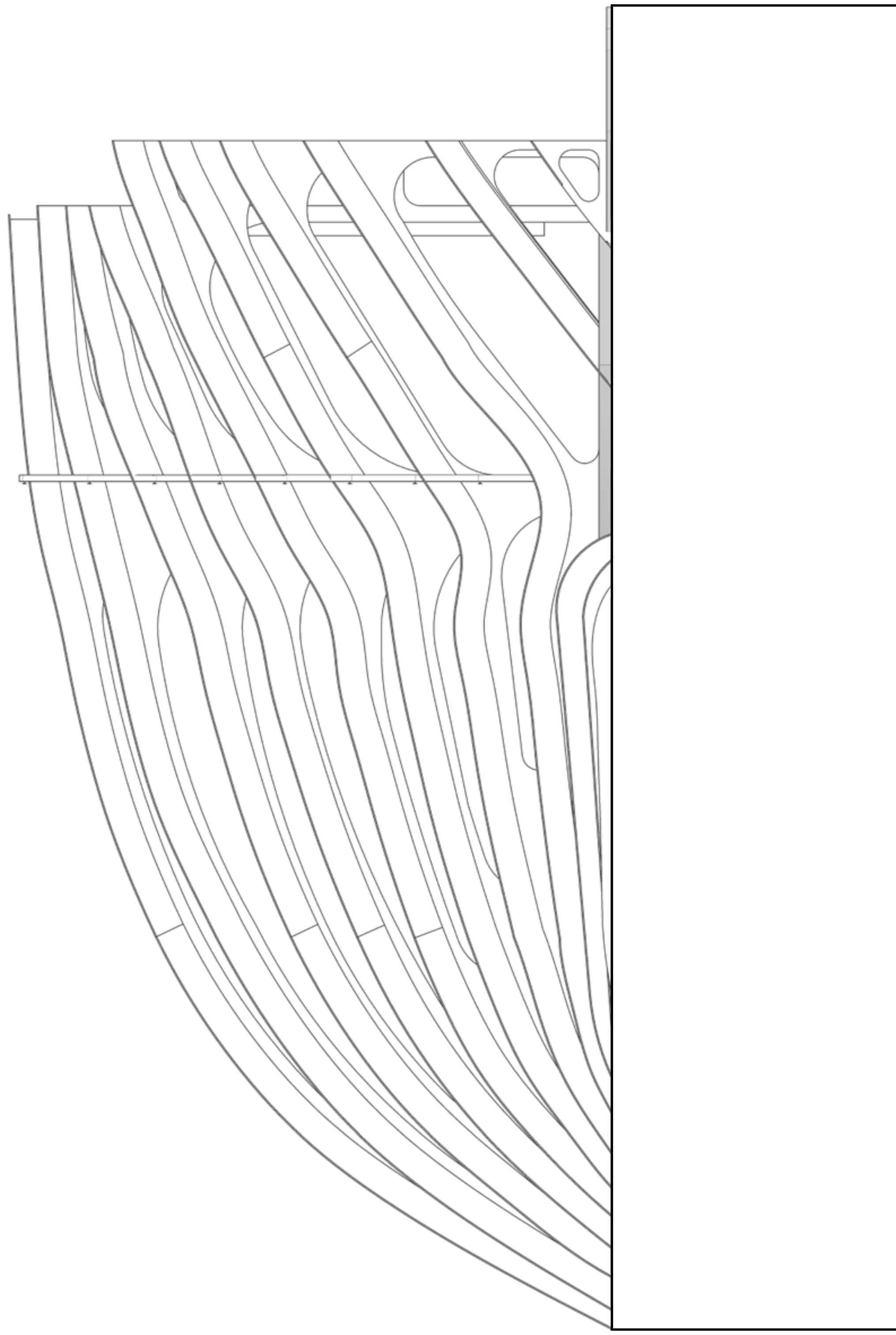

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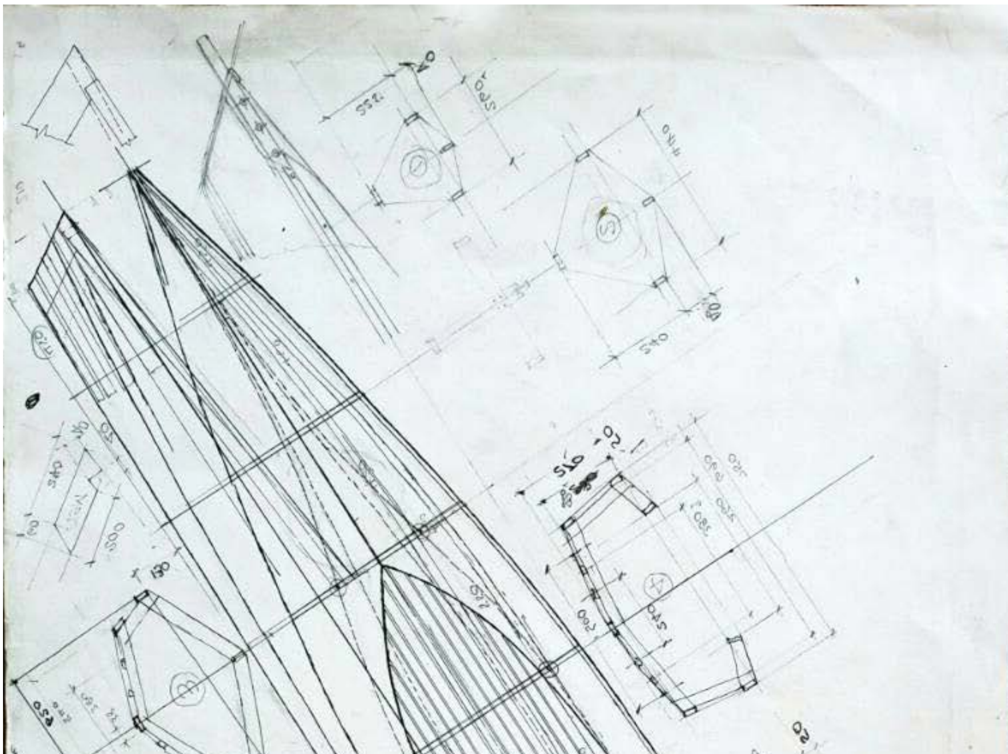

## GENESIS

I was blessed as a child to have spent many weekends with my grandfather, Rodney Middleton Winter, making jigsaw puzzles for Christmas presents and building model aircraft and battleships, some which we also designed ourselves. I watched him lovingly restore several salvaged vintage cars to their former glory. In some cases, he created entirely new hybrid cars from seemingly written-off vehicles which were often as good or better than the originals.

Some would argue that an Alpha Romeo-BMW-Toyota hybrid would be preposterous, but I watched him give these cars a new life, and he made them beautifully. My passion for design was birthed from these memories. It is his life which awoke my interest in architecture, and those early days spent watching and making have guided my thinking towards this dissertation.

*Fig. 01. The design of a small kayak by my grandfather, built as a gift for my mother when she was a child.*

*Fig. 02. The Atlas Slave, by Michelangelo (marble, height 277cm, circa 1530-34). This is one of many unfinished works of the master sculptor which I find as appealing as his completed works. There is a profound tension beyond the human form, as if it is the arrested physical expression of the sculptor's deeper understanding of his craft, suspended in its authentic, unfinished state.*

## PREAMBLE

This dissertation is an attempt to extract architecture from the site itself. Michelangelo, the Italian Renaissance painter, sculptor, architect, poet, and engineer, famously said,

> *Every block of stone has a statue inside it and it is the task of the sculptor to discover it.*

He clearly understood his role as the vessel by which an idea came to life in the physical world. In this light, the chosen site is treated much like a block of marble in the hands of a sculptor (the architect) and this dissertation is the documentation of the slow shaping, polishing, and final revealing of an idea.

The design is conducted within the speculative future of the Breakwater in Cape Town Harbour. Two main interests are outlined:

1. *Landscape:* a desire to better understand architecture as the mediator between man and nature, essentially, and to view landscape as architecture and architecture as landscape through the dissolution of convention and the celebration of the imagination. Architectural space is treated as an extension of the site.

2. *Rebirth:* waste, as a by-product of contemporary consumer culture, is defined as something which no longer has value, something which is superfluous.[1] The technological arm of this investigation is focused on the process of spatially re-imagining the breakwater site through the use de-constructed shipping vessels (machines which have become outdated and can no longer function in the post-industrial/information age).

The main focus on landscape and rebirth filters through into the design of the Iziko Cape Town Maritime Museum to accurately represent the project's development from its theoretical founding to its speculative architectural resolution.

Overall, this dissertation is focused on pushing the boundaries of spatial experience through the adaptation and re-imagining of a decommissioned ship. We know very well how to make good buildings which are comfortable and comply with council and environmental regulations. This endeavour is aimed at exploring new possibilities.

1 Oxford Dictionary, Oxford University Press, 2017.

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# INHERENT ATMOSPHERES

## DISSERTATION REPORT

*Iziko Maritime Museum*

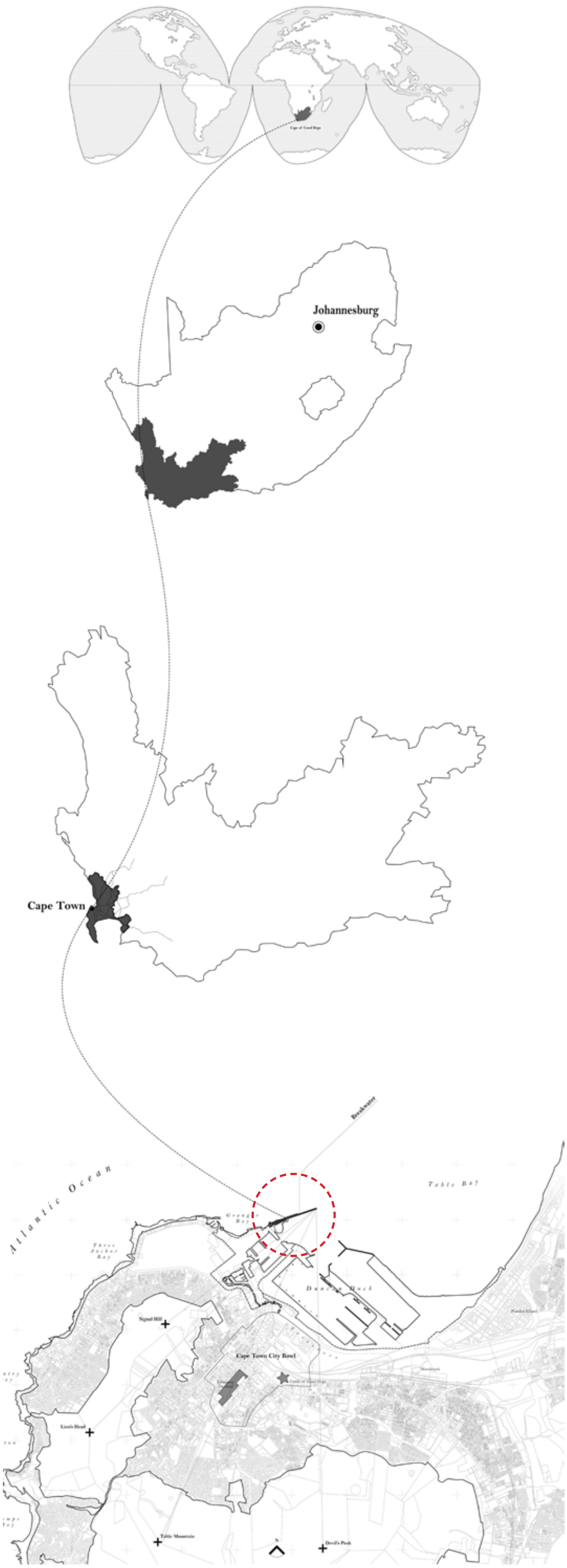



*Fig. 03. Locating the breakwater, Cape Town Harbour*

## INTRODUCTION

The foundations of this design report rest upon the study of the writings of Scottish geographer and biologist, Sir Patrick Geddes. In his theory of 'The Valley Section' he argues that nature is the fundamental determinant for society, hailing for a more regionalist approach to design and a sensitivity to place making. A second area of interest is that of rebirth, that is, the recycling of waste to create architectural space. These two interests intersect within a large site: the Cape Town Harbour, and they are further realized upon a smaller site: the Breakwater wall, at the end of E-Pier Road, in the V & A Waterfront and reimagined as a maritime museum made up through a ship-breaking process.

The historical narrative of the harbour reveals a rich reading of time and its presence across the vast landscape. The breakwater wall is the physical line dividing the tumultuous Atlantic Ocean and the man-made harbour. Research into the present-day shipping industry in the harbour lead to the process of ship breaking and recycling as a generator of architectural ideas.

Ship breaking, a process of material extraction and recycling, is a phenomenon of rapid modernization and is explored through an architectural lens. Anthropologist Mary Douglas refers to waste as *"matter out of place."*[1] An old ship which no longer serves a purpose is arguably matter with no functional value to society. This dissertation attempts to search for a value in such matter and redefine its value to society through architecture. It is this process of 'redefinition' which has driven the design process.

Through investigating the process of ship breaking, contemporary ideas towards waste and recycling are engaged with. This is by no means an argument for a building industry which is blindly based on waste, but it makes a critical statement towards the potential architectural opportunities offered within disruptive and evolving conditions such as rapid industrial transitions, as found in the shipping industry. This dissertation stands as the beginning of a conversation on how shipping vessels can be made in the future, with their afterlife in mind and not just their immediate functional shipping use.

1 Douglas, Mary. *Purity and Danger.* (London: Routledge & Kegan Paul Ltd, 1966).

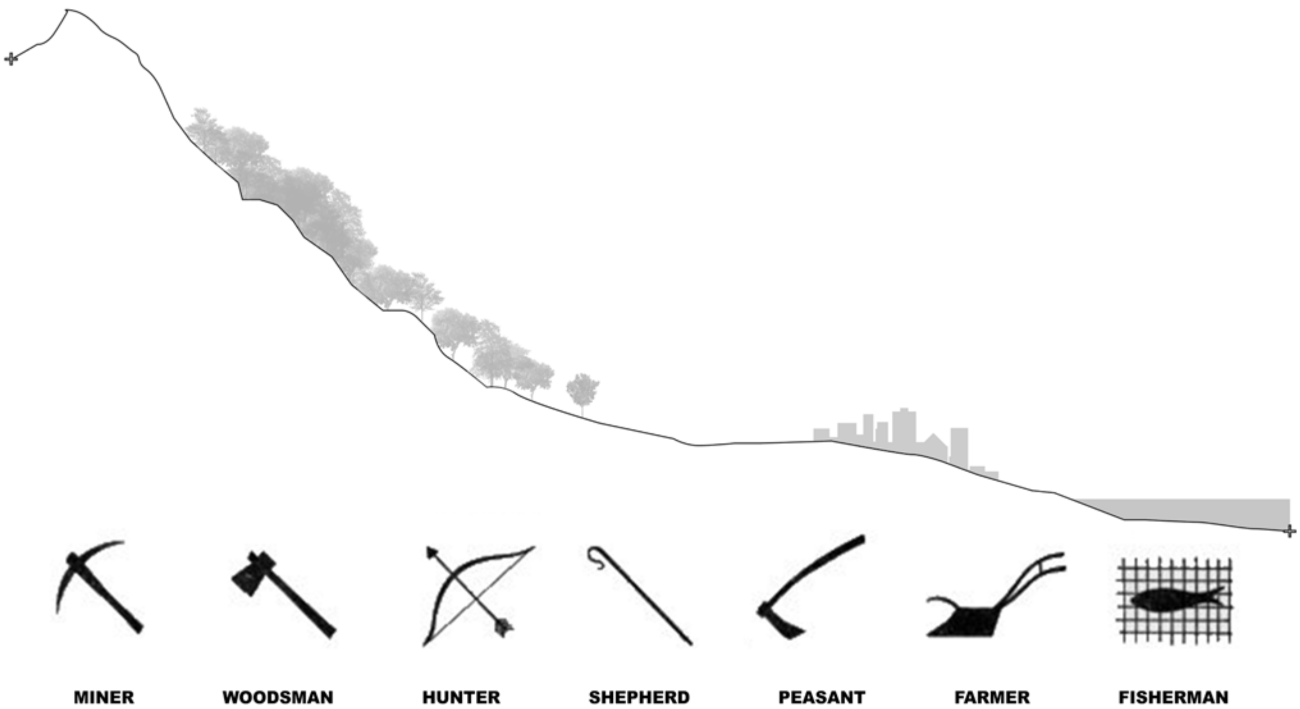



*Fig. 04. The Valley Section.*

## REGION

The work of Sir Patrick Geddes largely addresses the interdependancy between culture, economics and nature. He advocates for a integration of people and place, arguing that social and economic decline is inevitable without a respect and understanding of the natural environemnt in which we live.

This regionalist approach is expressed in his theory of 'The Valley Section' whereby, societal practice is viewed as a direct response to regional location. The elevation and nature of the section determine the occupations of his protagonists. For example, the woodsman is reveered as the "primal engineer" for the availibilty of timber nurtures his craft of making and building. Similarly, the shepherds dwell on the lower open lands which allow for the mass grazing of large heards.

The architectural ideas behind this theory are pertinent today, perhaps even more so than in the time of their conception. In Geddes book where this theory is explained, titled 'The Valley Plan of Civilization', he makes a case for his emphasis on the relationship between a place and society in saying,

> The kind of place, and the kind of work done in it, deeply determine the ways and institutions of history...[1]

The sensitivity to place has a direct impact on architects and designers as it architecture stands as a mediator between man and nature. The adaptation of the built environment then is not only architectural but must also, therefore, be a cultural, social and economical issue. This is seen in his comparison between a wheat-based individualistic society commonly found in Eurpean culture, and the rice-based cummunity which echoes the traditions of the Far East. A wheat farmer only needs help around harvest time, whereas the practice of farming rice must involve a whole village, the social nature of this process having a ripple effect on society.[2] In this way, cultures are defined by the region, and are seen as either a sustainable or unsustainable expression of nature.

Defining architecture as the "concretization of existential space"[3], Christiaan Norberg-Schulz, argues that existential space is the basic relationship between man and environment. He views architecture as the medium through which man locates and identifies himself in an environment, and finds being in space and time. Both Geddes and Norberg-Schulz argue for a more hightened sensitivty to place and culture, and their ideas are explored within this dissertation. The historical, economical, and cultural aspects of the chosen site are researched intently in order to extrude narratives which would serve is instigators in the design process.

1 Geddes, P. *1925*. p289.
2 Ibid.
3 Norberg-Schulz, 1980. p21.

## BOUNDARY AND BEGINNING

In spatializing his ideas of place, Martin Heidegger explores the idea of a 'boundary' as a means of defining a spatial experience. "A boundary is not that at which something stops but, as the Greeks recognized, the boundary is that, from which something begins its presencing."[1]

The breakwater site represents such a boundary. Essentially, it is the device from which the harbour begins its presencing. As mentioned in the introduction to the site, the breakwater is critical in maintaining the Cape Town harbour and has been for many years. It represents the beginning of the place, the gateway to the harbour. For those within the harbour, it is also the line representing the beginning of the untamed Atlantic Ocean.

Founded on this idea of place, the art of place-making then begins with a sensitivity of these components. Time and space, the natural and the man-made, all make up the characteristics of place. Traces of these components are found across the chosen breakwater site.

Although the Breakwater site can be seen from many prominent places in the city, its proximity to the dangerous waves of the Atlantic and exposure to the elements make it inaccessible to the general public. It takes on a binary identity by which it is both a prominent component in the harbour's identity but is rendered dangerous and relatively barren. It is this conflict which first set the site apart from other options in the early moments of this dissertation, and it is this conflict which shall permeate into the final outcome.

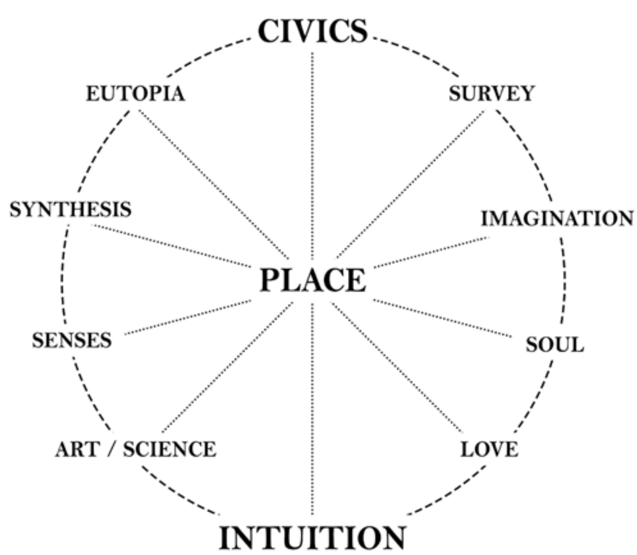



*Fig. 05 (a.) From 'Cities in Evolution' by Patrick Geddes.*

1 Heidegger, Building, Dwelling and Thinking.

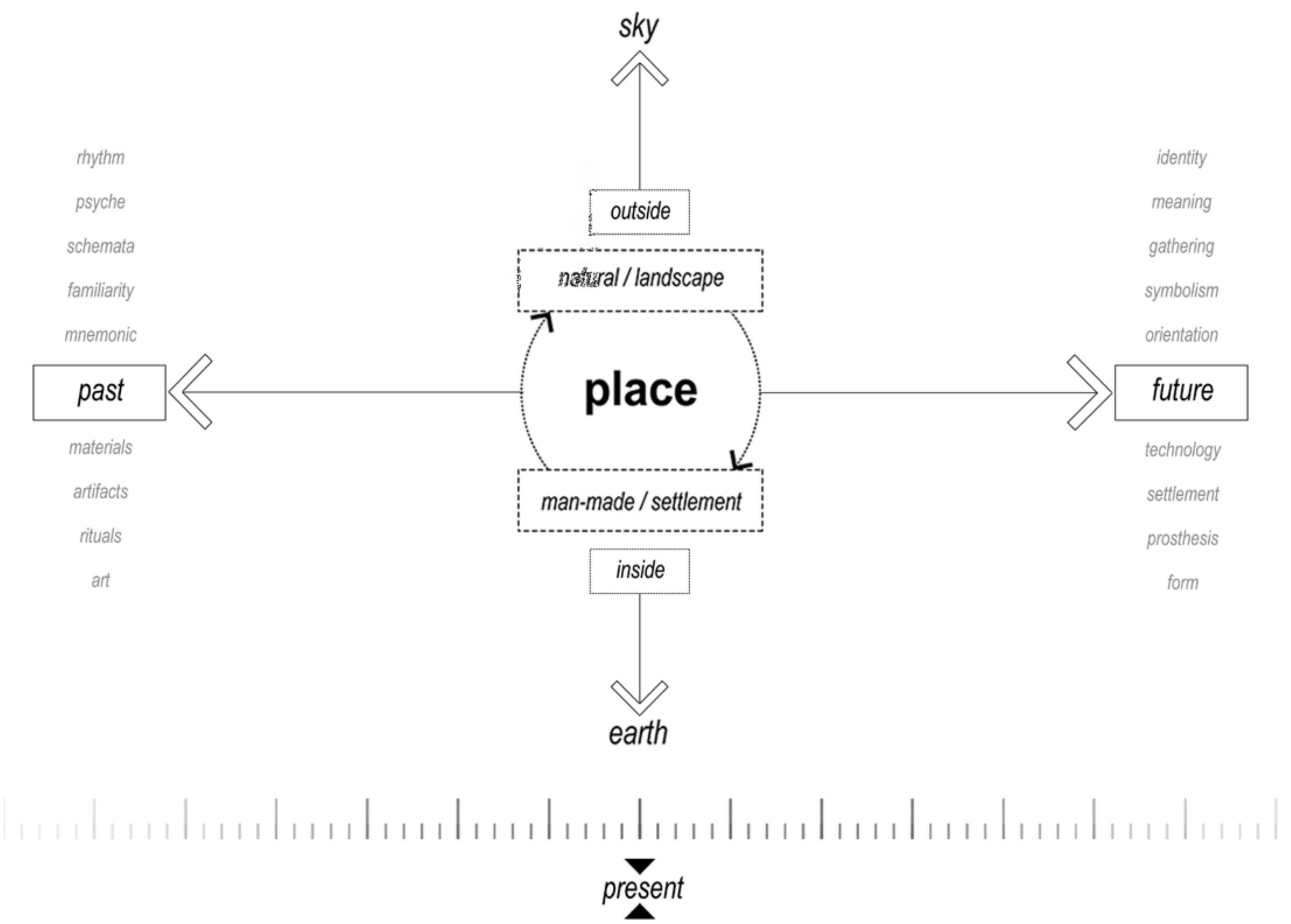



*Fig. 05 (b.) A diagrammatic summary of 'place' by the author, based on the theory of Norberg-Schulz.*


1660 - 1860
1860 - 1900
1900 - 1920
1920 - 1933
1933 - 1945
1945 - 1966
1985 - 2017
2030 - 2040

## THE BREAKWATER

Established as a port city, Cape Town's harbour in Table Bay has provided relative shelter from the harsh weather conditions surrounding the Cape of Storms. In the 1940s, the construction of the Foreshore in Table Bay served to provide around 194 hectares of land designated for the new rail system and Duncan Dock. At the time, it was considered to be the most ambitious land reclamation project attempted in the world. The scale of this undertaking serves as evidence of the global importance of the Cape shipping route at the rounding of the African continent.

Table Bay experienced its 'golden age' for some time before the construction of the Suez (1869) and Panama (1914) canals reshaped the global shipping routes. The harbour is well protected by the 1.4km long Breakwater wall, arguably one of the most important structures in Cape Town.

My interest in this site stems from several key aspects. It is one of the very few sites around the Cape Town Harbour area which remains undeveloped, largely due to its exposure to the harsh weather conditions on the rather exposed site. The broader site is made up of the super-structure of the Breakwater wall and reclaimed earth which was deposited there in the late 1980s. Much like the extensions of Manhattan Island, the majority of Duncan Dock and the V & A Waterfront is constructed upon reclaimed land consisting of construction rubble and quarried stone (see fig. 07 and 08 overleaf).

Currently, the Breakwater wall is in a state of disrepair, and the land beside the wall remains raw, and untouched. The northern edges of the wall are protected by concrete Dolos which are designed to absorb the majority of the impact of the waves. These structures are both beautiful and haunting as their weathered and broken state stand as testament to the forces of nature acting upon them.

Behind the Dolos wall rests a peculiar landscape constructed from 80 tonne concrete blocks which are laid around the termination of the old wall in a kind of 'larger-than-life' paving pattern. The scale of these massive components was taken into consideration in the design process as their immovable presence, so as to say, was tangible. The existing coastal armour and earth works formed this fascinating terrain of concrete, rusted steel and reclaimed rubble, weathered and entangled in the tough cape shrubs. The reclaimed earth is pushed up against the south face of the wall forming a mound to further bolster the defences. During spring, the bright colourful flowers soften the landscape to make it seem almost safe.

*Fig. 06. (right) Mapping the growth of the Cape Town Harbour (1652 - 2040)*

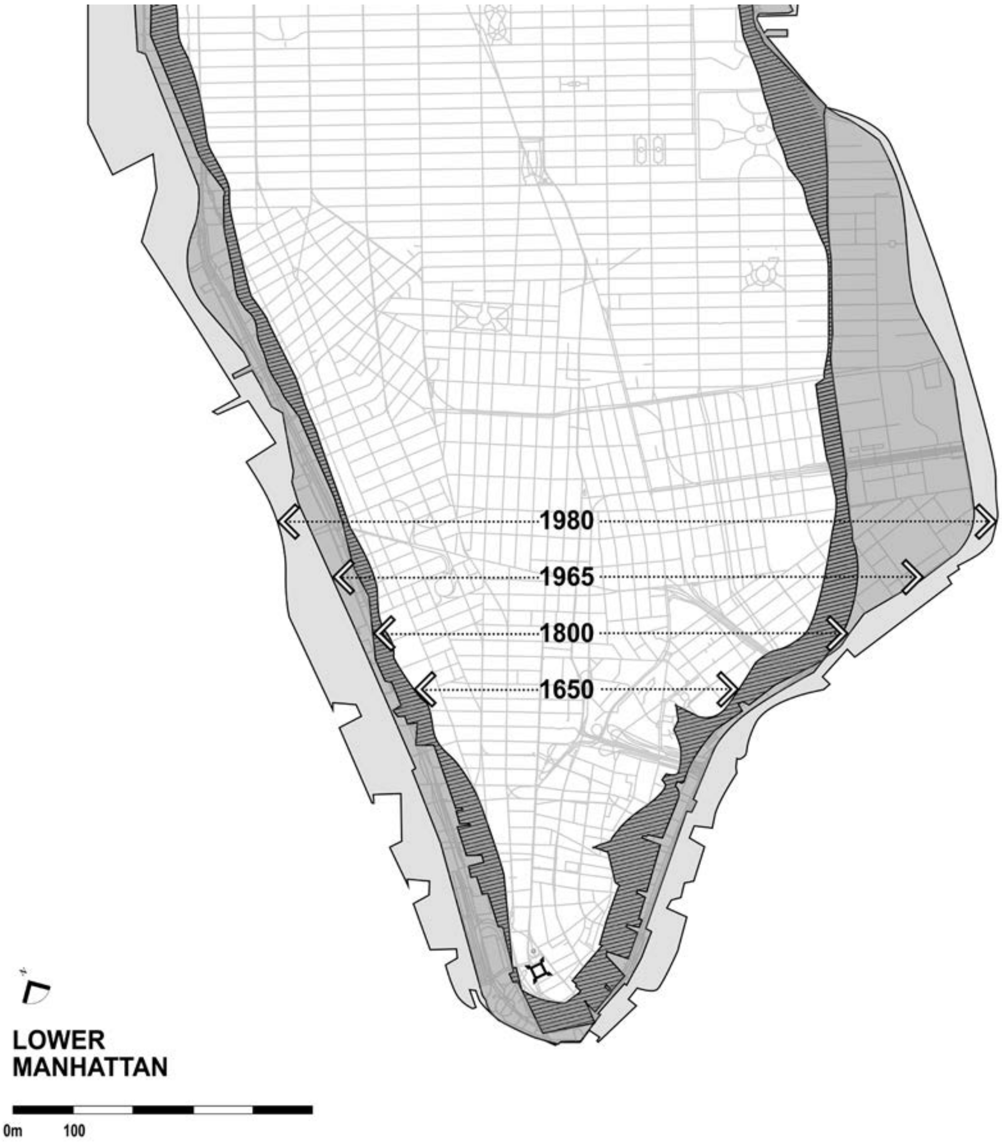



*Fig. 07. Land Reclamation over the years, Lower Manhattan Island, New York (by author).*

*Fig. 08. Park Street in Bristol, UK, after WWII.*

*New Yorkers were encouraged to use as much of their left over waste from construction projects as landfill along the Manhattan coastline. Rubble, rock and dirt from subways and foundations dig sites were systematically dumped to make room for more development. A lot of the rubble came from the bombed cities in Europe post WWII.*

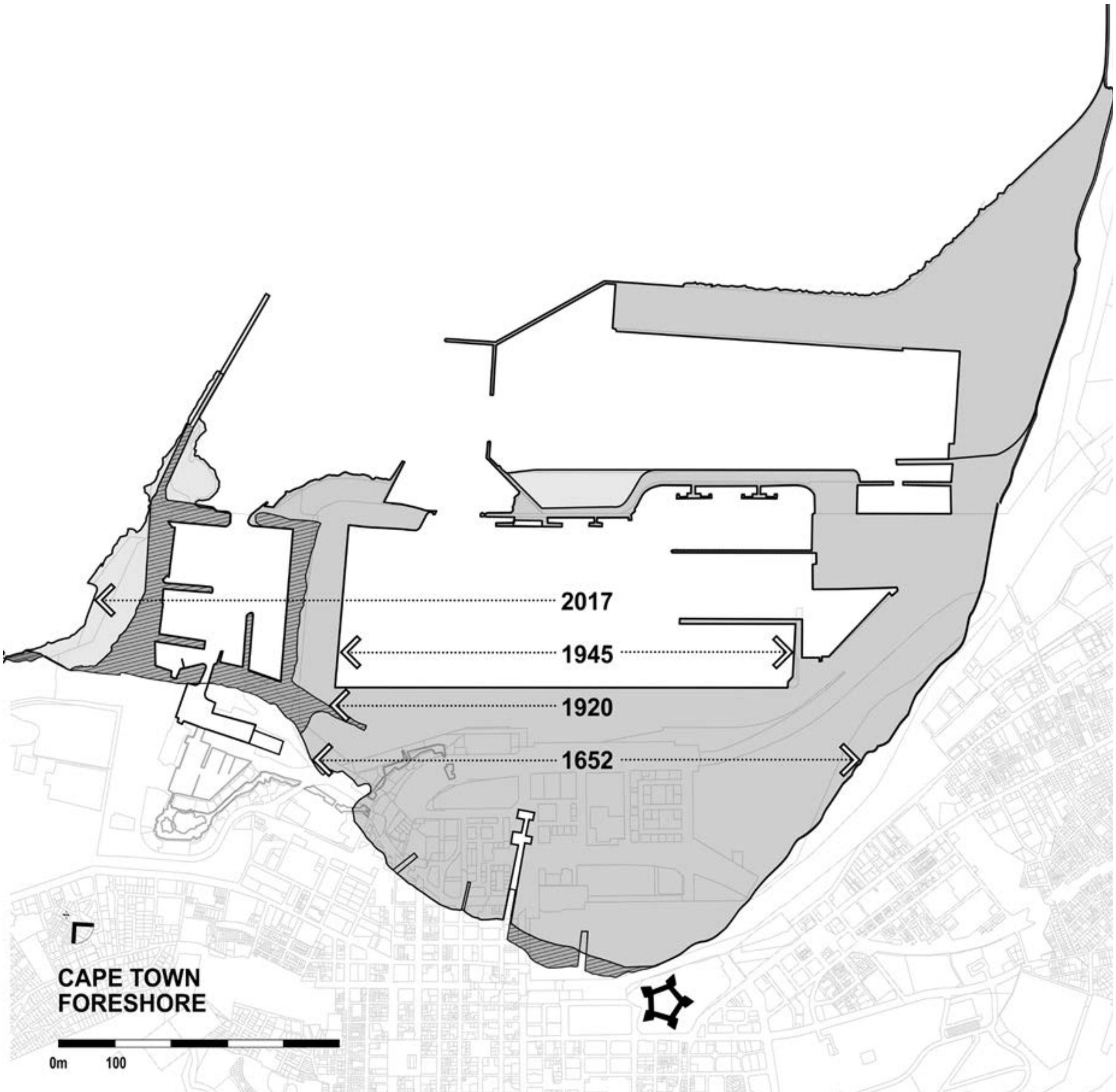



*Fig. 09. Land Reclamation over the years, Foreshore, Cape Town (by author).*

*In order to complete one of the largest land reclamations of the time, tonnes of lands had to be dredged up by large dredging vessels from Holland, and dumped into the area which is now known as the Foreshore. Over 194 hectares of land was reclaimed using the dredged up materials, as well as the rock removed from the construction of the V&A Waterfront and breakwater wall.*

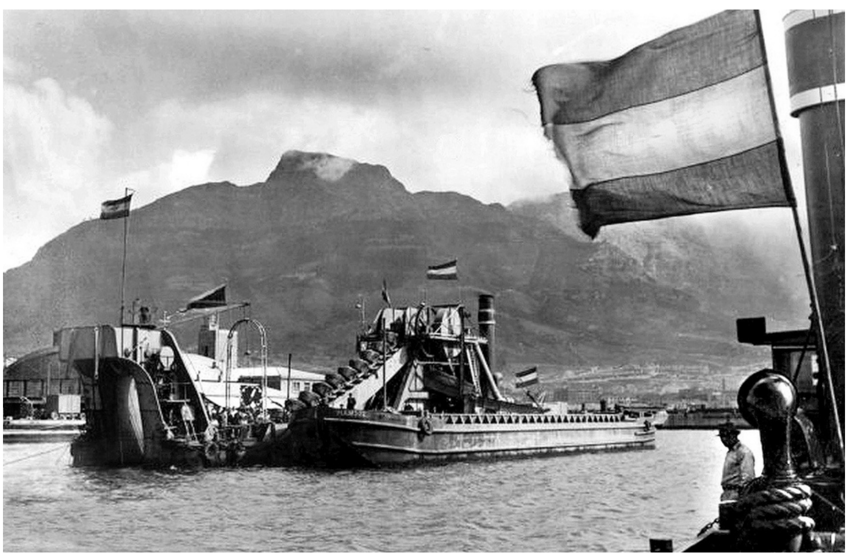


*Fig. 10. Dredging vessels constructing the Duncan Docks in Cape Town, 1939.*

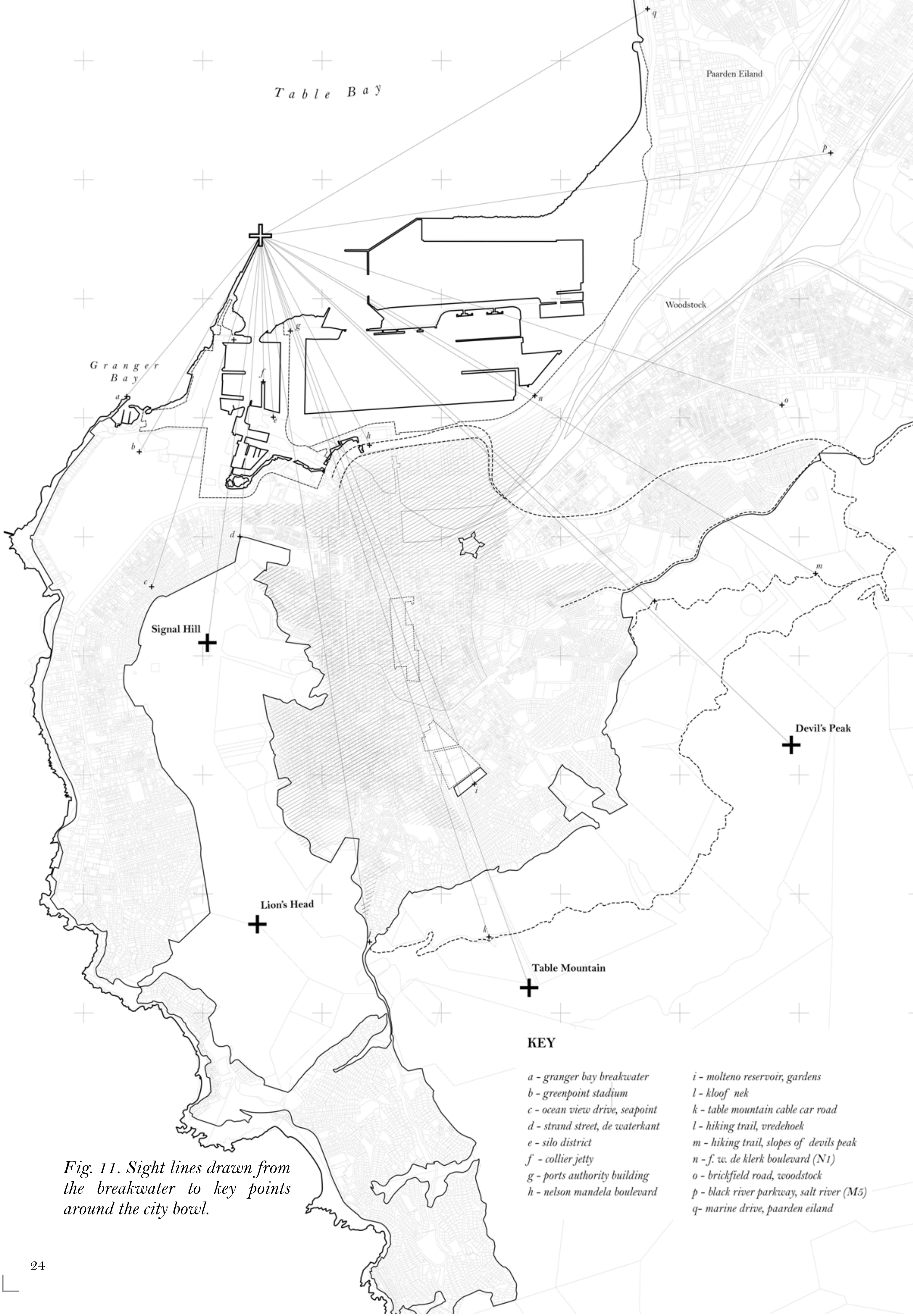



*Fig. 11. Sight lines drawn from the breakwater to key points around the city bowl.*

This site has a visual link to the harbour and key landmarks around the City Bowl area. There is a profound quality in the omnipresence of the Breakwater wall as its presence far exceeds the boundaries of site. This quality began to define the kind of building which could potentially be built here, more accurately, it began to clarify what *not* to design.


*Fig. 12. View of site from Table Mountain.*

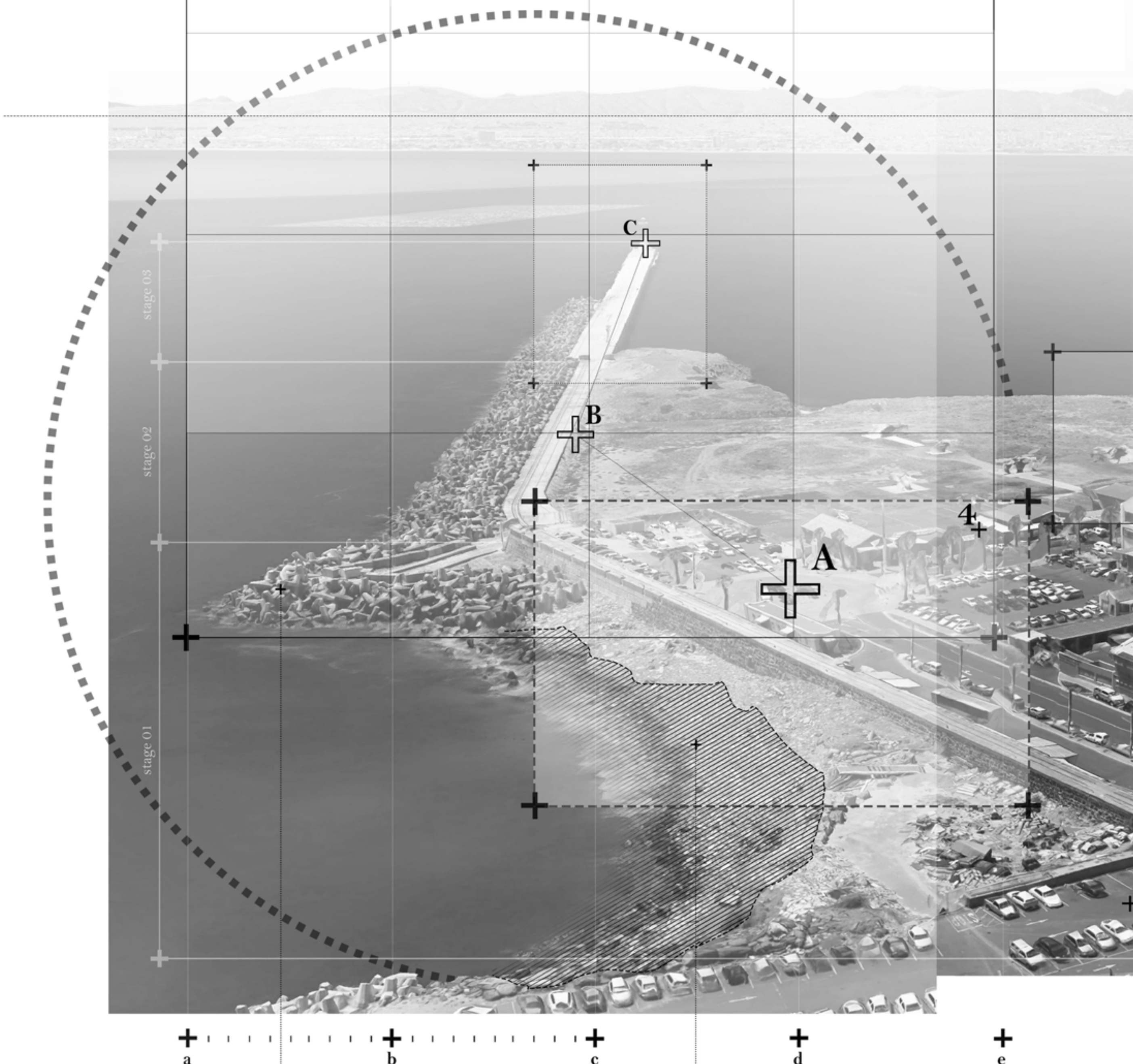

*Fig. 13. View of site from Lion's Head.*


*Fig. 14. View of site from slopes of Devil's Peak.*

## Cabo das Tormentas

Attracted by the riches to be found in Asia, Portuguese sailors rounded the Cape of Storms ('*Cabo das Tormentas*') in 1488, however, it was the Dutch East India Company who first settled in Table Bay in 1652. The settlement was originally intended to serve as merely a refreshment station for trading vessels on their way around Africa to India.

Table Bay offered very little shelter for the growing number of ships seeking to replenish their supplies, and each day spent in the harbour was a considerable risk. It was only in 1860 when Prince Alfred commissioned the construction of the breakwater, marking the beginning of the attempt to tame the tumultuous environment and secure Cape Town as a more permanent settlement.




### Dolosse

Concrete wave breakers which can weigh up to 30 tonnes. Invented by engineer Eric Merrifield after a storm ripped into the Eastern Cape coast of South Africa in 1963 and tore off 60% of East London harbour's armour.

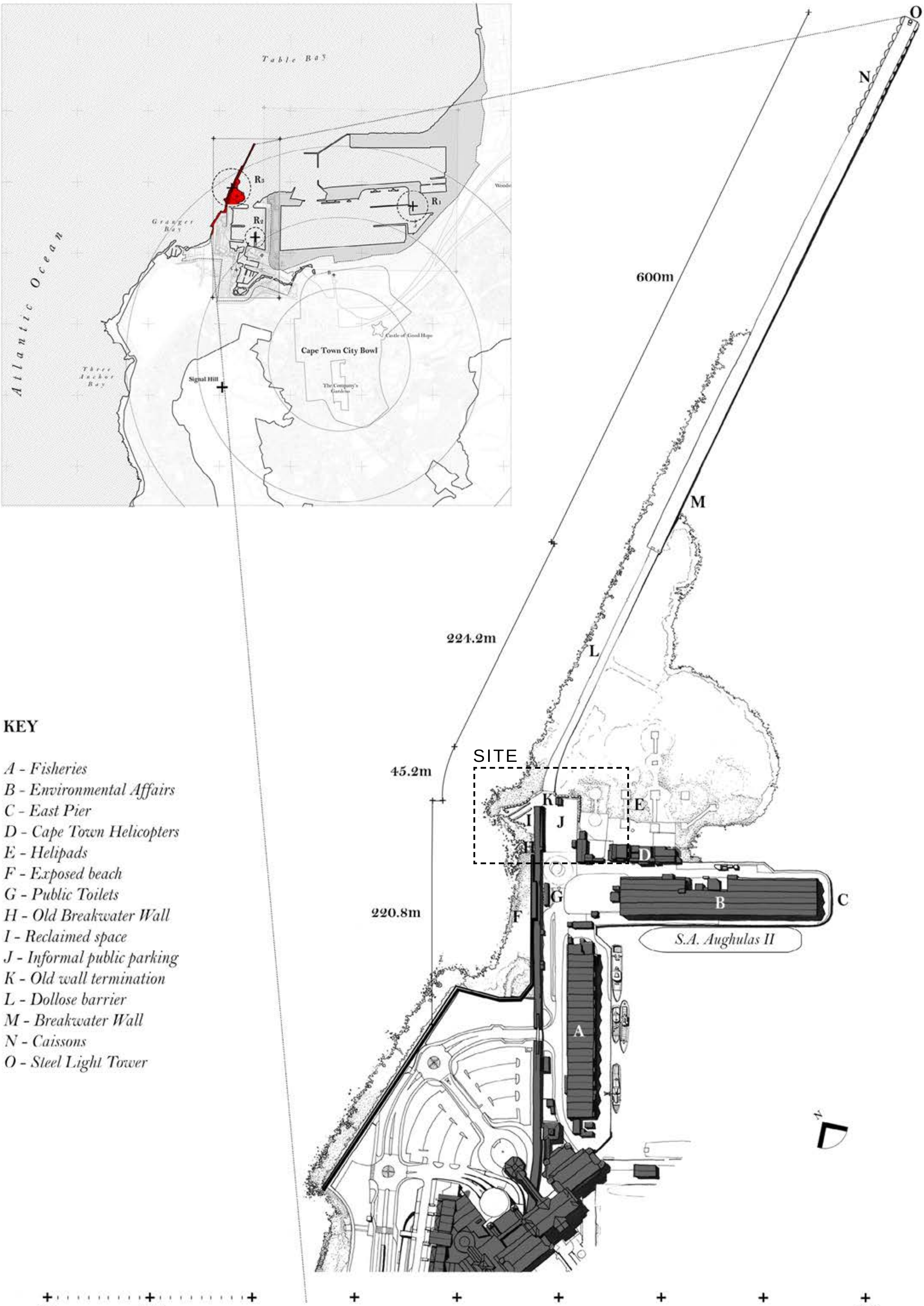
### Exposed Beach

Portion of the breakwater system which has been largely exposed to tidal damage due to a lack of dolosse or wave motion distrupters.


**E-Pier**

Constructed as part of the Victoria Basin in 1895 after the lengthening of the breakwater wall in 1890

*Fig. 15. An introduction to the breakwater site*




**KEY**

*A - Fisheries*
*B - Environmental Affairs*
*C - East Pier*
*D - Cape Town Helicopters*
*E - Helipads*
*F - Exposed beach*
*G - Public Toilets*
*H - Old Breakwater Wall*
*I - Reclaimed space*
*J - Informal public parking*
*K - Old wall termination*
*L - Dollose barrier*
*M - Breakwater Wall*
*N - Caissons*
*O - Steel Light Tower*

*Fig. 16. Contextual site plan.*

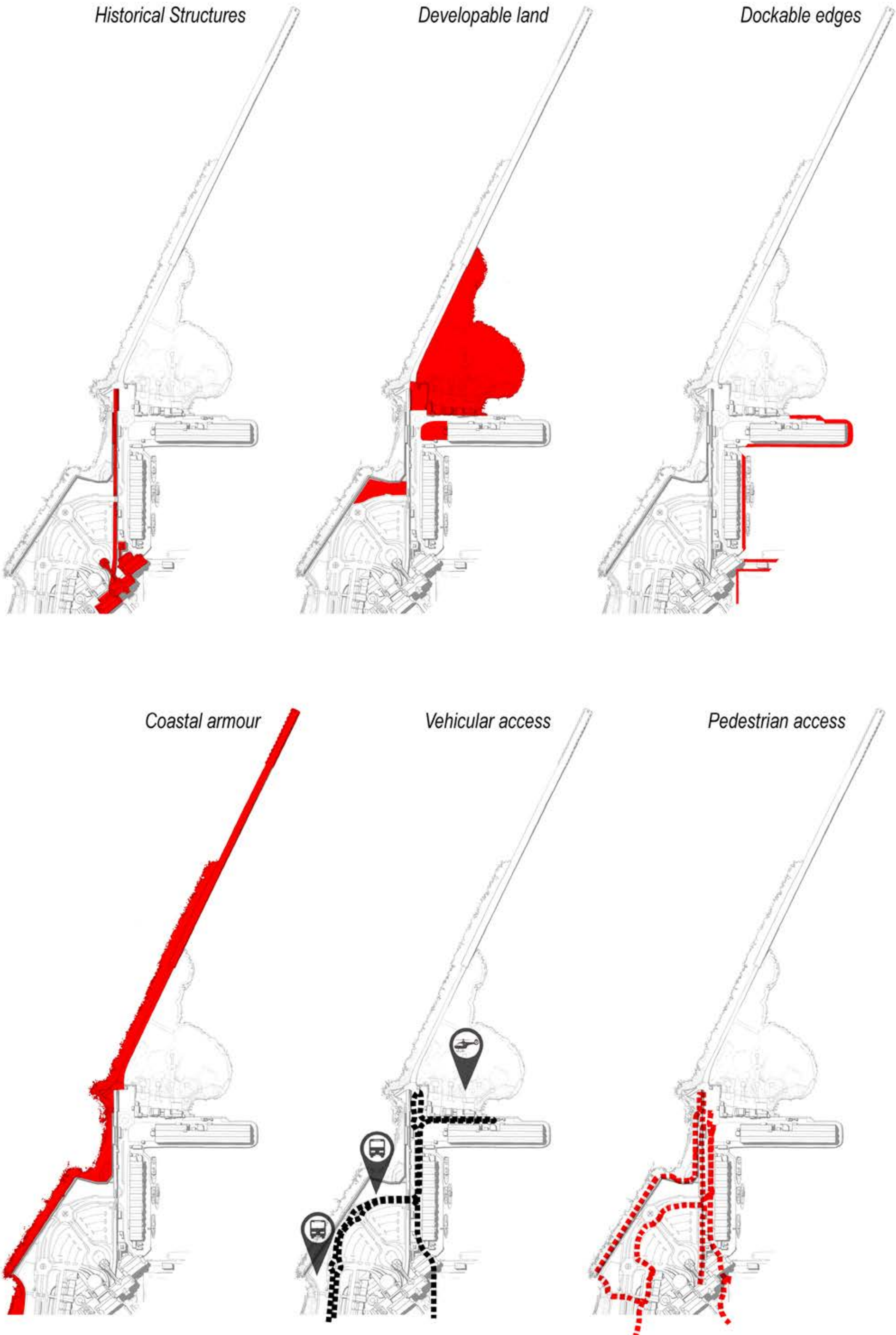



*Fig. 17. Drawings showing the basic readings of  site.*

*Fig. 18. View from the site towards the light tower at the end of the wall.*

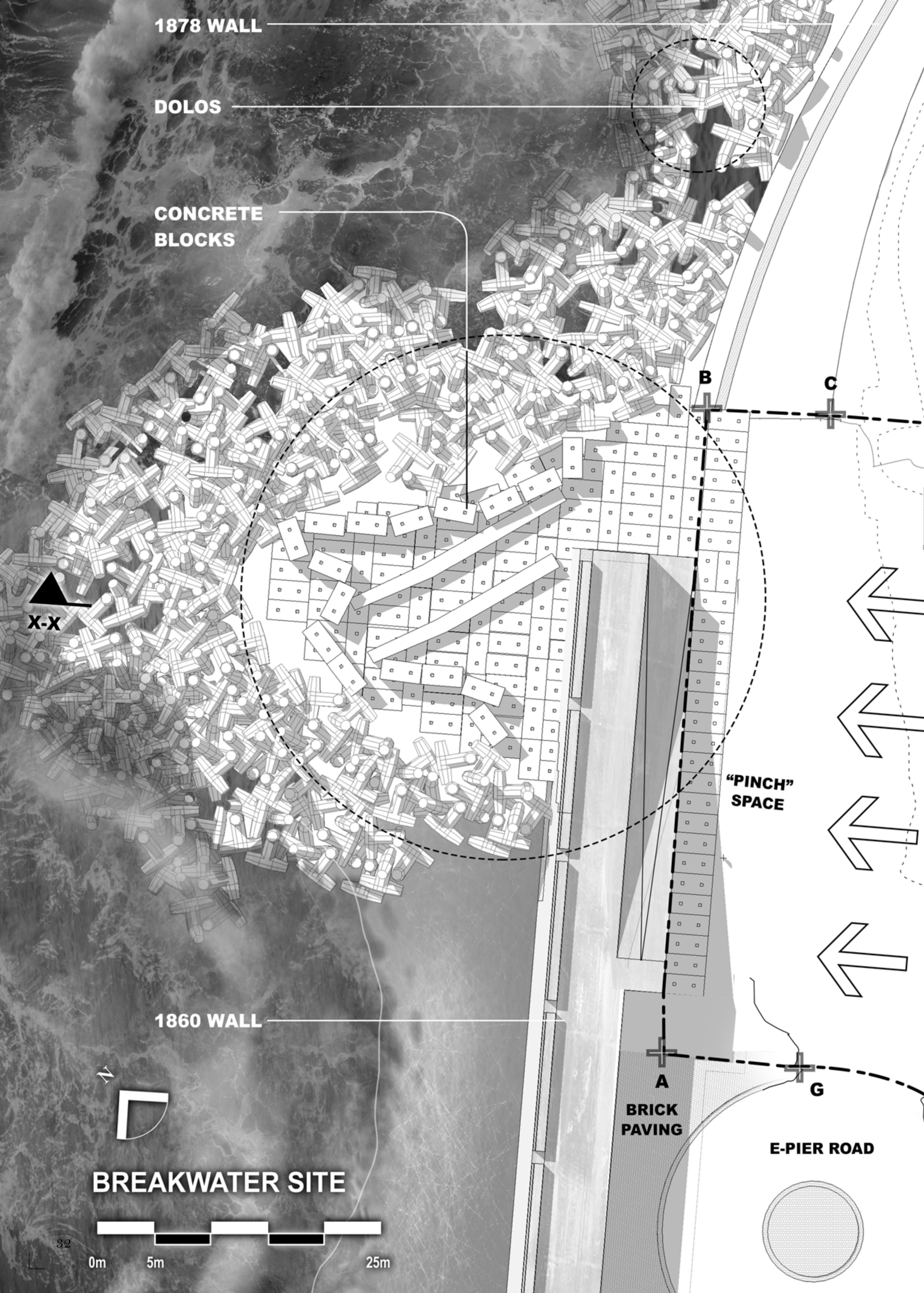
*Fig. 19. Coastal armour along the northern face of the wall.*

*Fig. 20. View looking back over the old wall at the Greenpoint Stadium.*

*Fig. 21. Rusted balustrade set into the old breakwater wall.*

*Fig. 22. Peculiar clip-on timber structure as a shelter near the bus stop.*

*Fig. 23. Debris on the shores infront of the wall, a place where boulders and concrete is reduced to smooth stones and sand. The beach is also littered with tangled and rusted steel from the reinforcing of broken dolos.*


1878 WALL
DOLOS
CONCRETE BLOCKS
B
C
X-X
"PINCH" SPACE
1860 WALL
A
G
BRICK PAVING
E-PIER ROAD
N
BREAKWATER SITE
0m
5m
25m

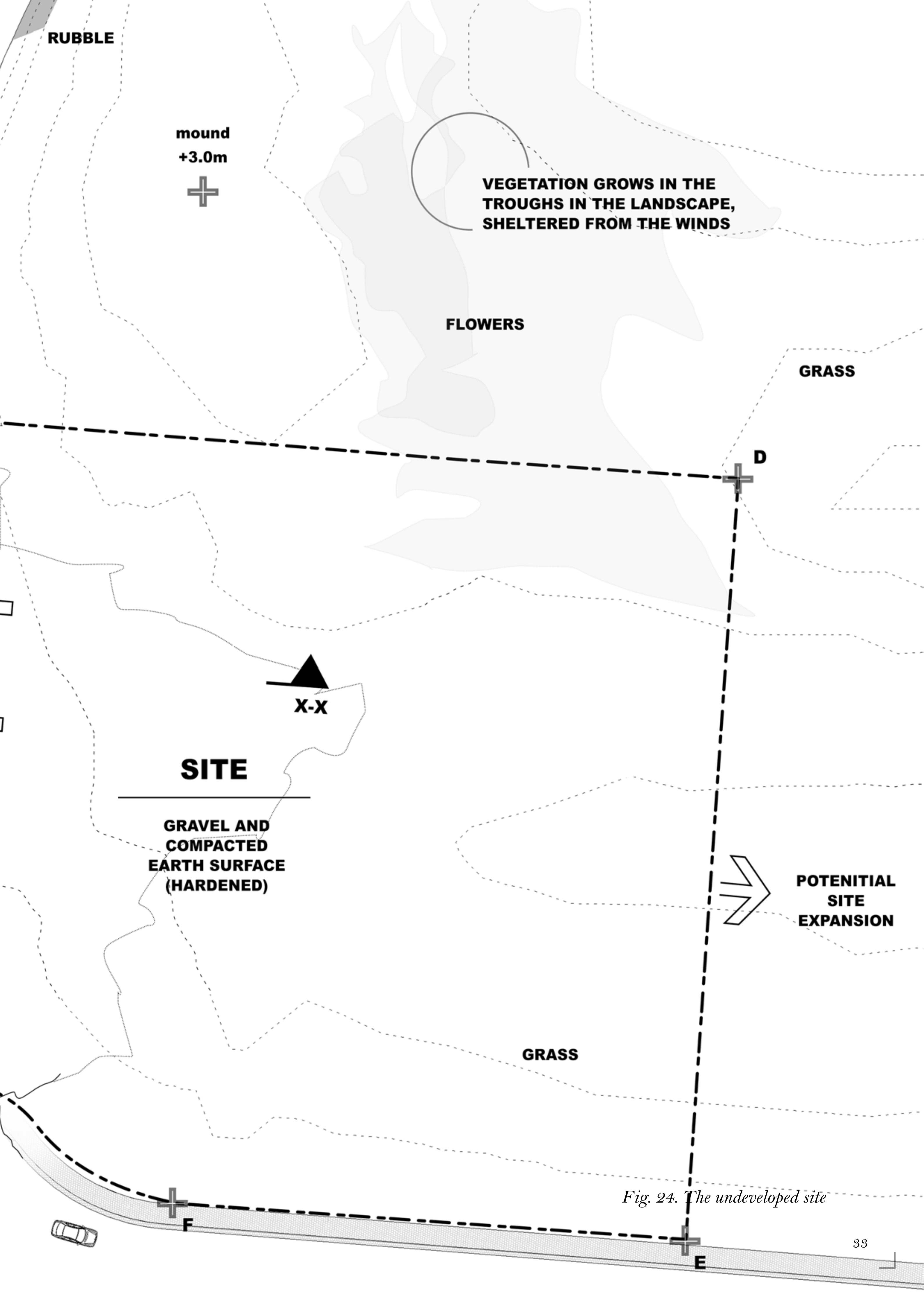



*Fig. 24. The undeveloped site*

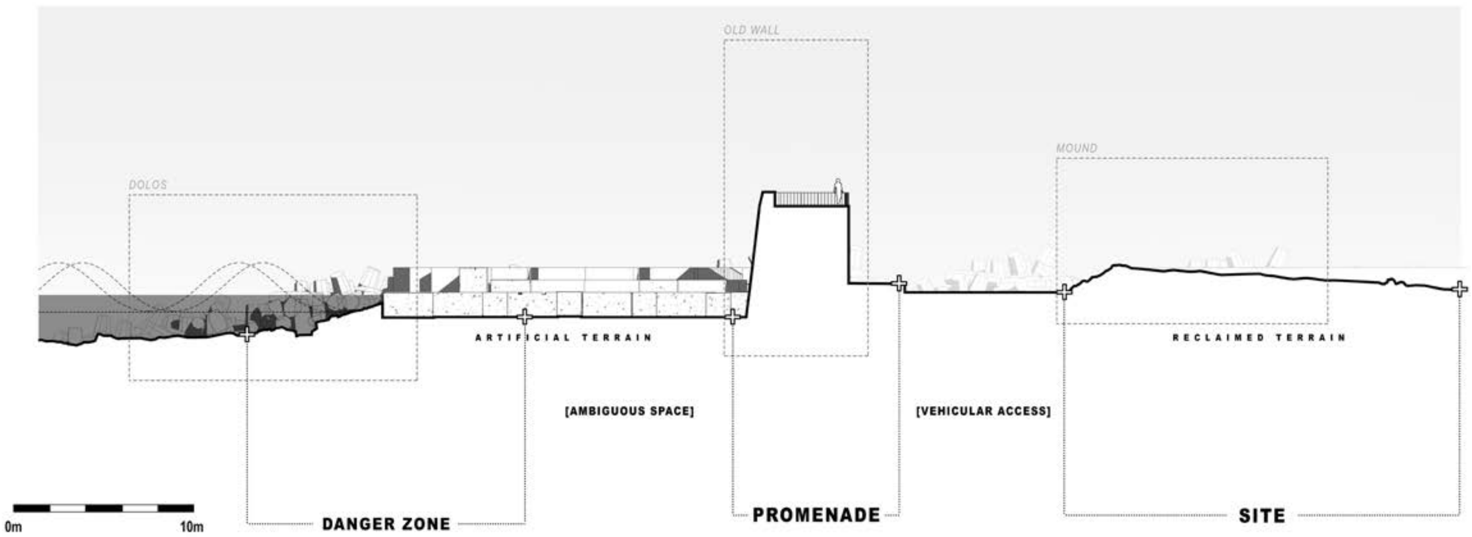
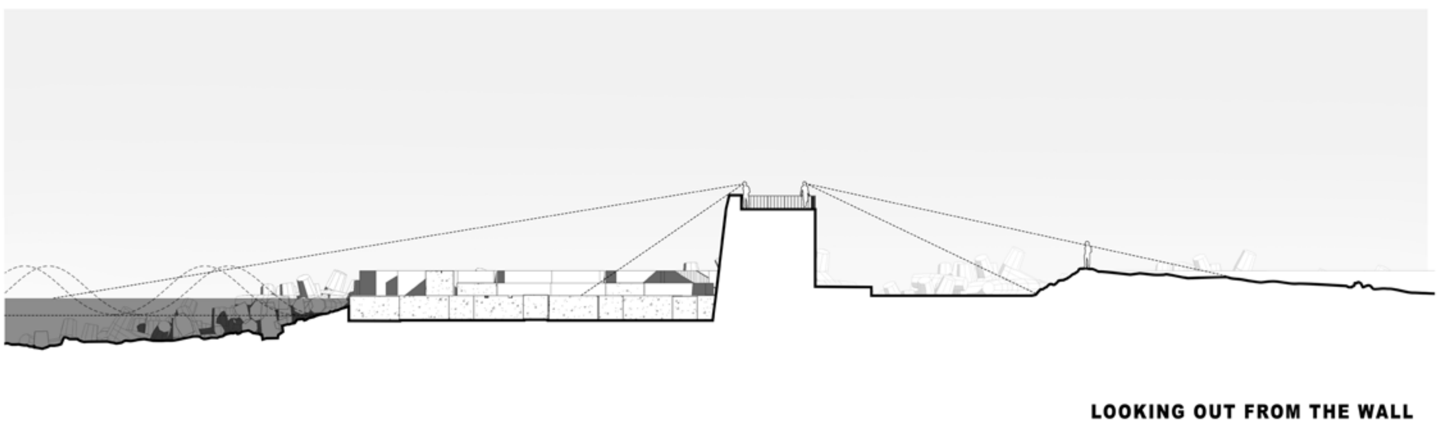



*Fig. 25. Section X-X cutting through the 'hip' area between the old and the new walls.*



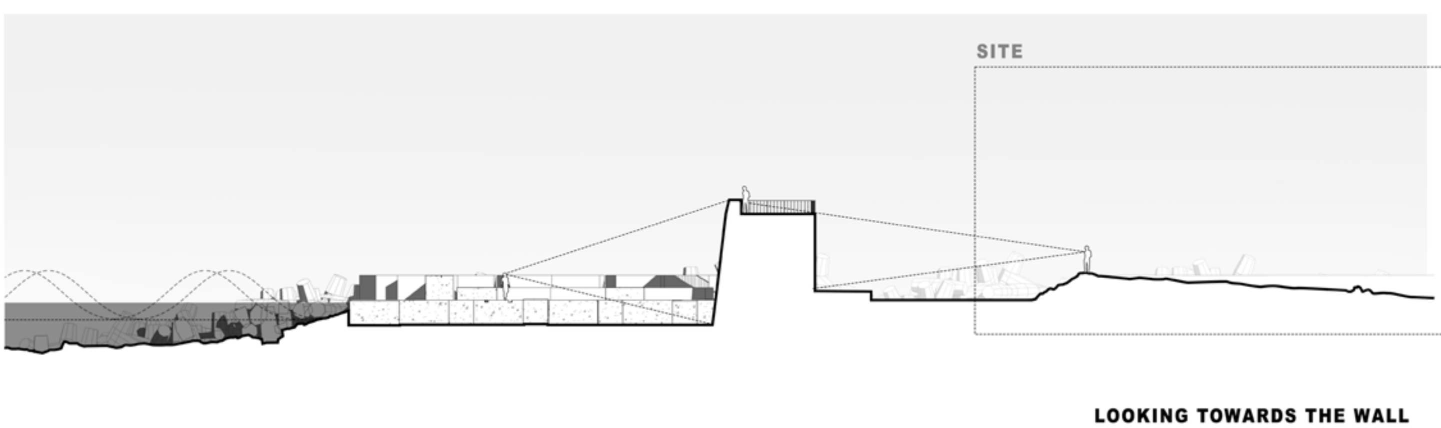




*Fig. 26. & 27. Adaptations of Section X-X above depicting the sight lines based on the different vantage point. The wall is a structure to look out from but, from the chosen site, it is a monument to admire.*

## THE PRESENCE OF THE WALL

A key experiential moment lies in the overpowering presence of the Old Breakwater wall. Unlike the newer extensions to the wall which are capped off at ground level, the Old Wall stands 5.7m above that level.

Looking back on the Old Wall is an experience which is currently not afforded to the public as the site is inaccessible. The idea of designing a building which sat behind the defences of the wall but which also created an awkward 'pinch' between the old wall and the new building developed. This space between the structures would become a boundary, of sorts, similar to that described by Heidegger. It would be the point at which the Old Wall ends, and the New Wall begins, celebrated by the extruded design amidst the walls.

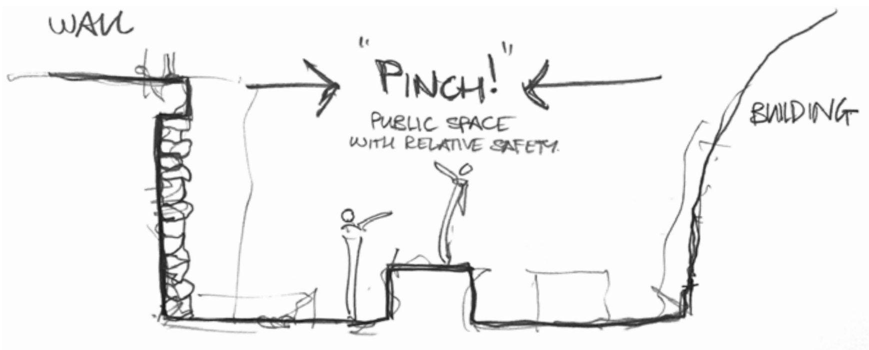



*Fig. 28. (above) early sketch of the void between the Old Wall and the new building.*

*Fig. 29. From ground level the sheer size of the Old Wall dominates one's experience. Currently there are very few safe places to stand back and view the wall from.*

*Fig. 30. The view from the mound across the site focuses on the bizarre artificial landscape rather than the Breakwater wall. The landscape in the foreground begins to hide parts of the city behind it.*

## MONOLITHIC LANDSCAPE

The extended breakwater wall is 500m long and is defended by 2865 concrete dolos, each weighing around 25 tonnes.[1] Dolos are used to absorb the force of waves as their collective structure is designed to dissipate the wave action rather than directly counter it. The reclaimed terrain between the old and the new walls is constructed from reclaimed rubble and massive concrete monoliths. The Old Wall is then seen to be extruded from this strange environment as it is rendered in the same quarried stone from which the land reclamations were accomplished with.

This is a key design incentive going further as there is great merit in designing a building which appears to be an extension or extrusion of the landscape. A decision was made here to design a building with a heavy monolithic structure set within the artificial mound of the site. The scars of construction and the heavy weathering upon the concrete surfaces are devices by which time is presenced on the site, as the newer blocks of concrete can be clearly distinguished from the old.

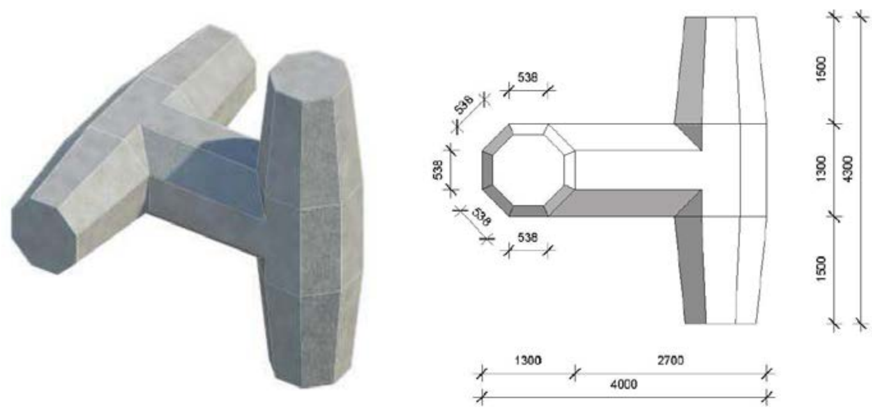



*Fig. 31. (above) Basic construction drawings of the Dolos.*

*Fig. 32. (below) The Kuoai No, a Taiwanese fishing trawler, rammed against the Breakwater dolos (1977).*

1 Tulsi, K & Phelp, D, *'Monitoring and Maintenance of Breakwaters which Protect Port Entrances.'* CSIR, 2009. p. 318.

*Fig. 33. The Dolos form an unusual terrain along the northern face of the wall.*

*Fig. 34. Photo of one of the massive concrete blocks used to create the 'hip' at the end of the Old Wall.*

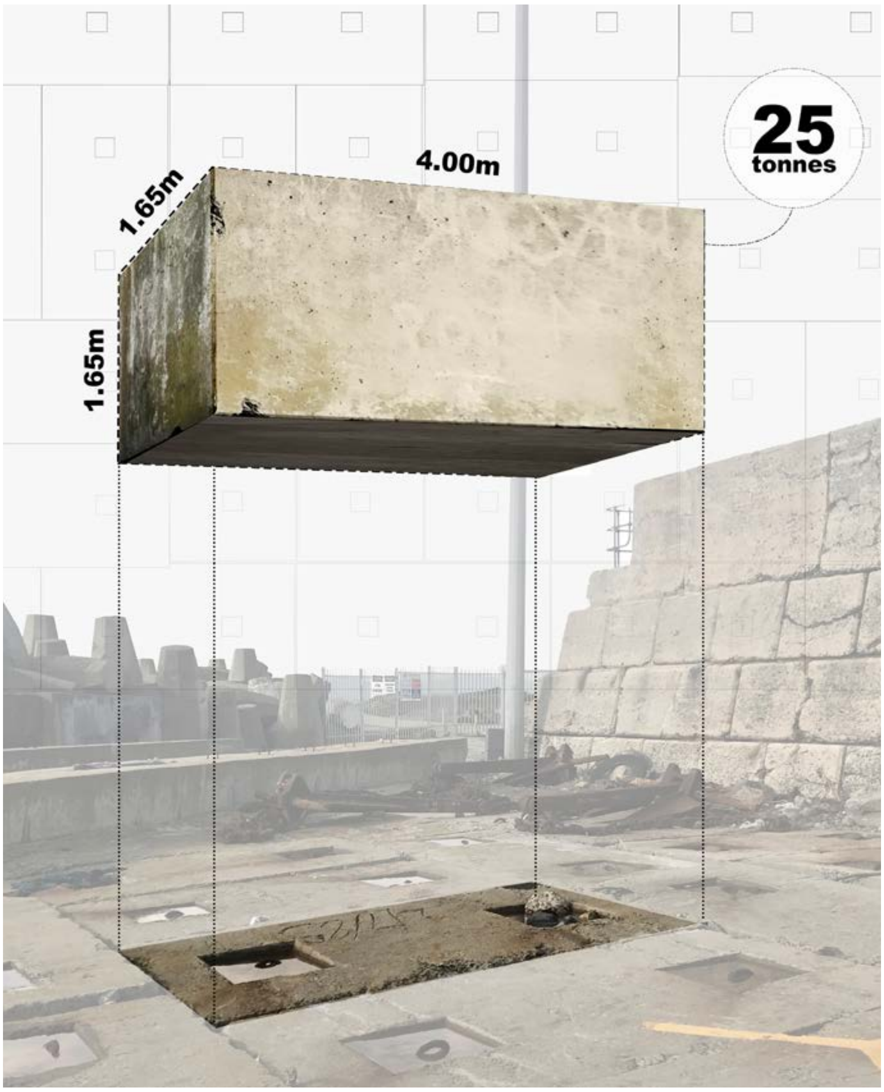



*Fig. 35. The large concrete blocks weigh around 20 tonnes and are laid out in a parquette pattern to create a somewhat alien and peculiar environment.*

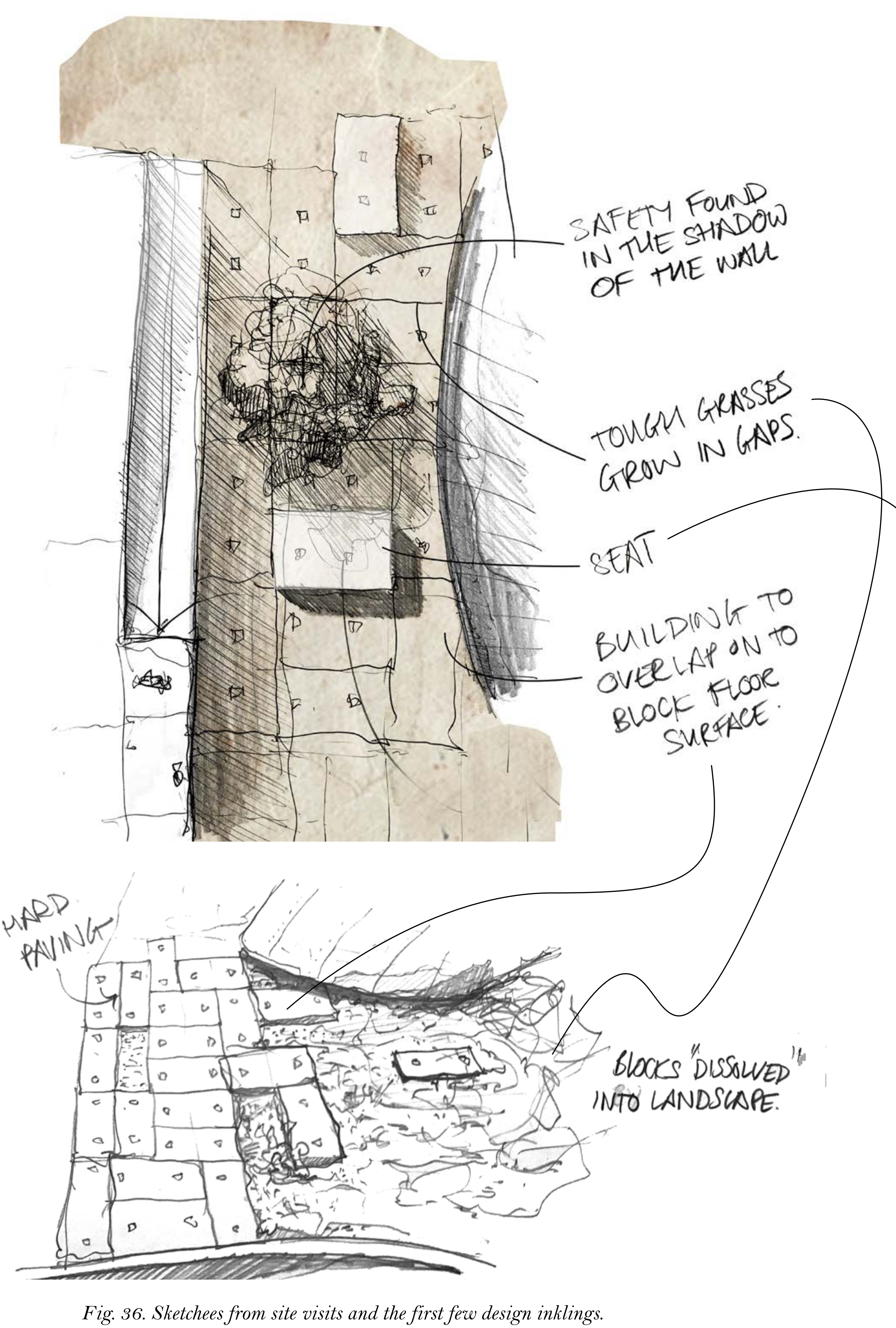



*Fig. 36. Sketchees from site visits and the first few design inklings.*

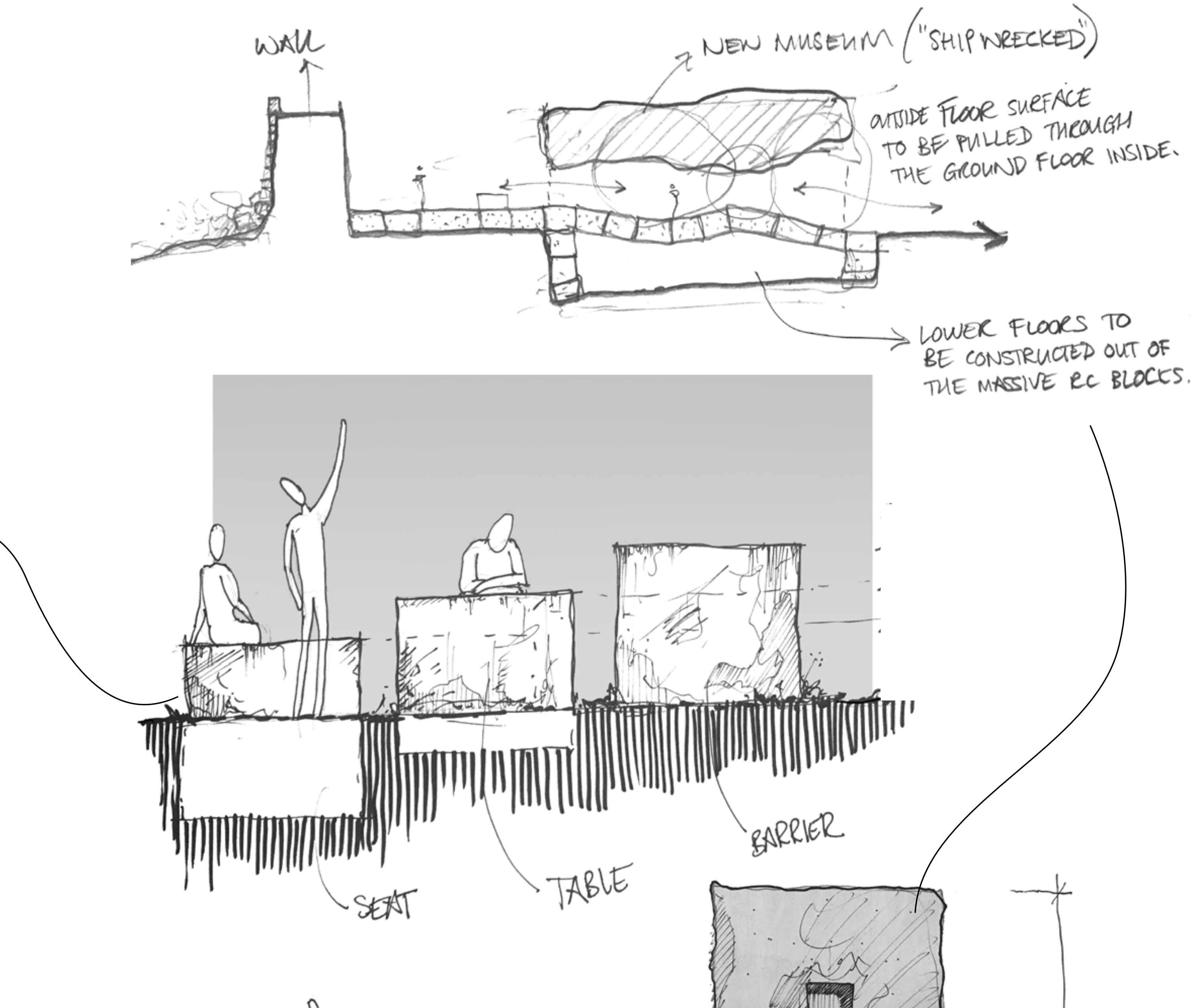



*Fig. 37. Sketchees from site visits and the first few design inklings.*

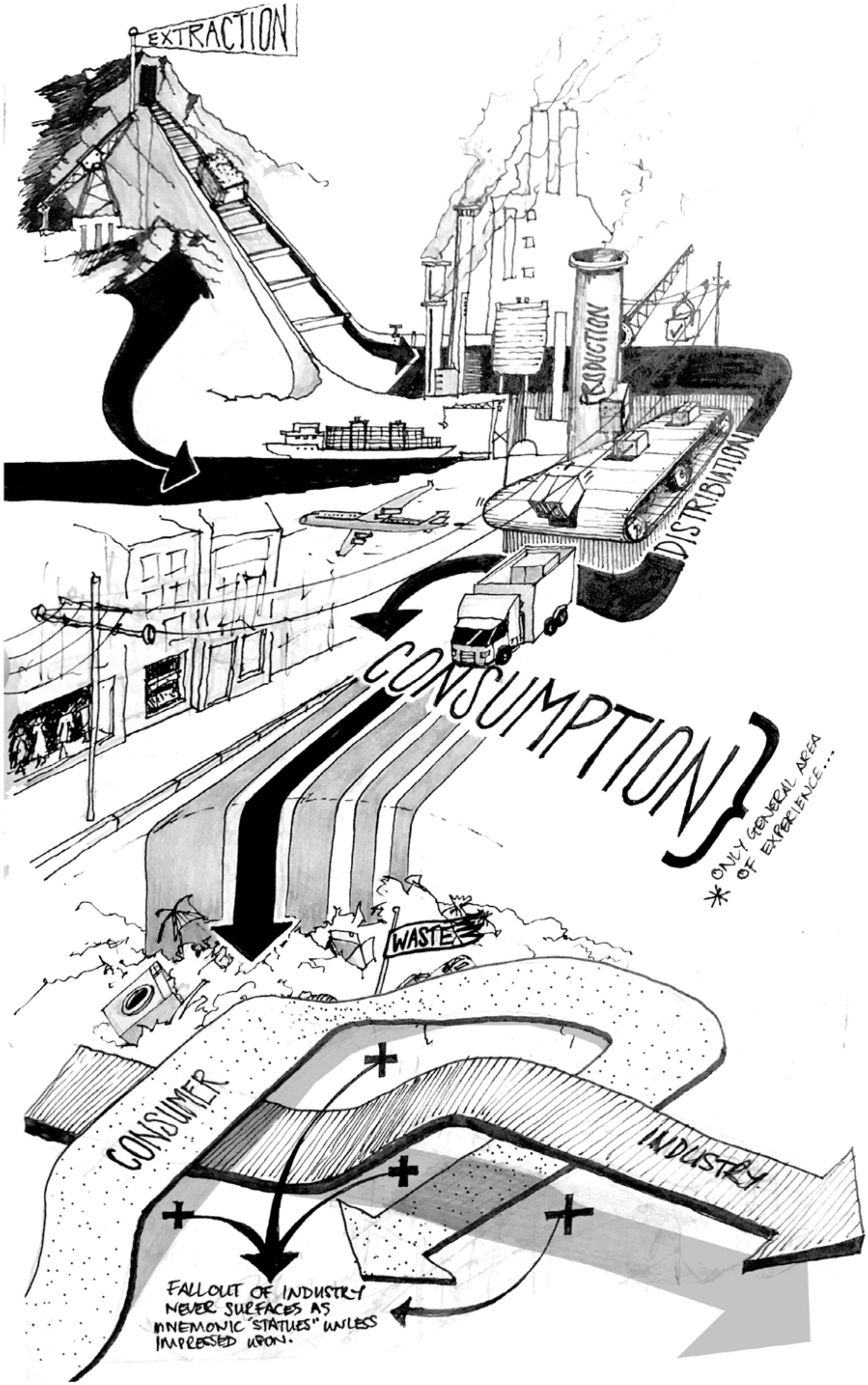



*Fig. 38. Early sketch depicting the global consumer culture and the process from extraction, manufacture, consumption and then waste (by author).*

## ANOTHER MAN'S TREASURE

The research into the broader context in which the chosen site sits lead to several key findings. Following the Valley Section idea of Patrick Geddes, an architectural program or language, so to say, should be derived from the conditions of the soil upon which it is built. The historical narratives across the site seemed a strong beginning to defining a language, and, as the site was formed through the use of large ships and heavy machinery, those instigators bore the brunt of the remaining research.

The primary question: What happens to these machines and ships when they no longer serve a purpose?

In *Purity and Danger*, Mary Douglas analyses the importance of dirt and cleanliness in different cultures. She argues that cleanliness and dirt may seem to be dichotomous, yet they really exist as a Möbius Strip of sorts. Her views towards cleanliness and dirt correlate with the views towards order and chaos, usefulness and waste.

> Order implies restriction; from all possible materials, a limited selection has been made and from all possible relations a limited set has been used.[1]

Where one might not think twice when seeing a pair of shoes on the floor in a hallway, if those same shoes were left on the kitchen counter while food was being prepared they would be considered dirty. In the same way, one is expected to keep their toothbrush in the bathroom but it would be considered rather unhygienic to keep it on the bookshelf in the living room. Essentially these examples bring about the notion that dirt is something which sits within an ordered system but does not belong in it. Douglas refers to it as "matter out of place".

Waste is the unwanted in the place of the wanted. In the same way, an old fishing vessel which has served many hard years at sea reaches the end of its operational life, and its dilapidated condition renders it as 'unwanted'. Its function becomes too costly and it becomes obsolete to its user. As a 'machine for floating in' (to take on Le Corbusier's idea that 'A house is a machine for living in') it no longer serves it purpose and, therefore, becomes matter which is out of place.

During times of global recession, such as the financial recession in 2004 to 2008, obsolete ships become liabilities and are sold to be turned into scrap. Although this kind of global economic fluctuation benefits these third world economies (one man's obsolete ship is another man's re-rolled steel rebar), the operational hazards of informal and unregulated shipbreaking are somewhat atrocious and have been under heavy scrutiny in recent years.

Organisations such as International Maritime Organization (IMO) and Greenpeace International, have developed a global stance on the

1 Douglas, Mary. *Purity and Danger.* (London: Routledge & Kegan Paul Ltd, 1966), p. 95.

*Fig. 39. A fishing trawler being repaired at the Robinson Dry Dock, V&A Waterfront.*

system of shipbreaking in order to implement strict environmental and human rights laws. In 1989, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal[1] began developing shipbreaking regulations which were legally binding and globally applicable, whereby the process of dismantling a ship could be achieved as efficiently as possible without compromising on the safety of those involved.[2]

Environmental regulations across the world have isolated one of the key factors which could reduce the impact of the shipping industry and that is the double hull. Most steel container ships before 1998 were constructed with single hulls. When the outer skin is punctured, a double hull provides a secondary barrier to prevent the ship's ballast and fuels from contaminating the environment, as well as preventing the ship from taking on more water.[3] International insurance companies no longer insure single hull vessels for this very reason.

As corporations are not willing to operate without insurance, a huge number of single hull ships are no longer operational. The majority of these vessels sail their final voyage to the tidal beaches of the global south, where labour is cheap and environmental legislation is loosely suggested rather than enforced.

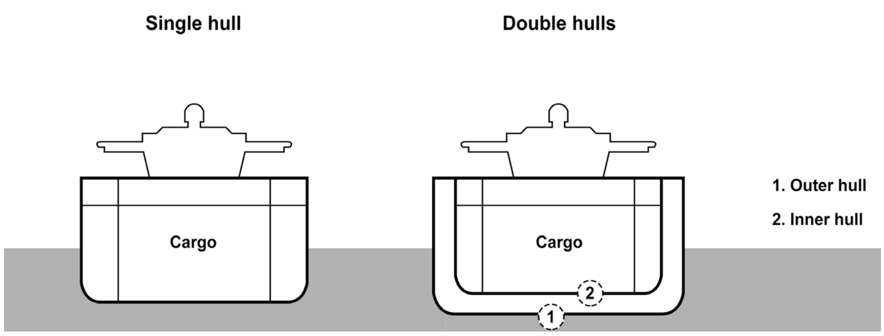



*Fig. 40. Single hull v double hull ships.*

A medium sized single hull container ship serves as the protagonist in this dissertation. The 'Feeder' sized container ship is one of the most common vessels to frequent the Cape Town harbour, aside from the much larger 'Panamax' (240m long) and 'Post Panamax (300m long), which are both double-hulled and were considered far too large for the scope of this project. The fictitious ship, named The Rose, was built using BIM software and based on naval architectural drawings.

| Vessel | Side view | Dimensions (LOA x Beam x Draft) | SB | CT | PE | Ng | EL | Dig-out | Dur | RB |
|---|---|---|---|---|---|---|---|---|---|---|
| **Container: Feeder** 3 000 TEU |  | 135m x 30m x 11,0m | | √ | √ | √ | √ | √ | √ | √ |
| **Container: Panamax** 4 500 TEU |  | 240m x 32m x 12,0m | | √ | √ | √ | | √ | √ | |
| **Container: Post Panamax** 6 600 TEU |  | 300m x 40m x 14,5m | | √ | | √ | | √ | √ | |

*Table. 01. The Duncan Dock has a relatively broad container ship capacity, rivalled only by the much larger and deeper port in Durban.*

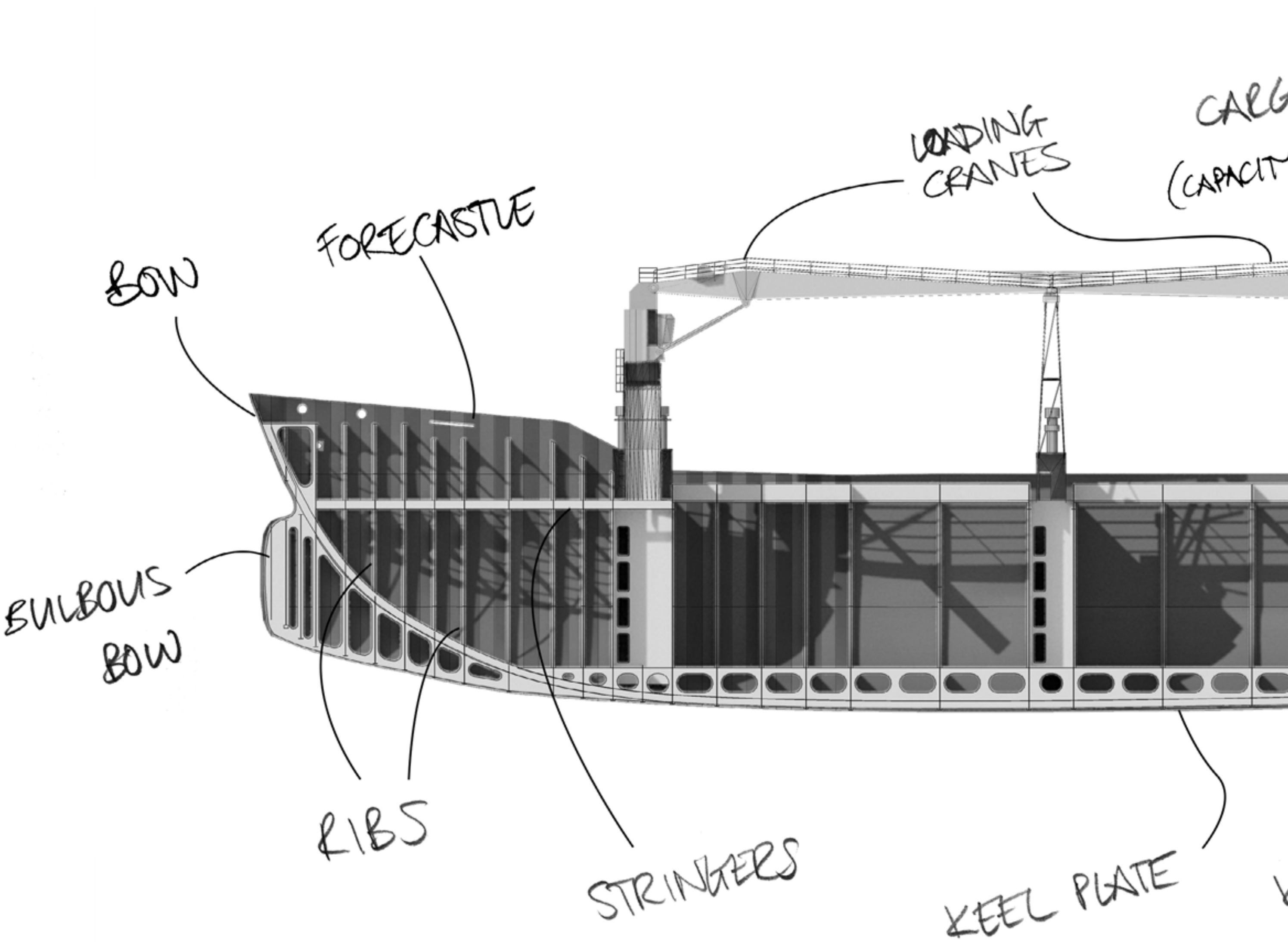
1 Basel Convention, 2011. The Basel Convention aims to regulate export and import of ships across the world.
2 Ibid.
3 Ibid.

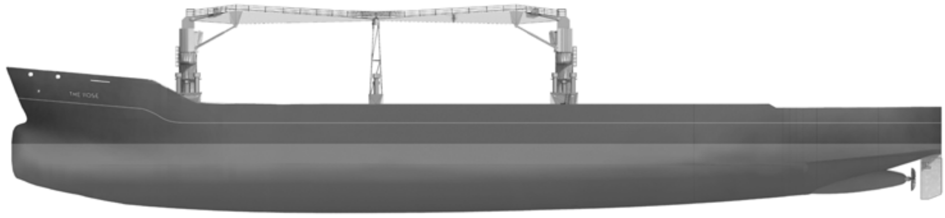
| 850 TEU vessel ('Feeder') | |
|---|---|
| dimensions | 134.60m x 21.30m x 9.00m |
| engine | MAK 9M 43 9-cylinder (8,400 KW) |
| capacity | 836 TEU max. – 526 TEU at 14 tonnes |
| deadweight | 8,900 tdw |
| tonnage | GT 7,600 |
| speed | 19.0 knots |
| holds | open top (centre) and covered (front) |
| description | Gearless feeder with two large open-top holds amidships. Forward holds covered by hydraulically operated hatch covers. Aft bays equipped with cellguides above deck. Type 168 ships provide electricity for 204 reefer containers. Single Hull. Moderate speed at 19 knots. Large number of ships built. |

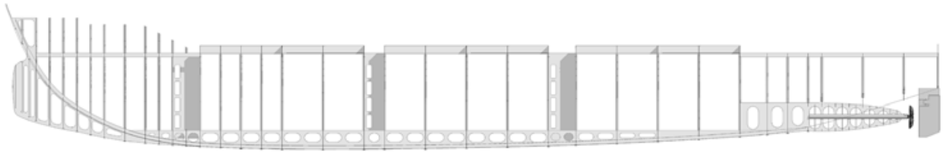
*Table 02. Information on typical Feeder container ships (source: www.containership-info.com)*

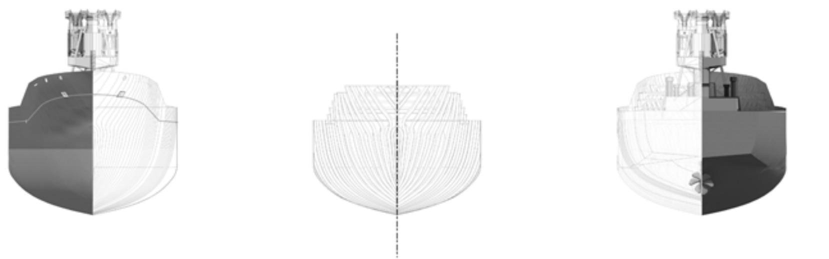
*Fig. 41. (top right) BIM model of the 135m long Rose superstructure.*

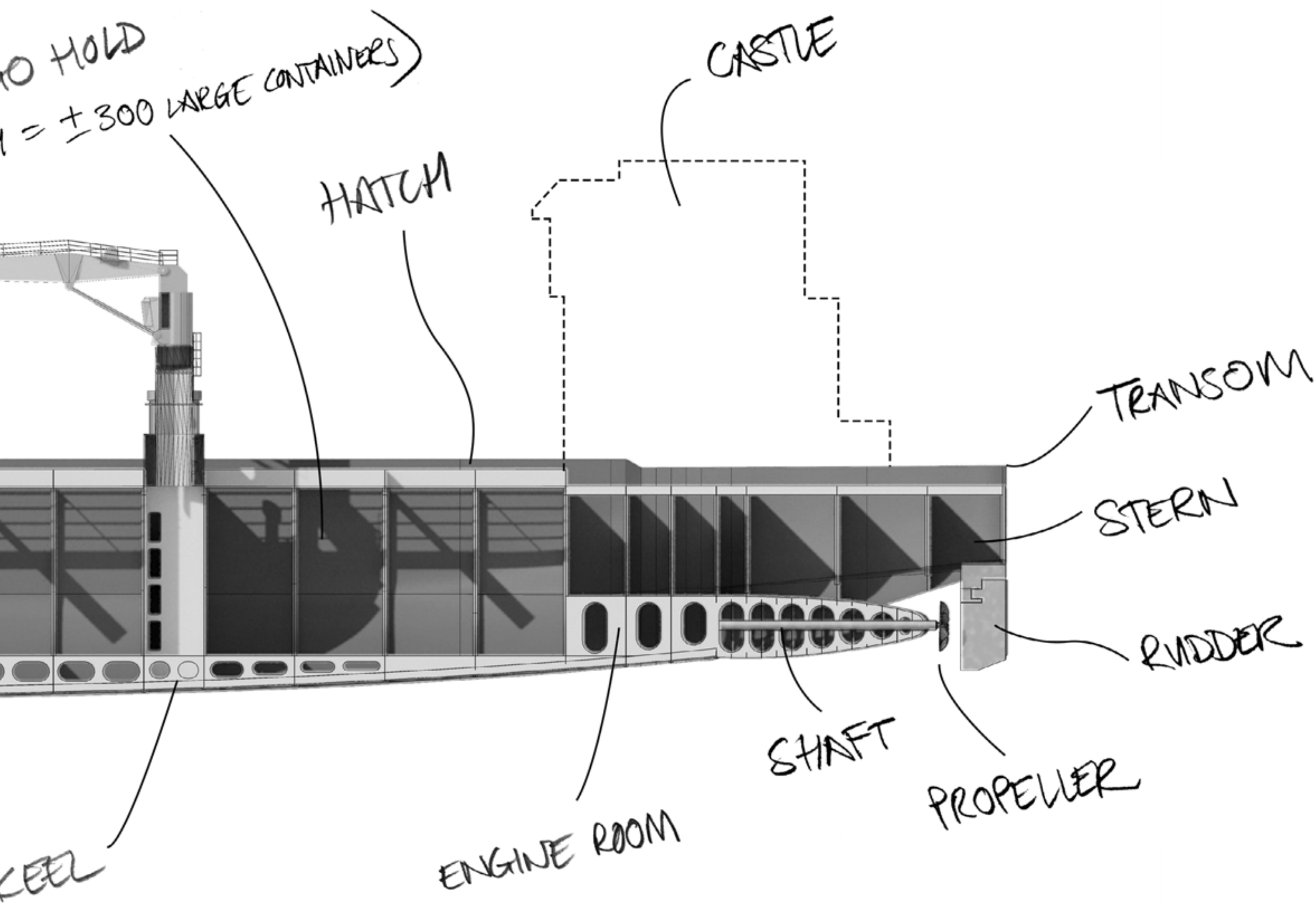
*Fig. 42. (below) The Anatomy of a ship.*










HOLD
= ± 300 LARGE CONTAINERS)
CASTLE
HATCH
TRANSOM
STERN
RUDDER
SHAFT
PROPELLER
ENGINE ROOM
KEEL

## SHIP BREAKING

Three ship repair sites have been identified in the Cape Town Harbour area which will be used for ship breaking. Namely the slipway and Robinson Dry Dock in the Alfred Basin, and the Sturrock Dry Dock in Duncan Dock. The operational capacities determine the size of the ships which can be dismantled, establishing a necessary scale of the 'building blocks' by which an architectural end will be realised.

These three ancillary sites were intended to be the spaces where the ship breaking would be conducted, and the extracted components would then be transported by barge to the breakwater site. As the design developed, there came a point where the sheer size of the desired components seemed far too large to be transported in this manner. The eventual program, a maritime museum, demanded large spaces. The solution to this problem was to take on a hybrid system between beaching and the dry dock methods.

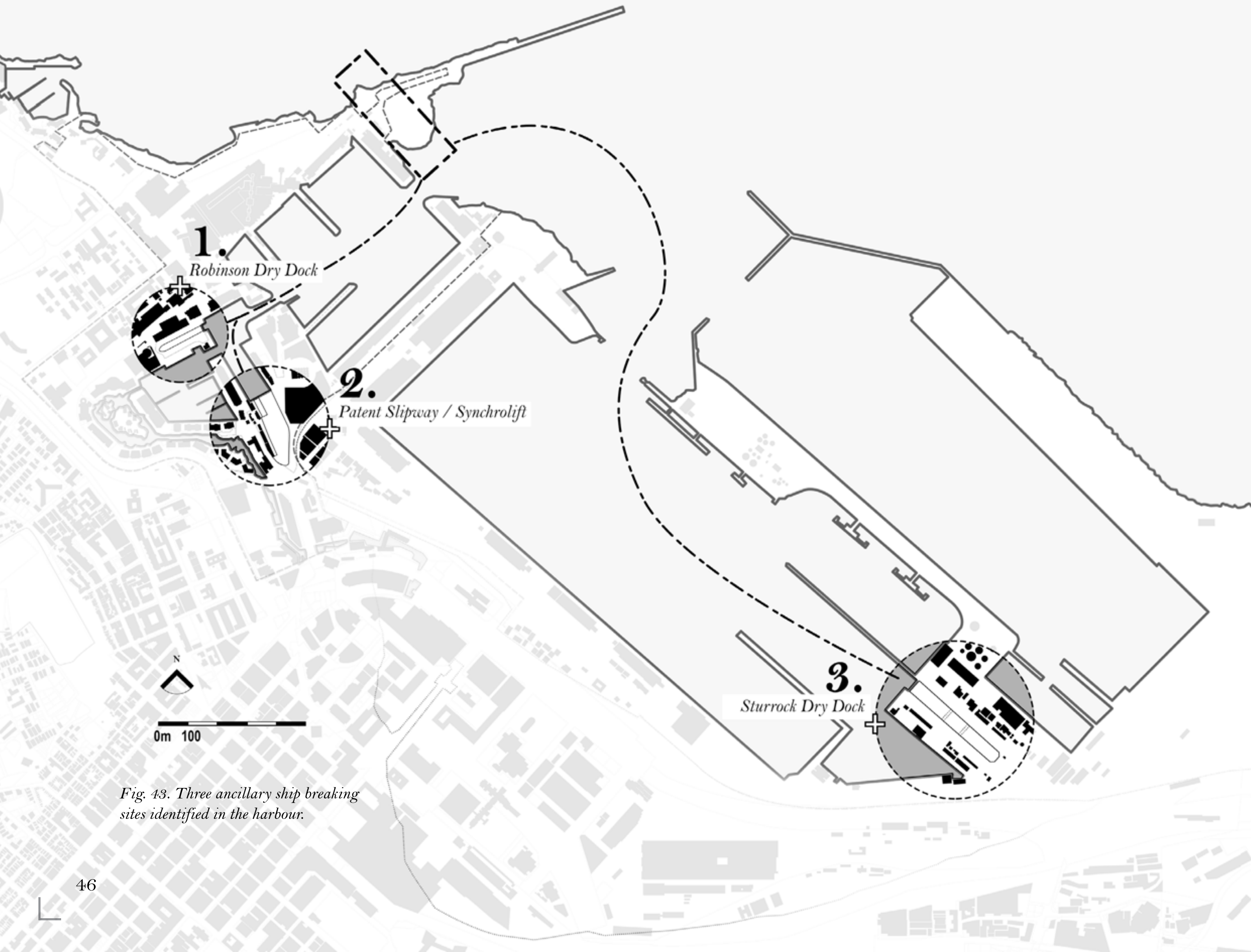



*Fig. 43. Three ancillary ship breaking sites identified in the harbour.*

*Fig. 44. A medium sized fishing ship being repaired in the Robinson Dry Dock, Cape Town.*

*Fig. 45. Quayside breaking taking place in Shanghai, China.*

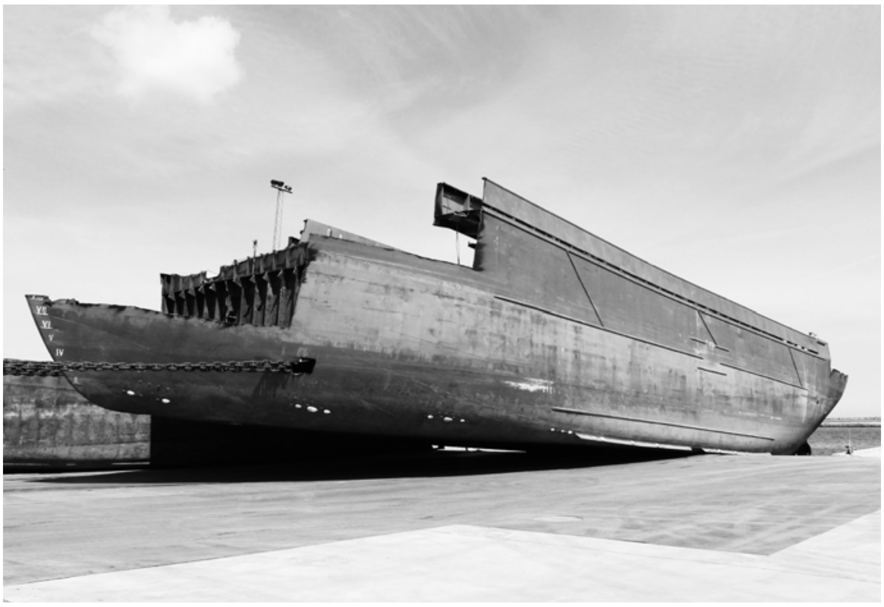


*Fig. 46. A large ship being dragged up a slipway in Fornæs, Denmark.*

*Fig. 47. (diagram) The Life-cycle of a ship and its resources. As this process is already rather complex, the decision was made to limit the scope of the ship breaking procedure to the primary superstructure of the vessel only. All minor structure and fittings are assumed to be easily extracted, recycled and sold. Some fittings will be resued in the museum.*

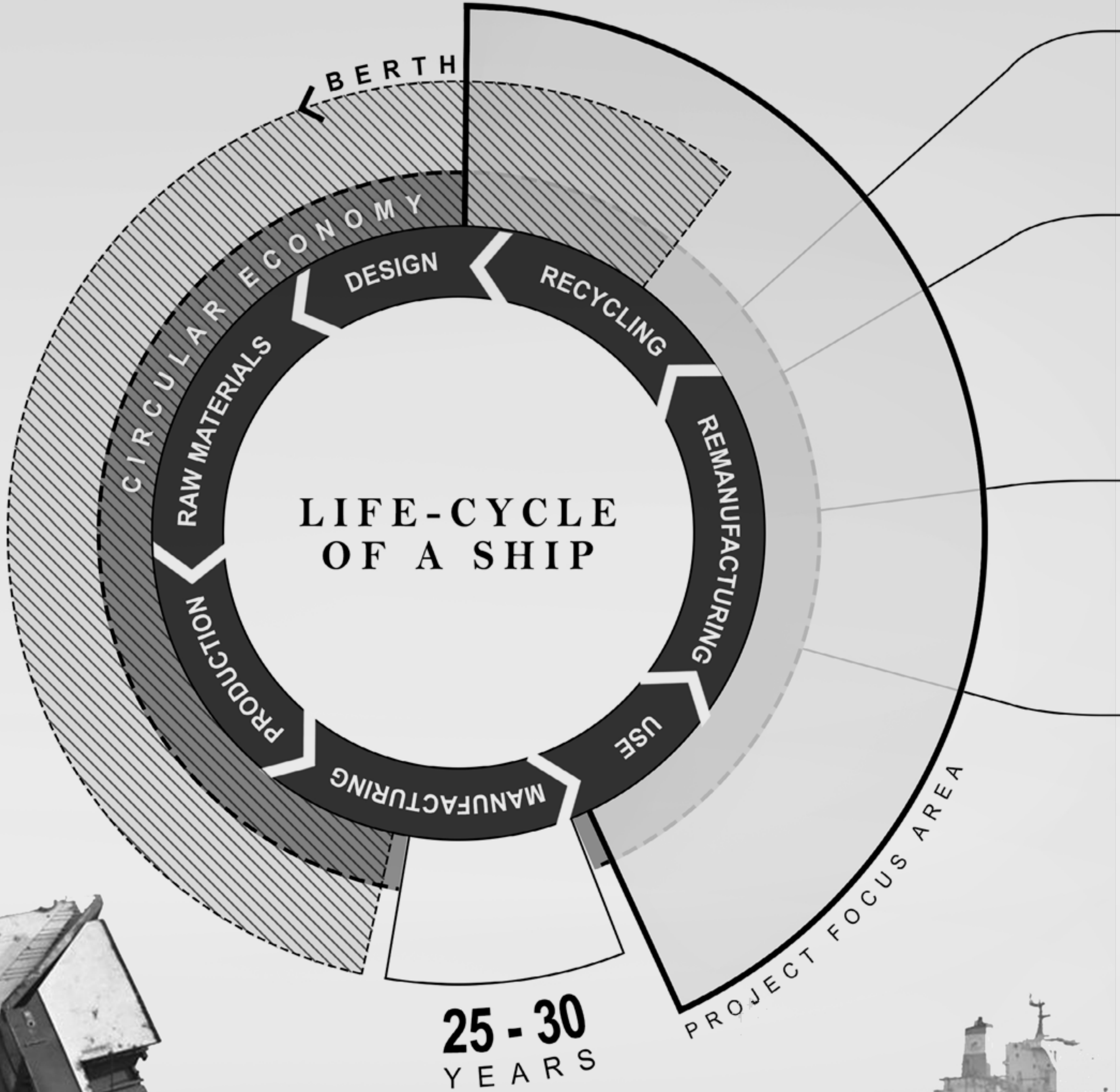



*Fig. 48. (left photo) Left in the mud, Alang, India (Jan Møller Hansen).*

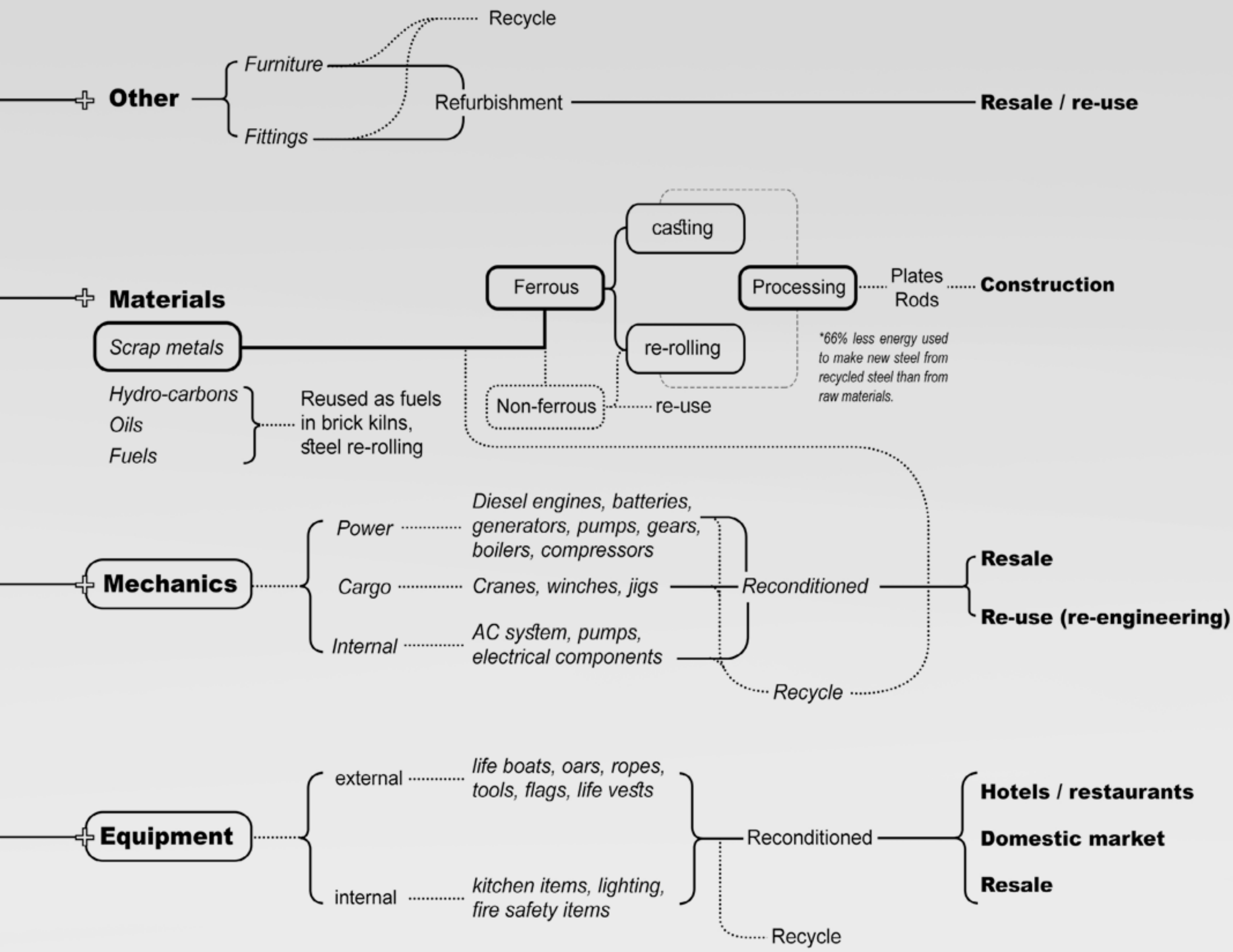



*Fig. 49. (right photo) Ships torn apart, Chittagong, Bangladesh (Edward Burtynsky).*

## SHIP BREAKING STRATEGY

The idea to break apart the ship in satellite sites was not at all feasible and so the design of an on-site hybrid system was developed. The strategy would involved the construction of a dry dock, of sorts, where by a trench with dimensions 150m long x 40m wide x 5m deep would be dug alongside E-pier. This would serve as the basin within which the Rose would be de-constructed (see fig. 50 below). The vessel is cleaned and all toxic waste and ballast liquids are removed in the Robinson Dry Dock, adherring to the environmental guidelines set ou by the IMO. Once approved, the relatively bare superstructure of the ship would be guided to the breakwater site and be beached within the shallow trench. An earth wall will be built behind it to close in the trench.

The construction of the new museum would then begin as the vessel is systematically de-constructed, starting from the bow to the stern. This process of deconstruction would be assisted by both the on-board loading cranes of the Rose as well as a large temporary gantry system. These machines are used to extract the required components and transport them along rails into place. With this basic system in mind, the design then had to be approached with the idea that the museum would be made out of the bow pieces first, and then slowly grow as each new piece was laid and fixed into place. This process of layering complex components drove the design to new and interesting forms.

Once the Rose was completely de-constructed and then reconstructed as the museum, the trench and the gantry tracks would be left to be swallowed up by the landscape. These would essentially be mnemonic devices; subtle clues as to the origins and process of the new building. This is an attempt to extend the building's presence beyond its physical walls and allow its occupants the experience of both mystery and discovery of a building which in rooted in the raw and beautiful landscape.

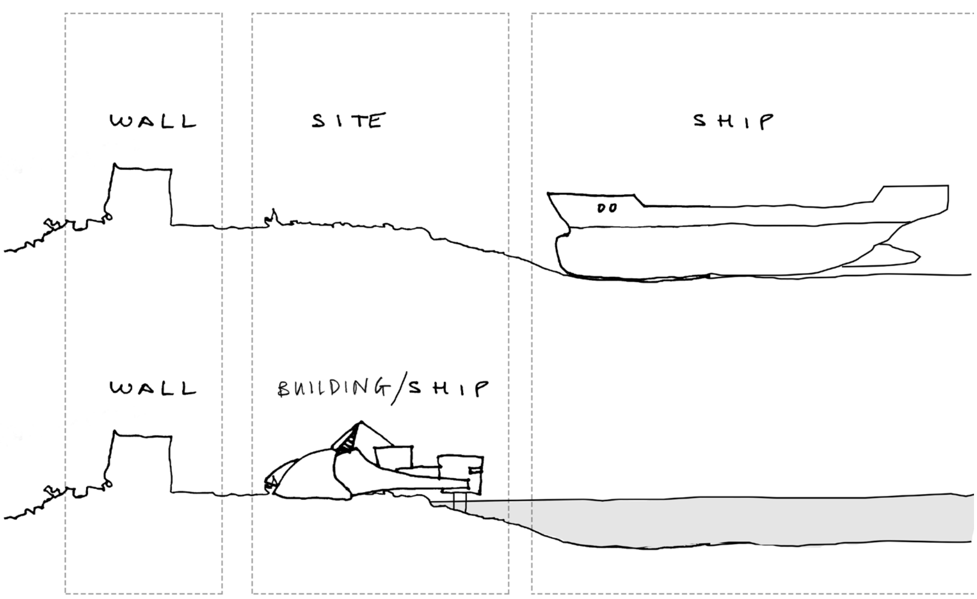
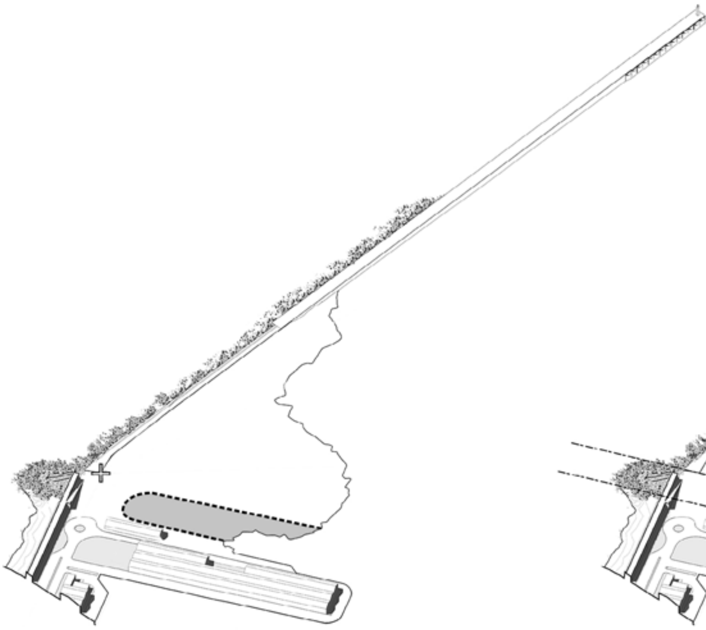
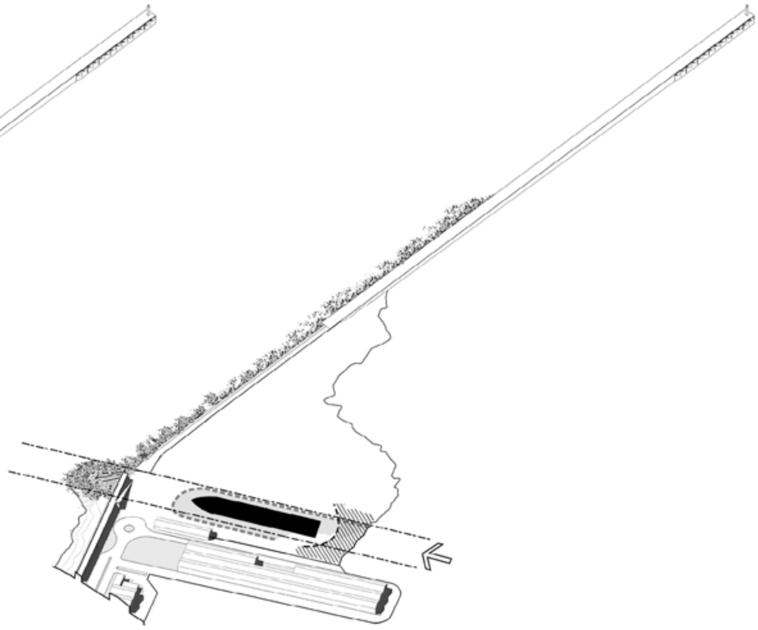


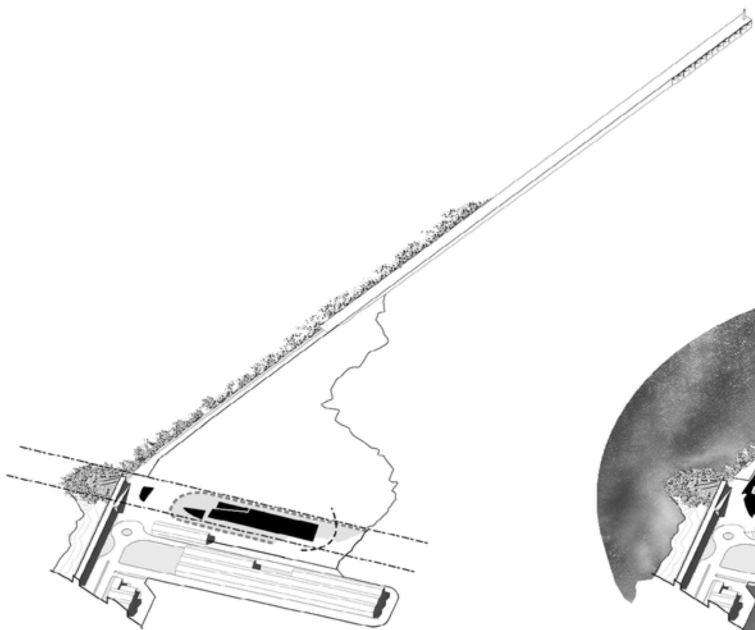

*Fig. 50. Sketch: from ship to museum*



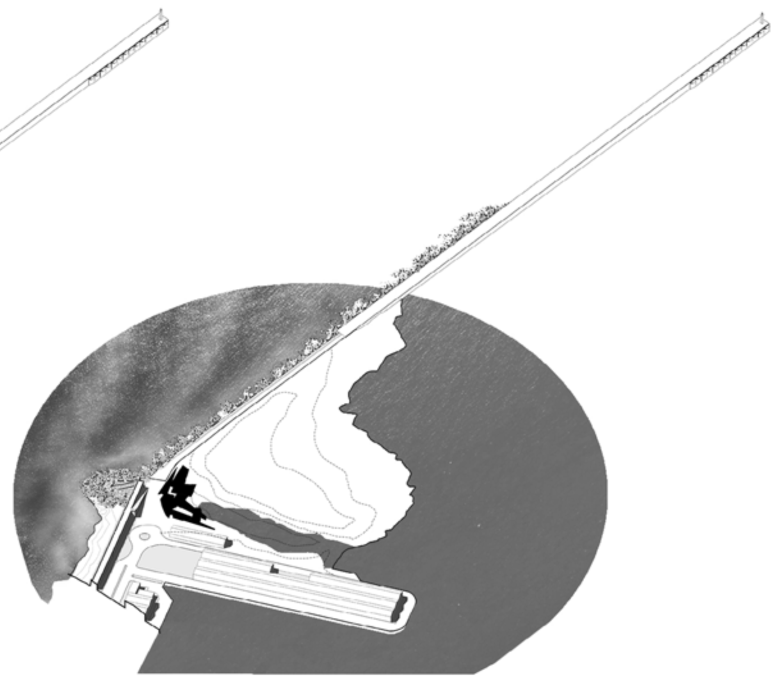
**01** Earth excavated to create 5m deep beaching zone. Temporary gantry system is installed.



**02** The Rose is beached, and a earth wall is built behind it to negate the 1.5m tidal range.



**03** Once enclosed, the Rose is systematically deconstructed and used to build the new maritime museum.



**04** The temporary 'dry dock' is then used as a tidal pool, as cleaner water from the Atlantic is pumped into it, poetically reconnecting the Rose with the sea.

*Fig. 51. Diagrams showing the ship breaking and development strategy.*

## DISAGGREGATION

The issue of de-constructing a super-structure of this scale was tackled by curiosity and the desire to experiment, rather than a pragmatic approach to guarantee absolute structural integrity. That being said, all effort has been made to find a synthesis between technical resolution and a child-like imagination. The first attempt to de-construct the ship was done in the conventional manner found in the ship-breaking capitals of the world, such as Alang in India and Chittagong in Bangladesh, that is to say, the ship was dissected orthogonally along its structural skeleton (see fig. 52 below).

Digitally dissecting the ship with BIM software was a quick approach to generating the building components. The components were abstracted in order to test spatial ideas (following pages).

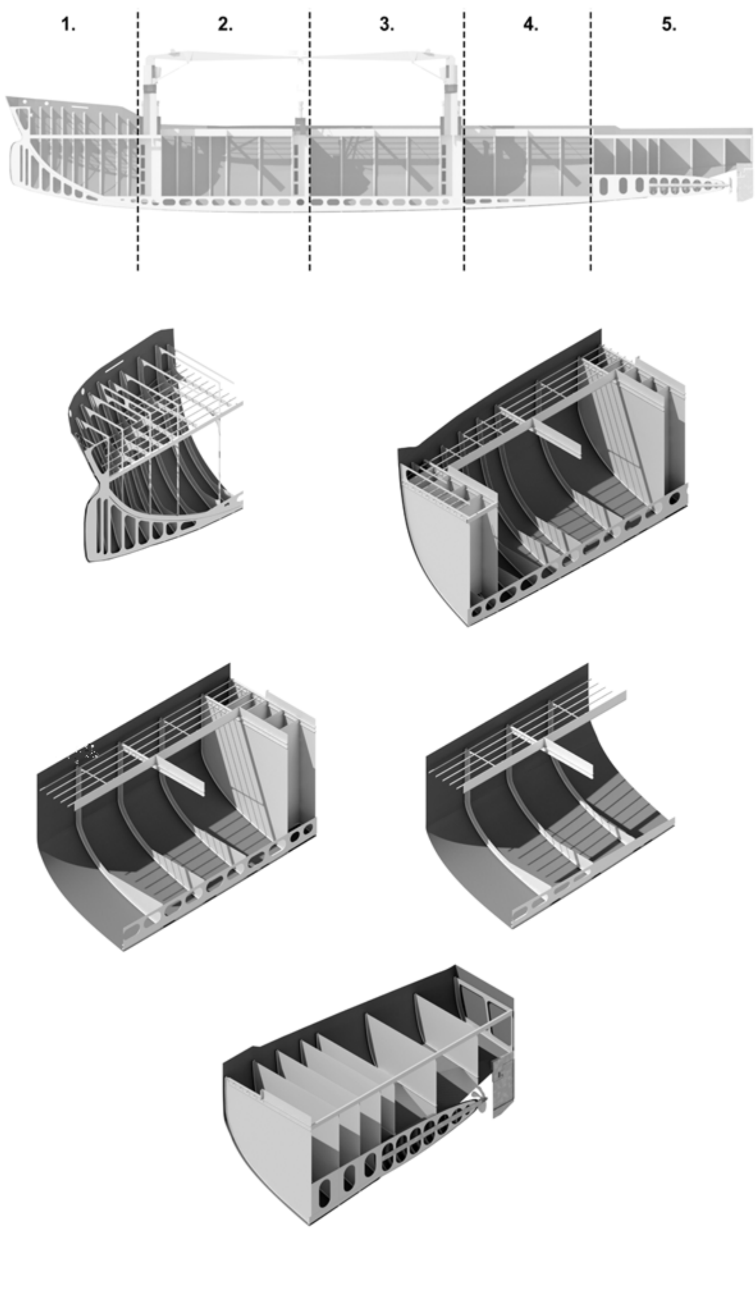
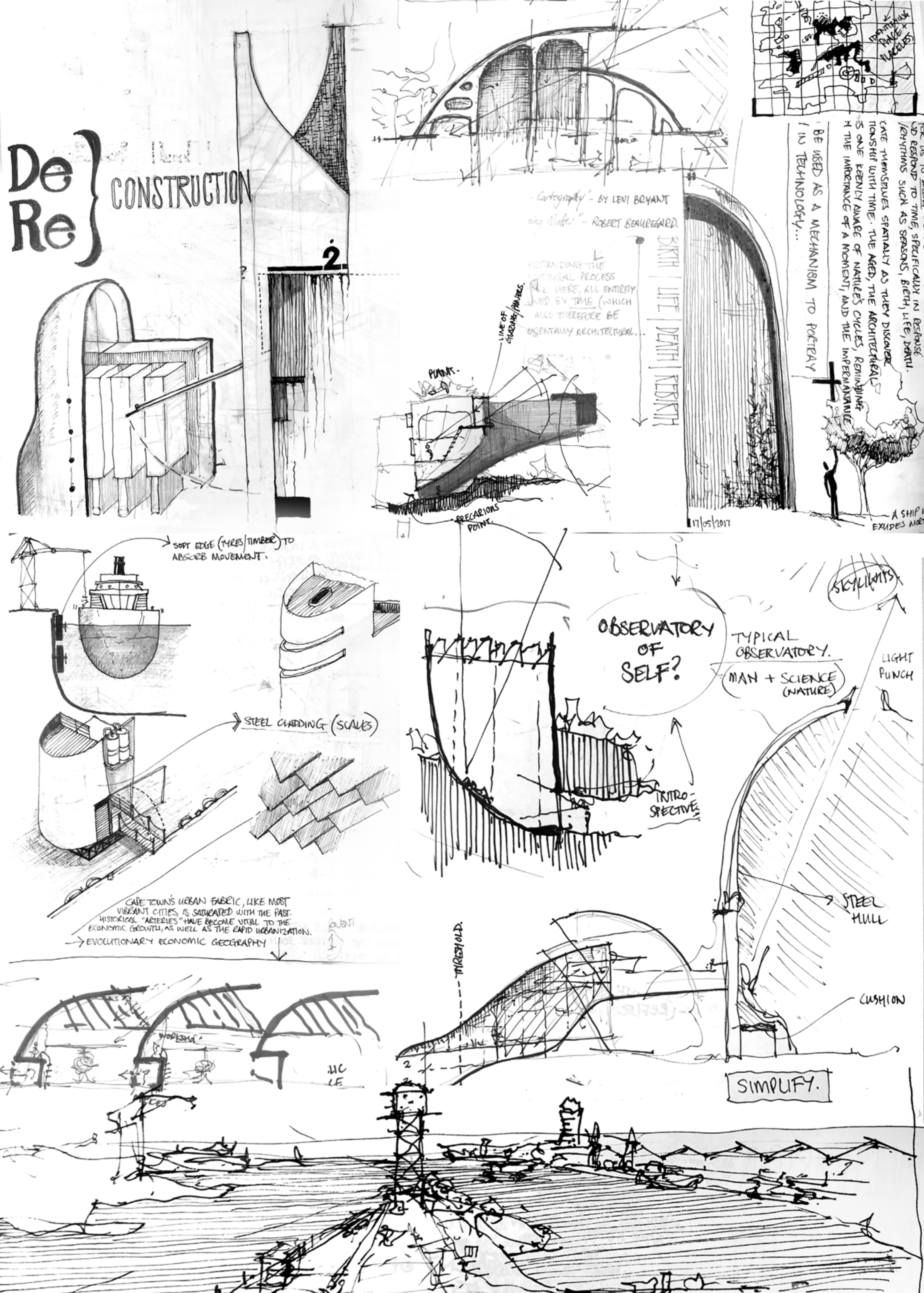



*Fig. 52. (left) The Rose, orthogonally dissected along her structural lines.*

*Fig. 53. (right) Early conceptual sketches of the components with various uses.*



De
Re
CONSTRUCTION
2
"Cartography" - BY LEVI BRYANT
"...ing Matter" - ROBERT BEAUREGARD.
BIRTH | LIFE | DEATH | REBIRTH
LINE OF GLAZING/PANELS.
PLANT.
PRECARIOUS POINT.
BE USED AS A MECHANISM TO PORTRAY ... IN TECHNOLOGY...
17/05/2017
A SHIP ... EXUDES MOR...
SOFT EDGE (TYRES/TIMBER) TO ABSORB MOVEMENT.
STEEL CLADDING (SCALES)
CAPE TOWN'S URBAN FABRIC, LIKE MOST VIBRANT CITIES, IS SATURATED WITH THE PAST. HISTORICAL "ARTERIES" HAVE BECOME VITAL TO THE ECONOMIC GROWTH, AS WELL AS THE RAPID URBANIZATION.
→ EVOLUTIONARY ECONOMIC GEOGRAPHY
OBSERVATORY OF SELF?
TYPICAL OBSERVATORY.
(MAN + SCIENCE (NATURE))
INTRO-SPECTIVE.
SKYLIGHTS
LIGHT PUNCH
STEEL HULL
THRESHOLD.
CUSHION
SIMPLIFY.

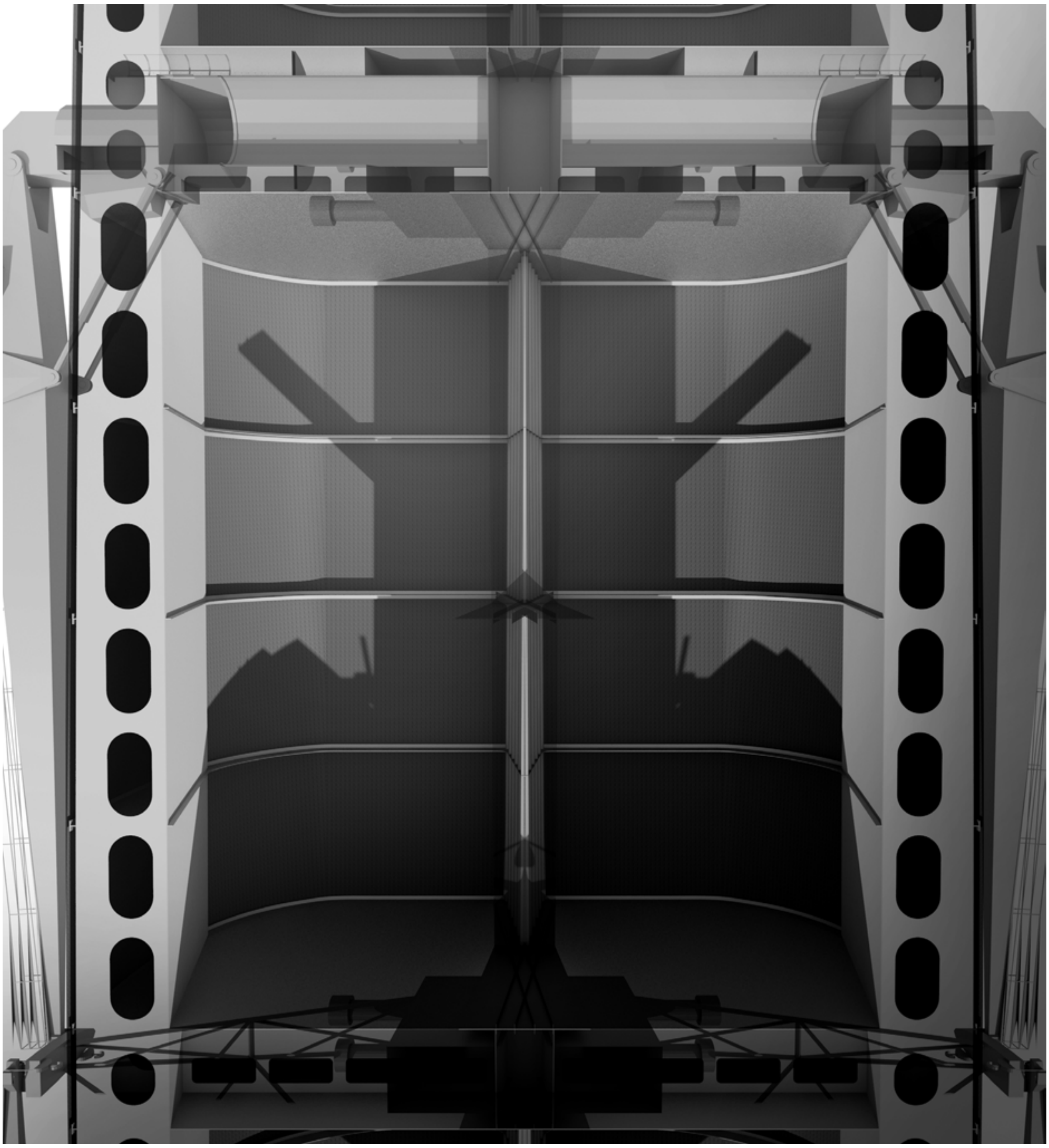


*Fig. 54. Conceptual form study 01.*

*Fig. 55. Conceptual form study 02.*

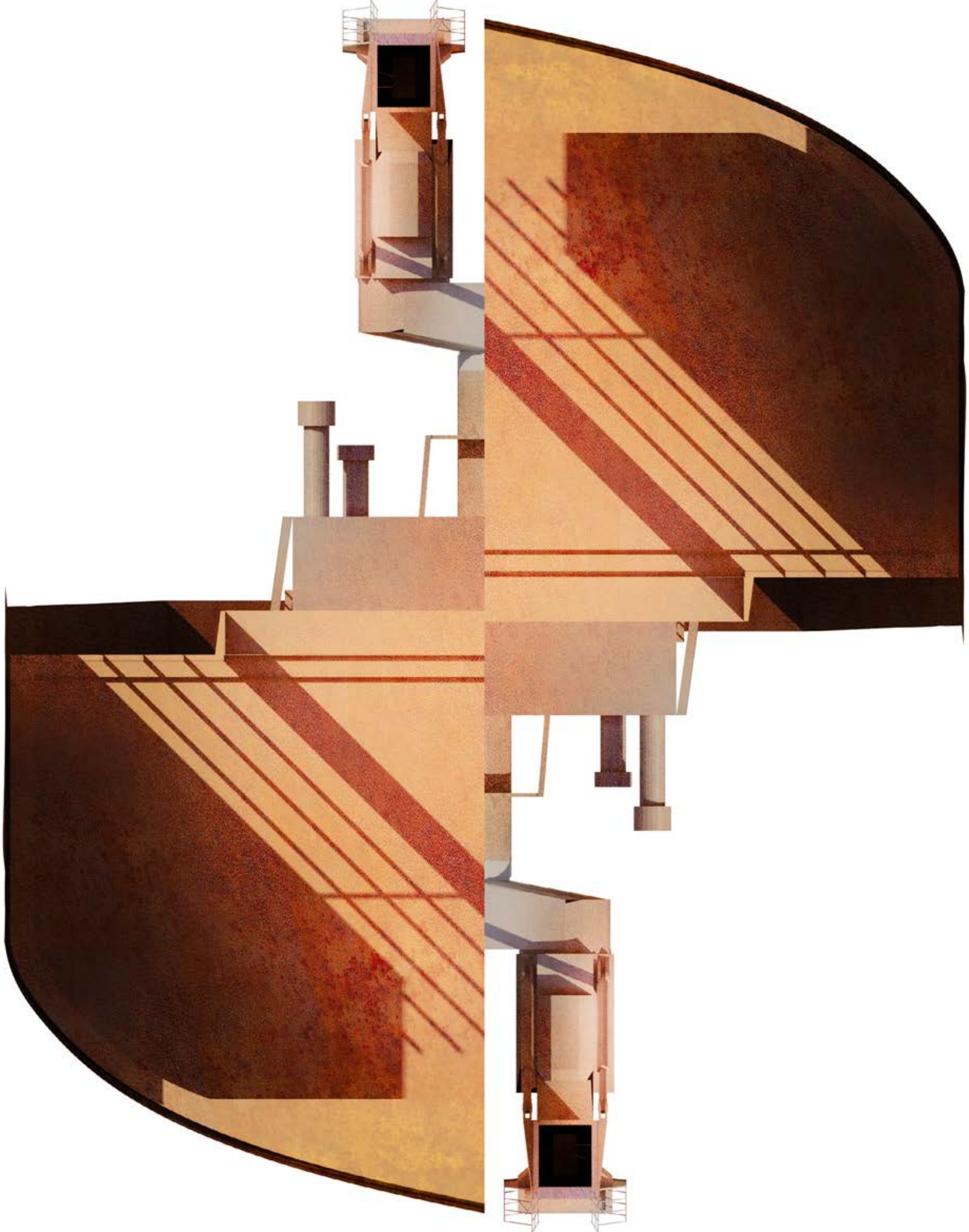


*Fig. 56. Conceptual form study 03.*

*Fig. 57. Conceptual form study 04.*

Abstracting the forms in this way echoes the ideas of Baroque sculptor Gian Lorenzo Bernini, as he said,

> There are two devices which can help the sculptor to judge his work: one is not to see it for a while. The other... is to look at his work through spectacles which will change its colour and magnify or diminish it, so as to disguise it somehow to his eye, and make it look as though it were the work of another.[1]

Abstraction here is used as a lens though which these forms take on a whole new identity spatially and programatically. Through this fluid process of experimentation, several interesting relationships and spaces were discovered. The cross-section of the ship seemed incredibly repetitive, however, and some of the experiments appeared ordinary, expected and, at times, rather boring. The concept of taking apart a massive ship only to re-arrange orthogonal pieces in an obvious way seemed to be an injustice to the overall idea. The adage 'Go big, or go home!' seemed to ring true in this scenario.

The work of artist and sculptor, Richard Serra, has played a huge role in my architectural journey thus far. Much of his work is aimed at exploring the relationship between materials and their relationship with viewer and site. Most profound to me, and pertinent to this design journey, are his studies of large steel plates which are curved in provocative forms. These single sheets explore concavity and convexity, and represent Serra's yearning to better understanding the power of simple geometric form as they entice the viewer to explore such unique forms.[2] Serra's work celebrates form through the isolation of a single material.

Similarly, this design journey steers towards continually asking the question, "What if...?" What if the method of taking apart a ship could be done differently in order to generate exciting forms, stretching the final building's identity further away from a recognizable ship and more towards the celebration of the extracted, peculiar forms. What if the team of arc welders and engineers could extrude a variety of forms from the Rose, and interesting spaces can be imagined within them?

Much like Serra's work, the form of the hull (essentially a monocoque[3]) is manipulated to form a landscape of sorts, settling the weathered, steel museum into the breakwater site. The singular material as a semi-structural skin accentuates the overall form.

---

1 Levin, Irving (1980). *'Bernini and the Unity of the Visual Arts.'* New York: Oxford University Press.

2 Interview between Richard Serra and Adrian Searle, Frieze.com, 'Metal Works.' 2008.

3 Essentially this is where the outer skin is integral with the structure of the body. It is a term derived from French: mono meaning 'single' & coque meaning 'shell'.

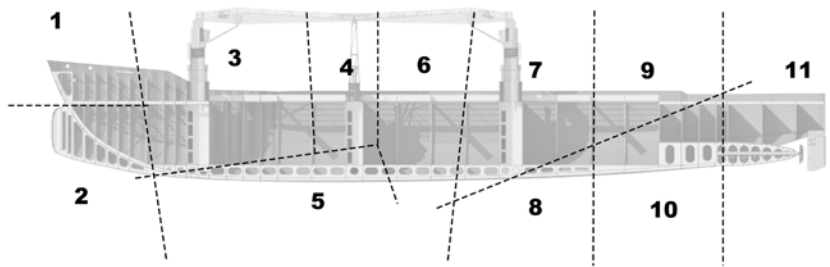
*Fig. 59. 'Beata Ludovica Albertoni', Marble by Gian Lorenzo Bernini (1598-1680, Italy)*

*Fig. 60. 'Torqued Spiral' by Richard Serra, 2004.*

*Fig. 61. 'Snake' by Richard Serra, 1997.*

Again, the Rose was put into a virtual laboratory where it was dissected along less orthogonal lines. The resultant pieces were analysed firstly in abstraction and then through an iterative process whereby many different combinations of components were documented both in isolation and placed onto the breakwater site.

The following diagrams (pages 62 to 67) are conceptual and aimed at testing ideas of how these pieces could come together to create intersting spaces. This method of experimentation was conducted without contraint of program or function, and was rather focused on finding a synthesis of form and potential issues with the construction process. Each component of the Rose was placed on site in the systematic order of the proposed disassembly method (from bow to stern).



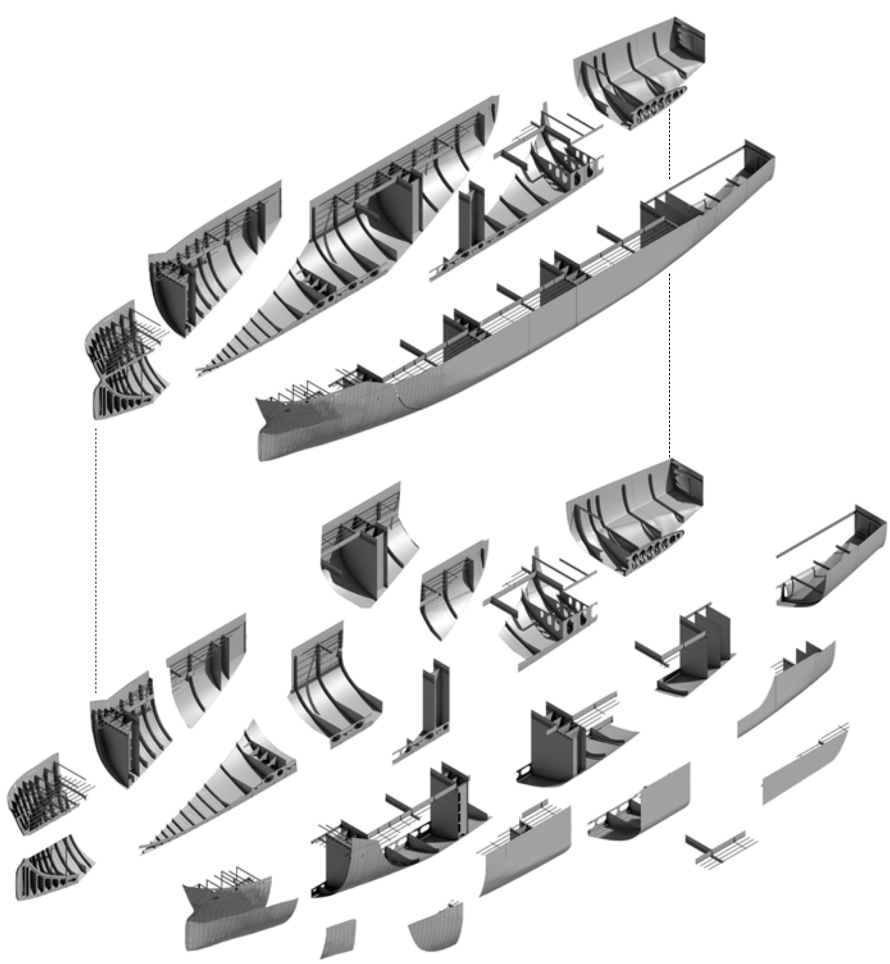
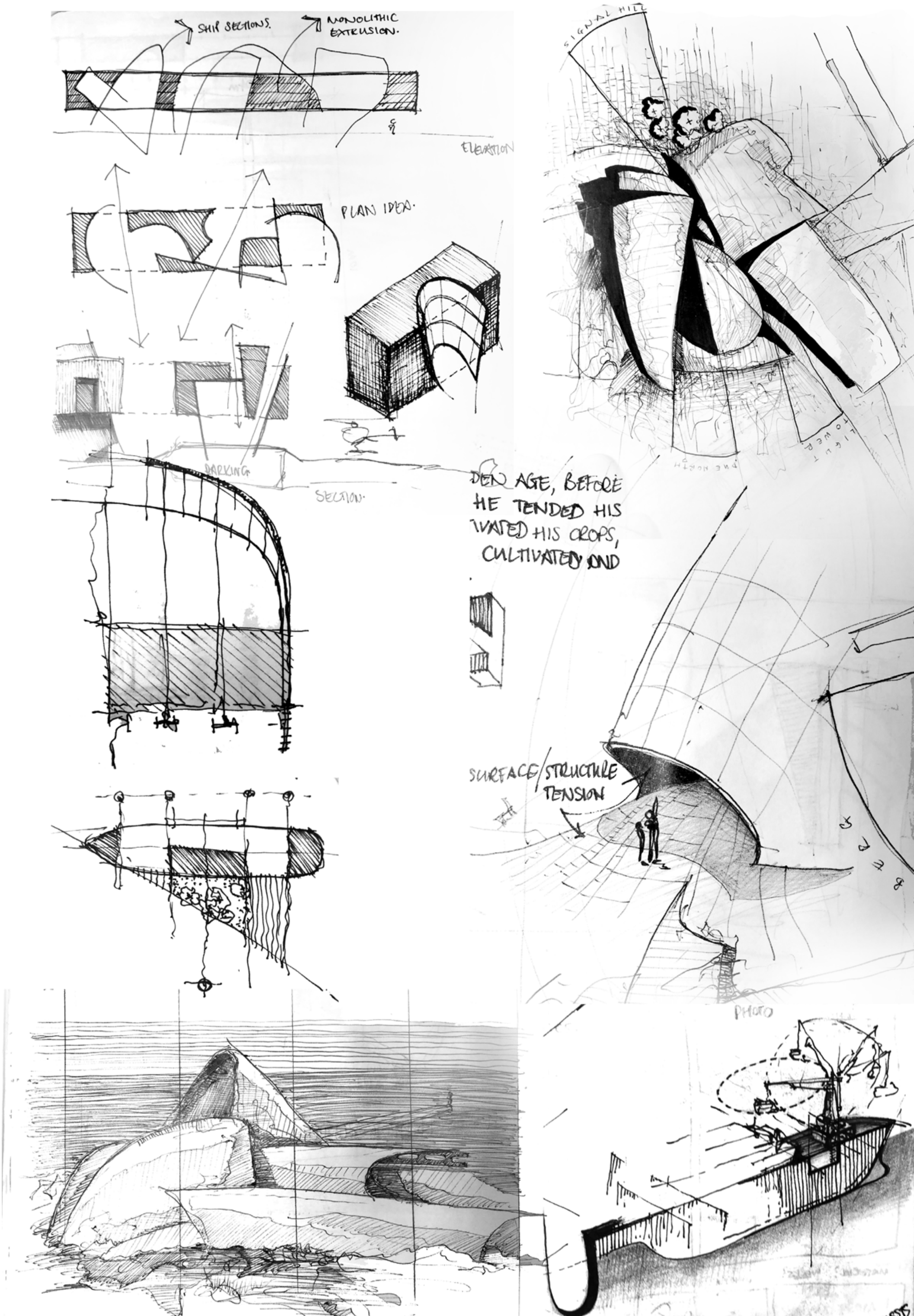



*Fig. 62. (left) Fig. XX. The more imaginative dissection drawings of the Rose.*

*Fig. 63. (right) Early conceptual sketches of the more dynamic components.*


SHIP SECTIONS.
MONOLITHIC EXTRUSION.
ELEVATION
PLAN IDEA.
PARKING
SECTION.
SIGNAL HILL
LIGHT TOWER.
DEN AGE, BEFORE
HE TENDED HIS
WATED HIS CROPS,
CULTIVATED AND
SURFACE/STRUCTURE
TENSION
PHOTO

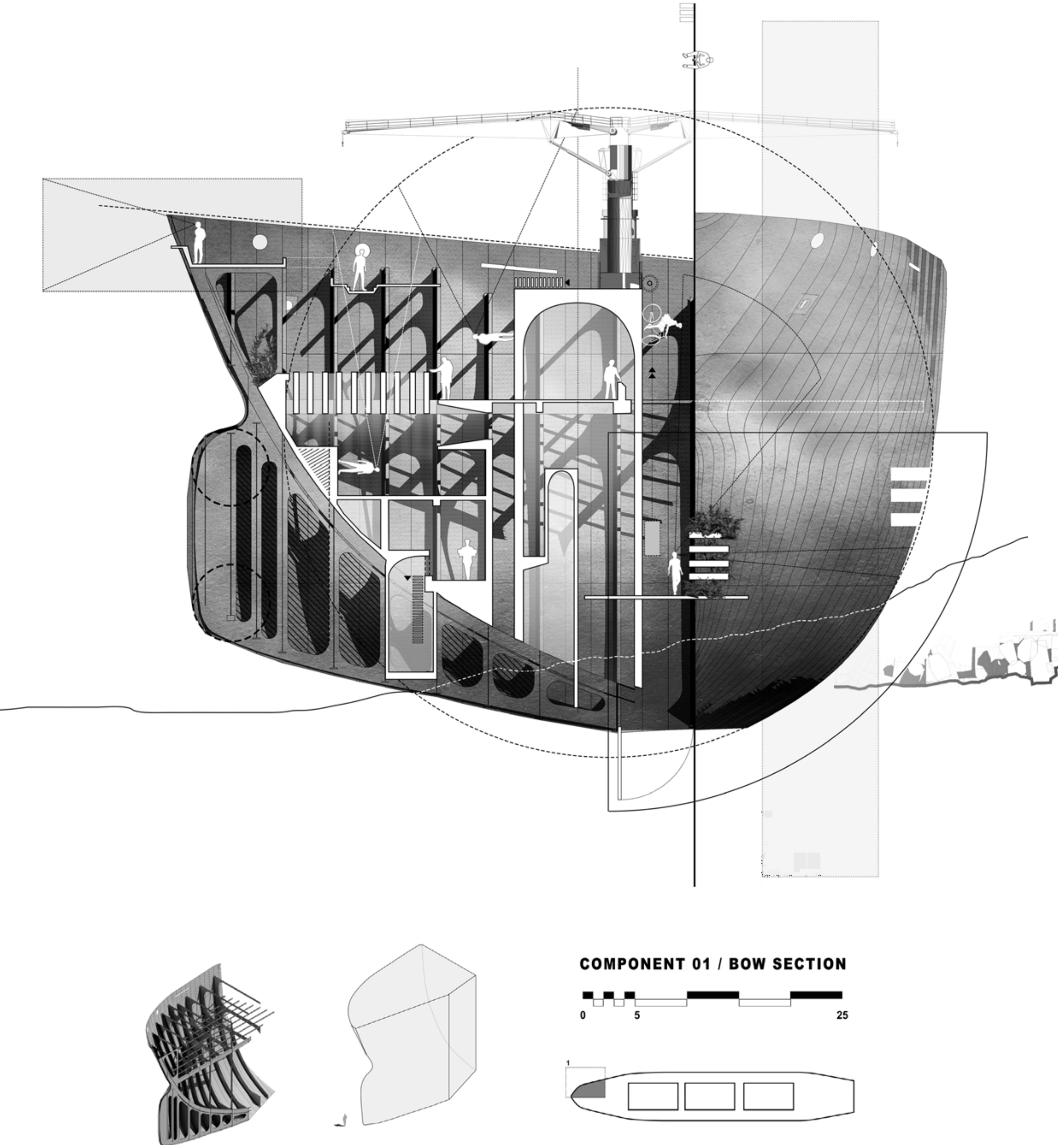



*Fig. 64. Conceptual form study: Bow.*

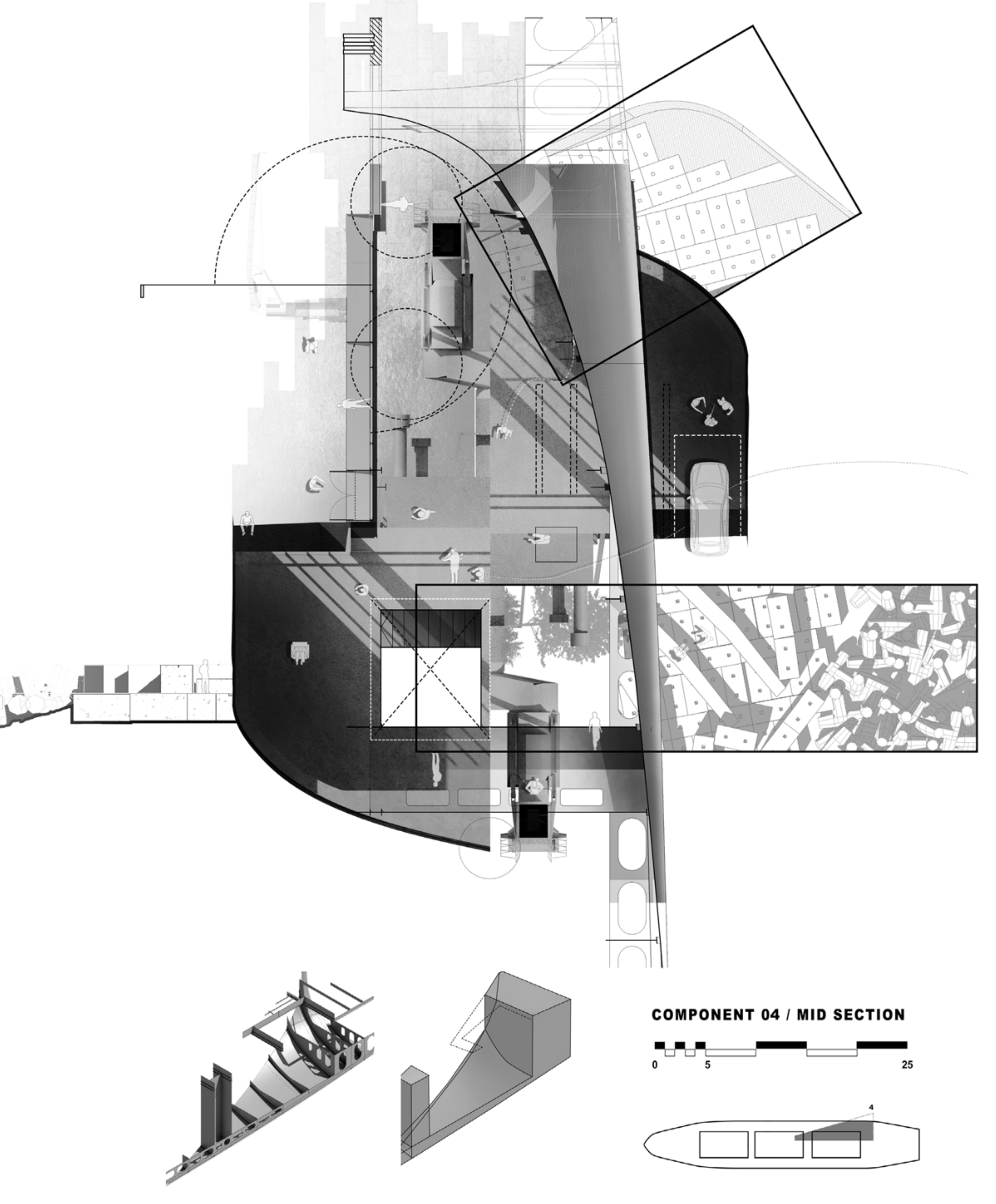
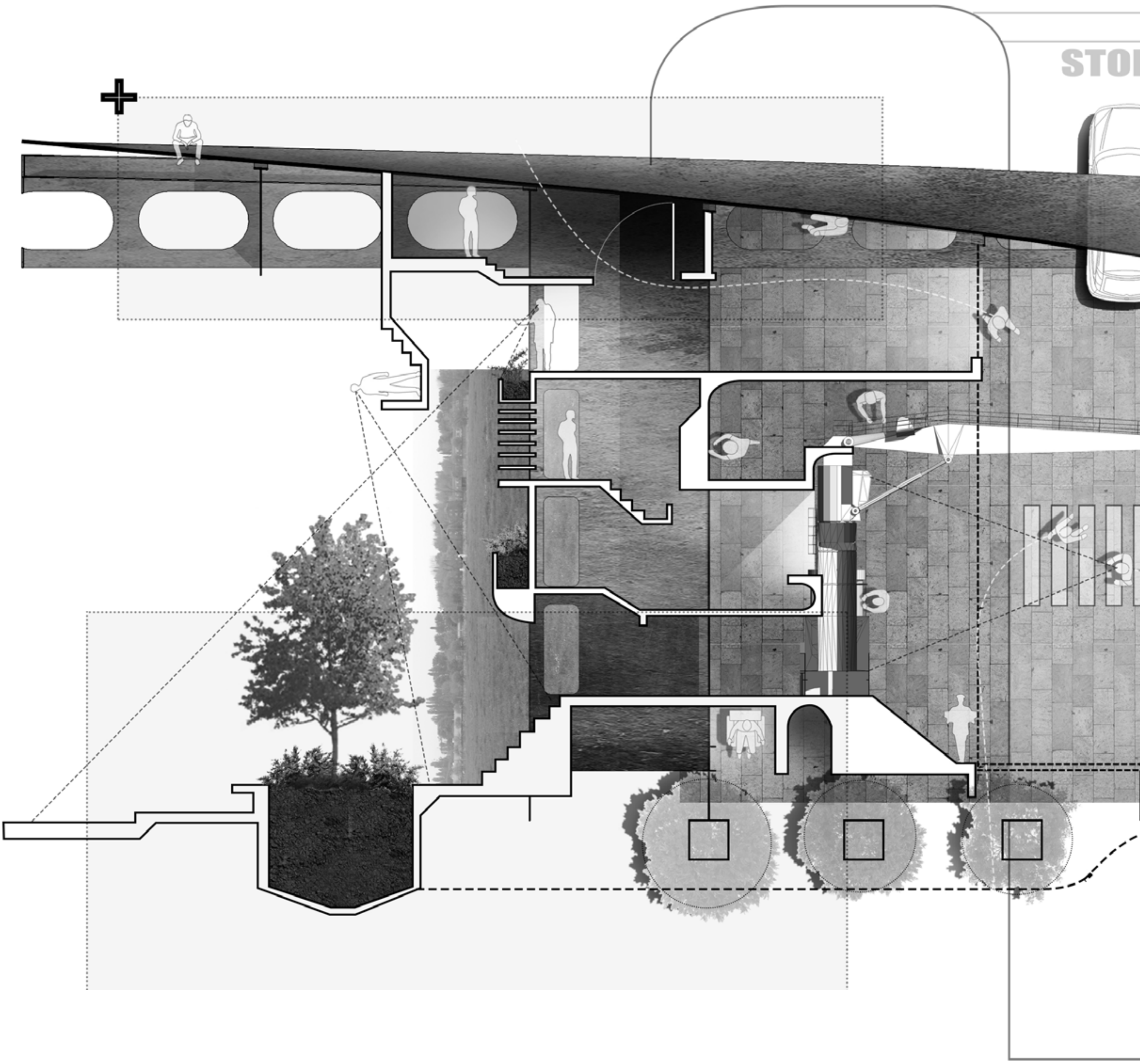
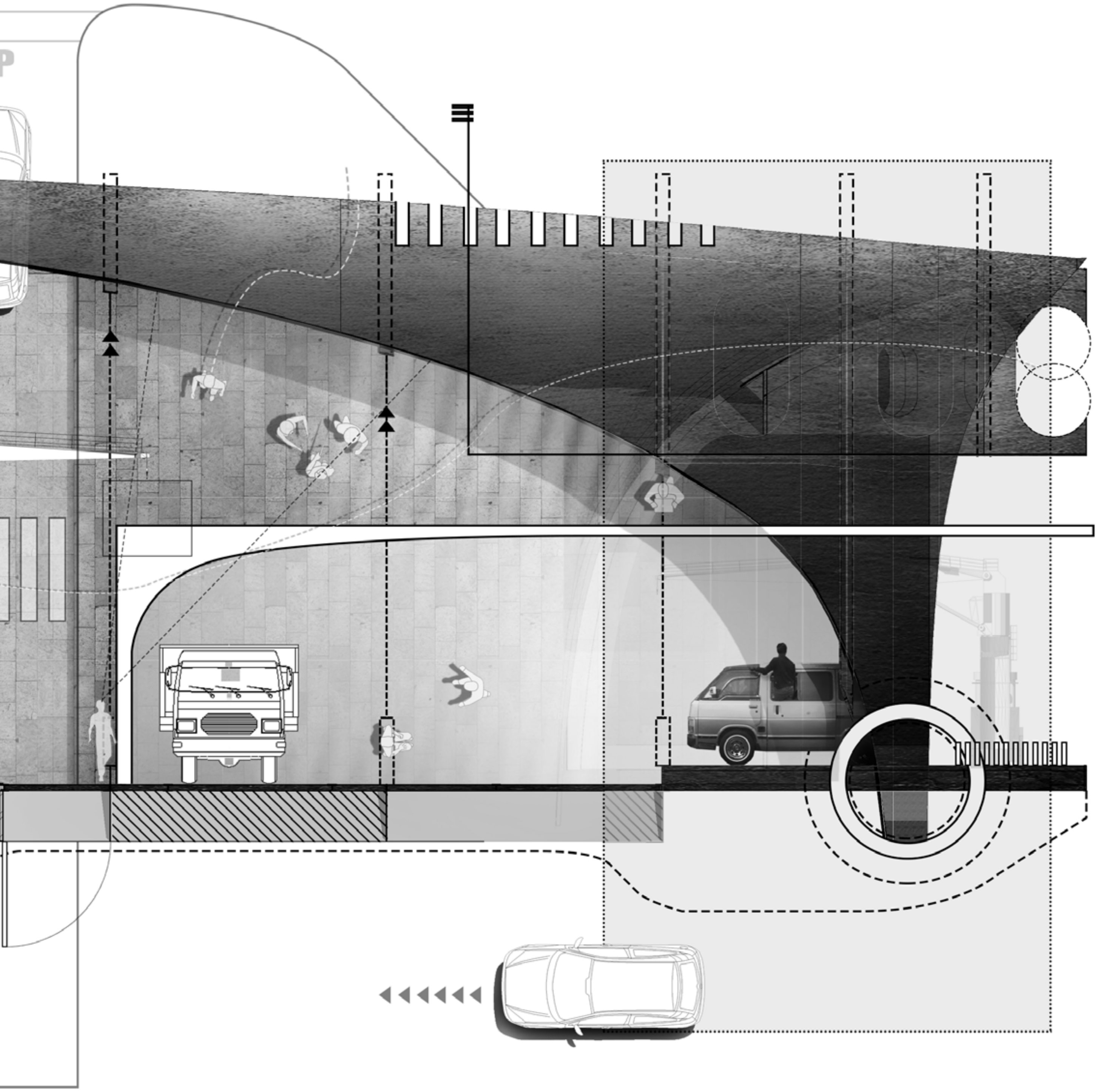



*Fig. 65. Conceptual form study: Mid-section.*




This exericise was intended to be playful, to let the mind wonder and imagine what spaces could develop over time. The only constant in all of the compositions is the presence of human figures which solidify the scale of the overall space and form. Elevation, fixtures, materials, lighting were all manipulated or exaggerated in order to express some of the early design ideas.

This was an important constant as it is very easy to loose sight of how large some of these components actually when operating this process digitally.



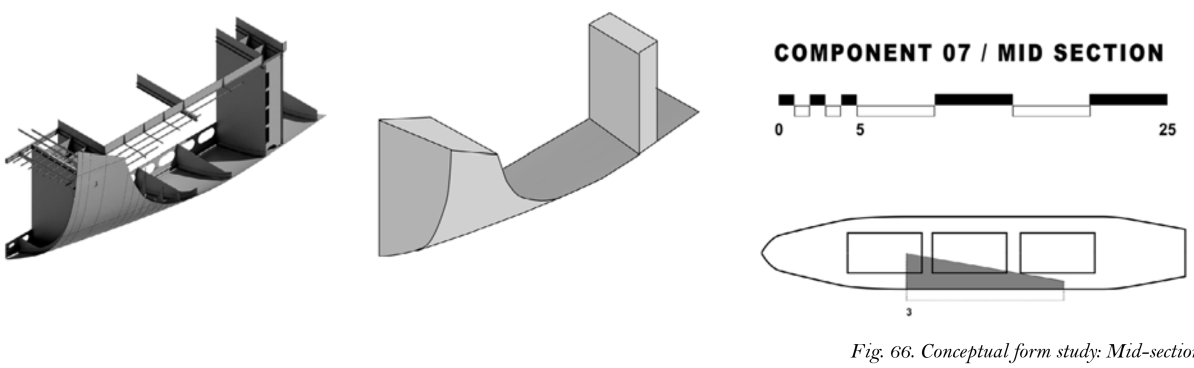



*Fig. 66. Conceptual form study: Mid-section.*

01

*Fig. 67. Form Iteration Study: No. 05 (isometric)*

02

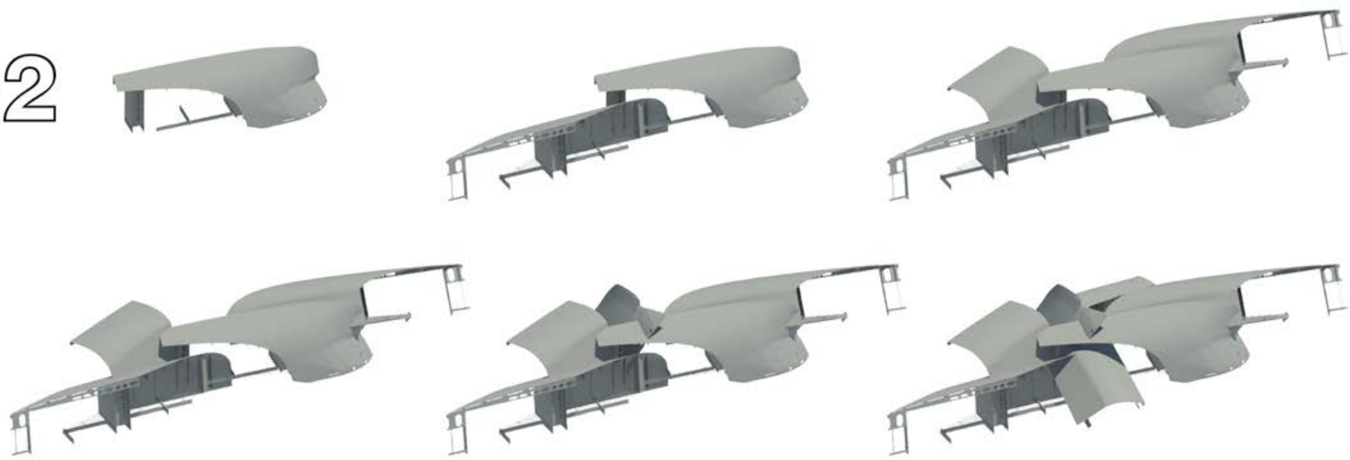


*Fig. 68. Form Iteration Study: No. 24 (isometric)*

The next stage of abstraction and experimentation was to model many different iterations of the components of the Rose together as a building. Each new model was documented in plan, isometric view elevation, and 3D renders to provide a thorough analysis of the relationships between the different forms. 30 different iterations were constructed over two months. Through a process of elimination, certain key spatial relationships were found, as well as several intriguing geometric occurrences which are further developed in the sketch design.

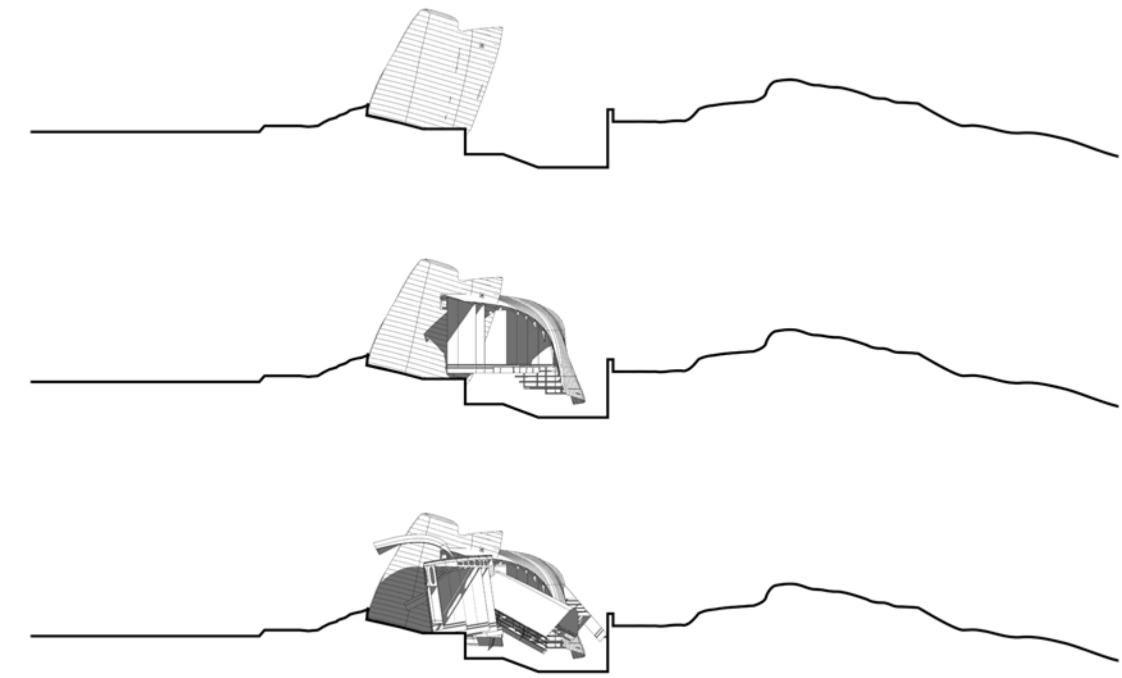


*Fig. 69. Form Iteration Study: No. 02 (elevation)*

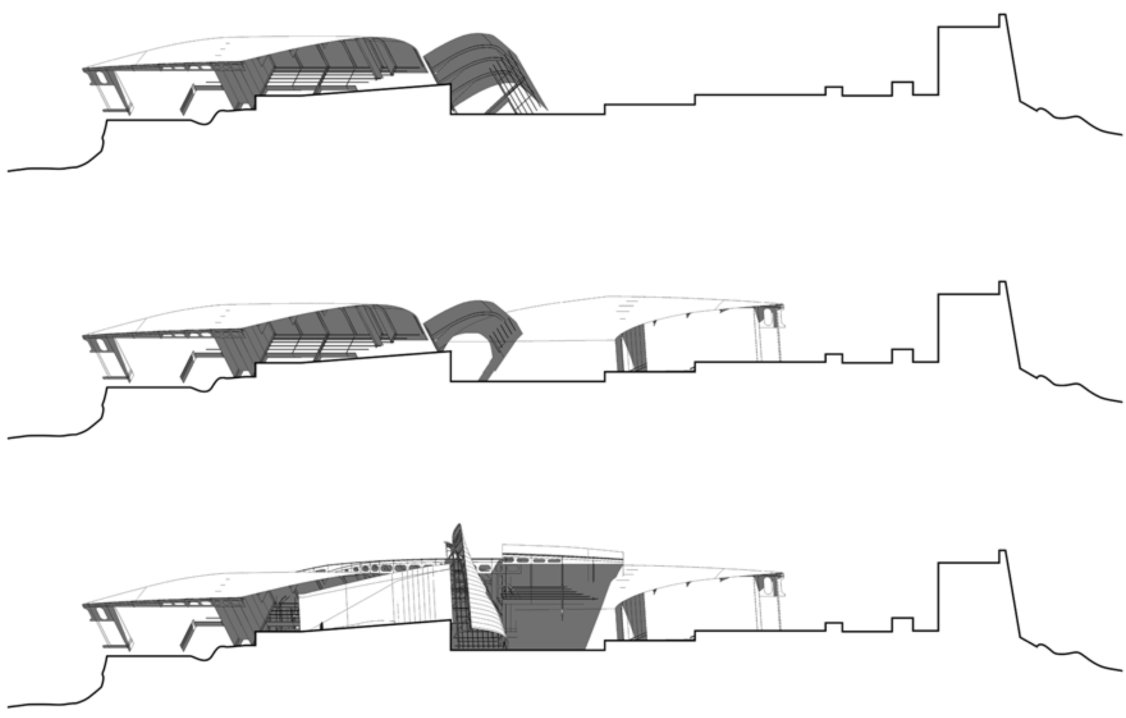


*Fig. 70. Form Iteration Study: No. 24 (elevation)*

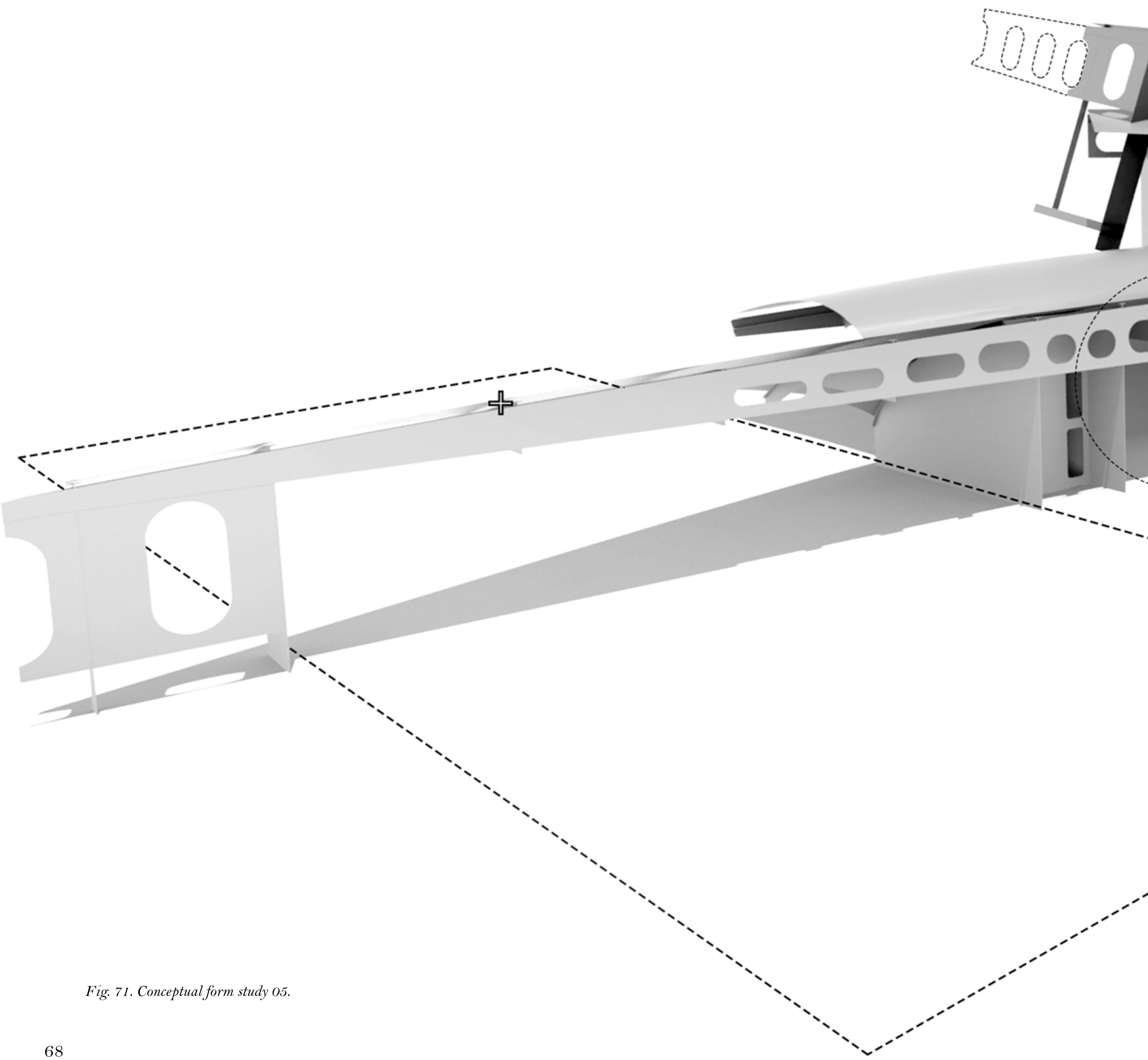
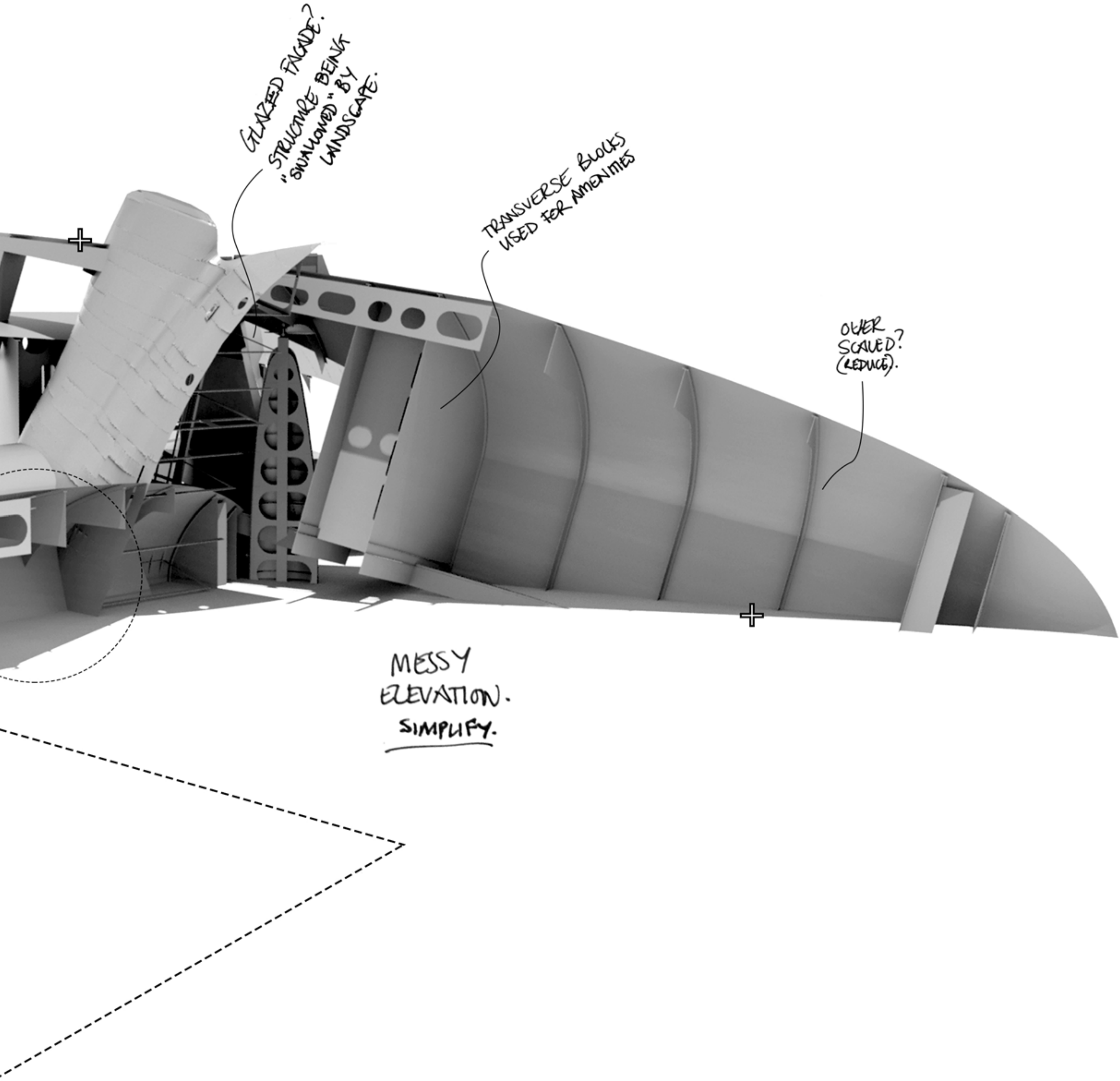


*Fig. 71. Conceptual form study 05.*


GLAZED FAÇADE?
STRUCTURE BEING "SWALLOWED" BY LANDSCAPE.
TRANSVERSE BLOCKS USED FOR AMENITIES
OVER SCALED? (REDUCE).
MESSY ELEVATION.
SIMPLIFY.

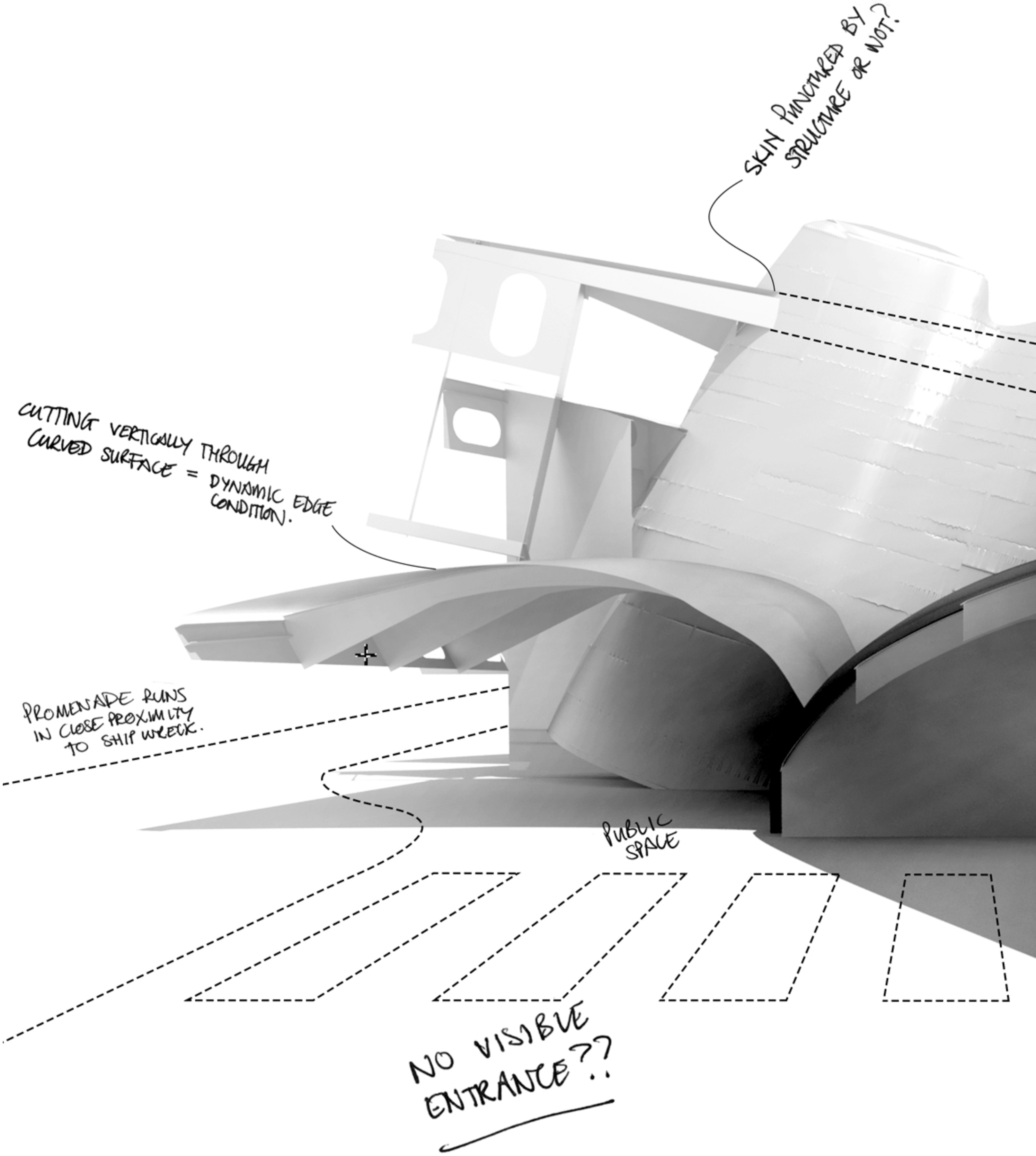
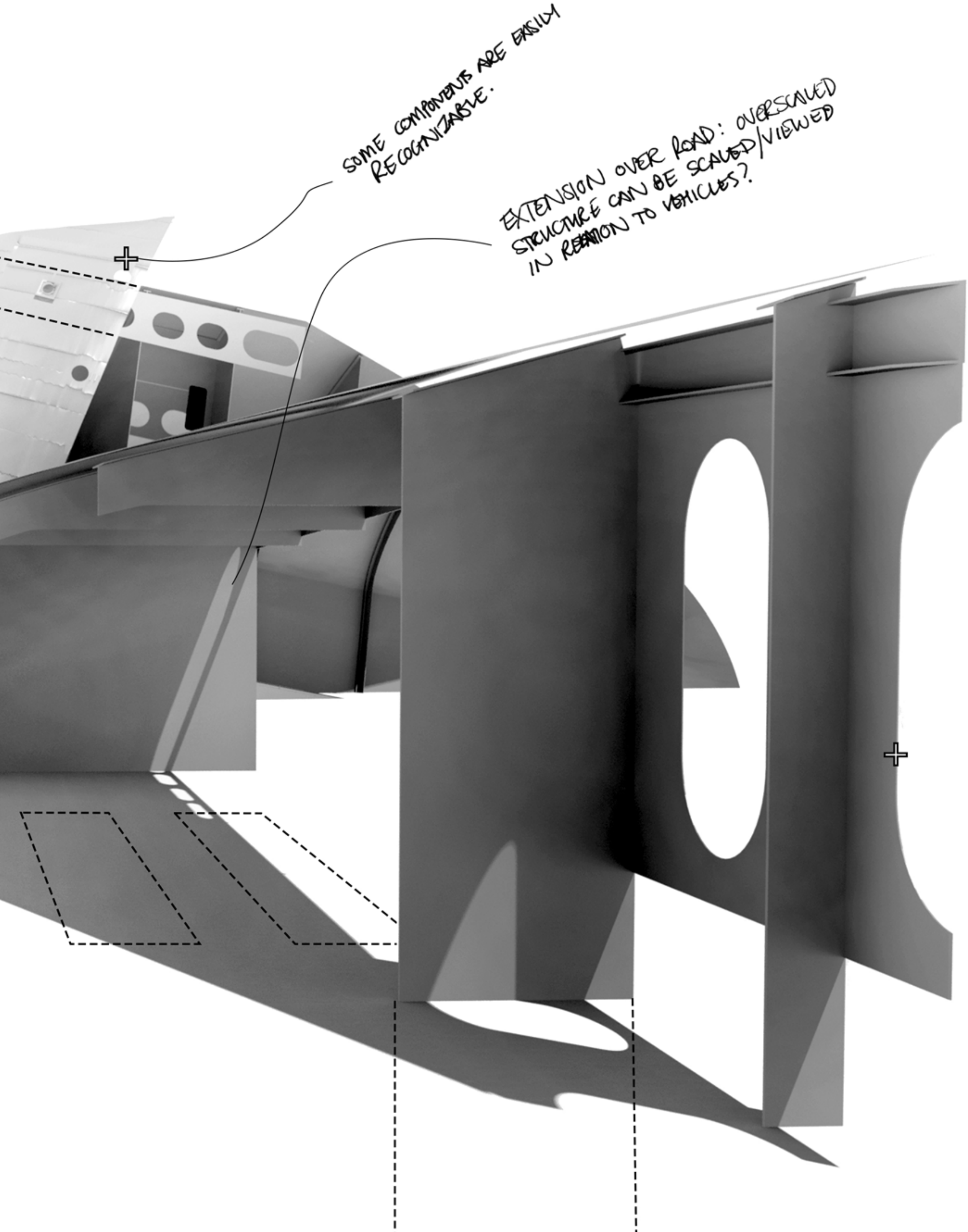



*Fig. 72. Conceptual form study 06.*


SOME COMPONENTS ARE EASILY RECOGNIZABLE.
EXTENSION OVER ROAD: OVERSCALED STRUCTURE CAN BE SCALED/VIEWED IN RELATION TO VEHICLES?

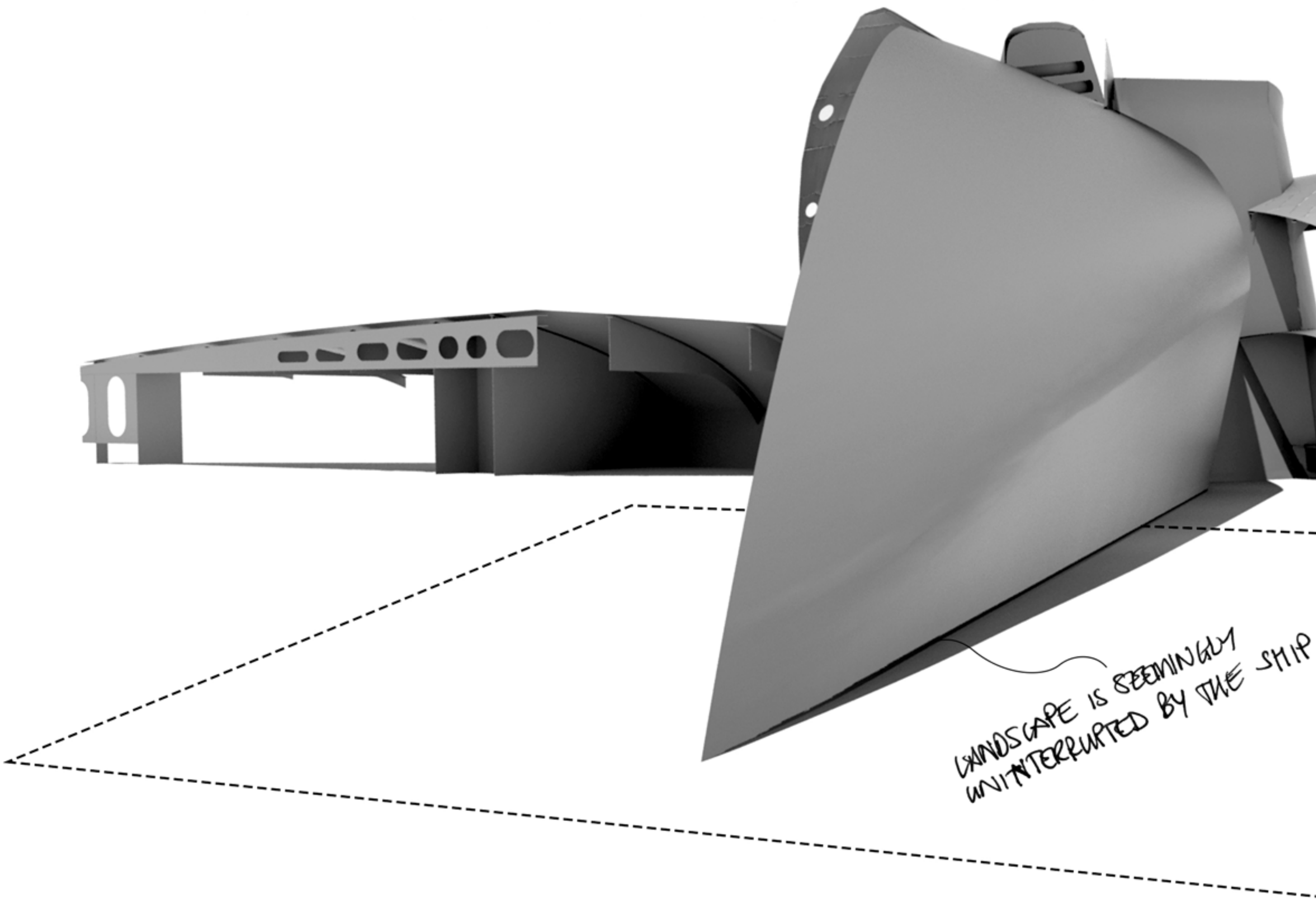
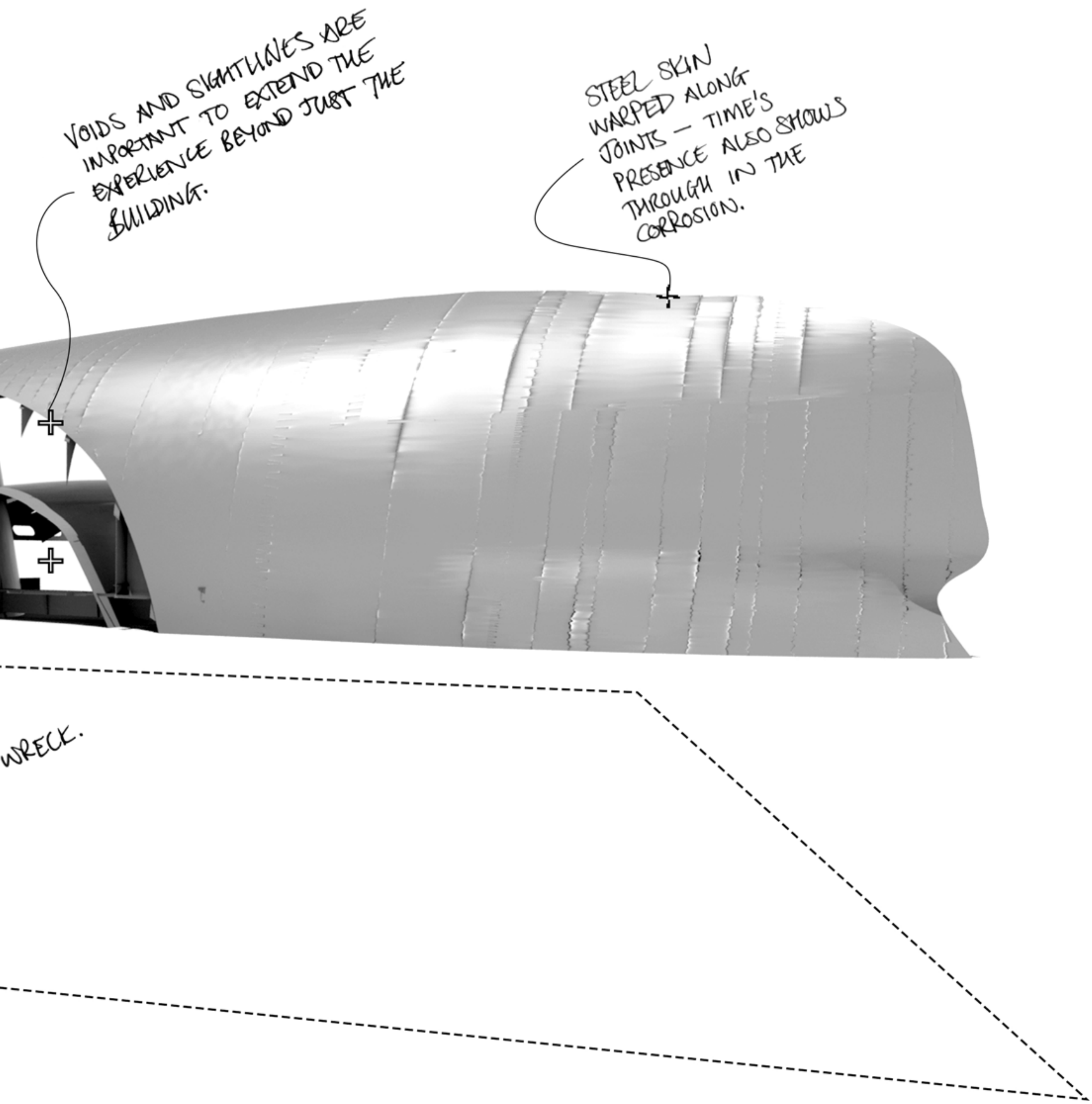



*Fig. 73. Conceptual form study 06.*



VOIDS AND SIGHTLINES ARE IMPORTANT TO EXTEND THE EXPERIENCE BEYOND JUST THE BUILDING.
STEEL SKIN WARPED ALONG JOINTS – TIME'S PRESENCE ALSO SHOWS THROUGH IN THE CORROSION.
WRECK.

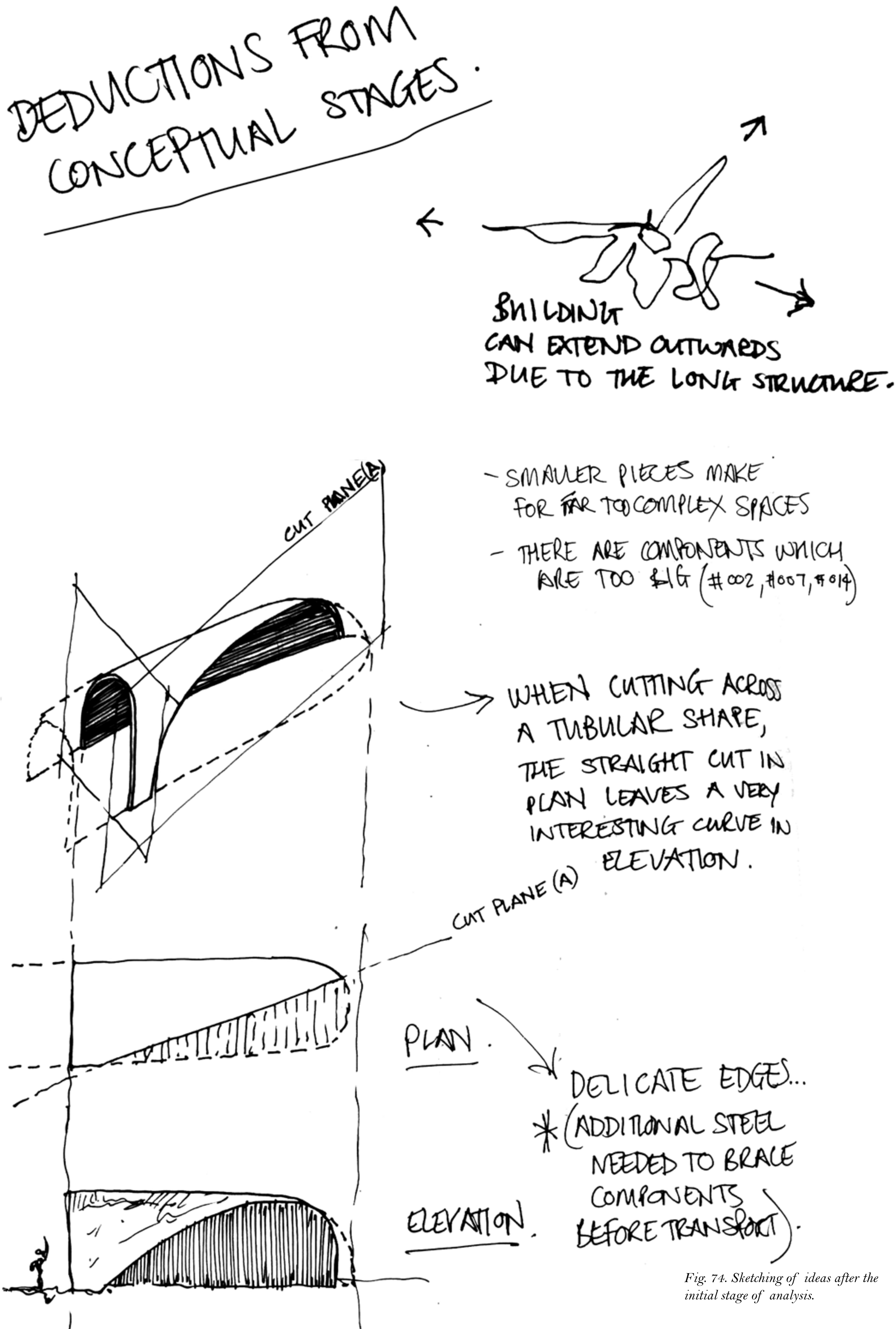



*Fig. 74. Sketching of ideas after the initial stage of analysis.*

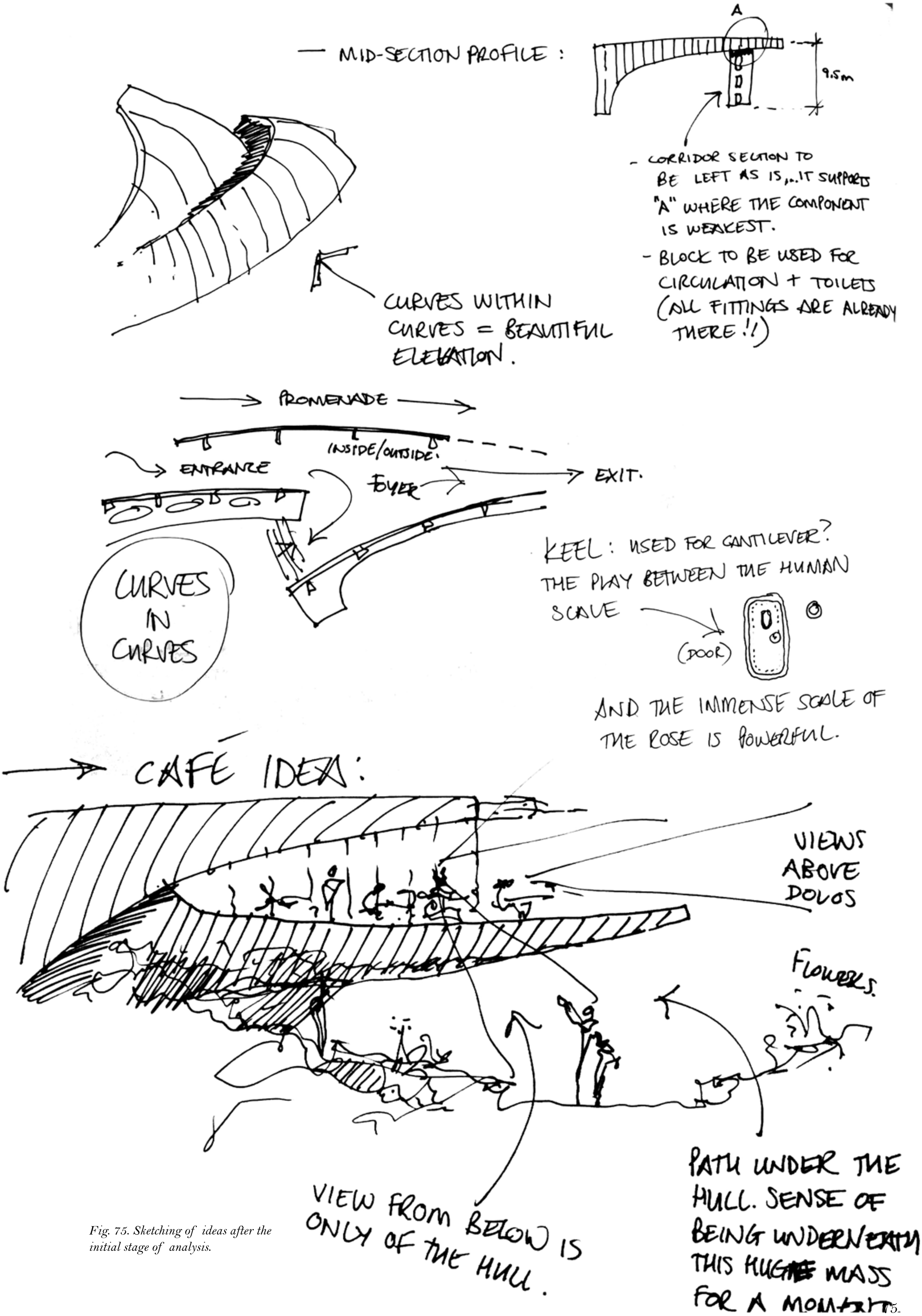



*Fig. 75. Sketching of ideas after the initial stage of analysis.*

## TECHNICAL ANALYSIS

The land along the breakwater is largely made up of stone from the near by Signal Hill quarries as well as the soil and rocks extracted from the construction of the Prince Alfred Basin (1860), Victoria Basin (1920) and Duncan Dock (1945).[1] One of the key design decisions from the early conceptual stage of the project was for the museum to consist of a strong concrete base with the elegant steel forms from the Rose resting upon it, much like a ship which has been wrecked upon the rocks. Construction of such a building at the breakwater site was investigated, and two primary concerns were highlighted:

1. Foundations: The soil conditions on site would demand a deep foundational system to reduce potential movement in the structure over time, as well as to found the building on the bedrock rather than the loose reclaimed land.

2. Steel Structure: The forces acting on the various large components of the Rose would need to be evenly distributed into the ground. Due to their individual complexity, a feasible structural system would have to be applied to accommodate the steel structure.

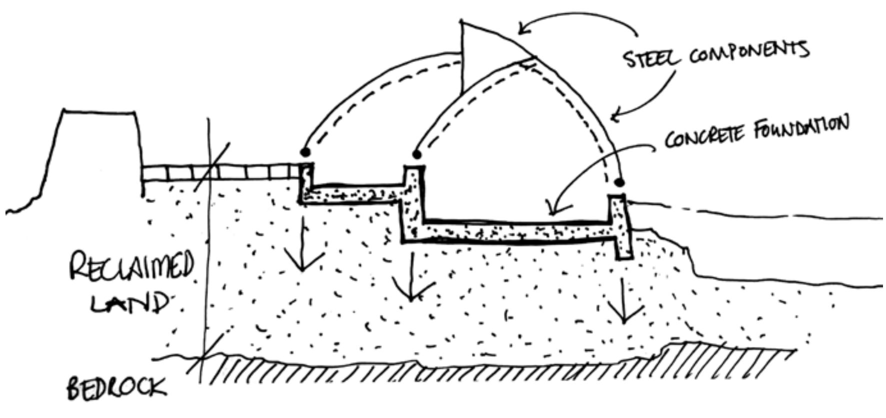



*Fig. 76. Early sketch of the basic idea behind the foundation of the museum. The foundations and floor slabs are mimicking the surfaces around the old wall, and the large 4m x 2m x 1.5m concrete blocks are also used throughout the lower levels as the same language of the exterior terrain is drawn in through the building.*

## 1. FOUNDATIONS

The first issue, that of the foundatons of the museum, was resolved through the use of a pile foundation system. A pile is basically a long cylinder of a strong material, usually reinforced concrete, which is installed deep into the ground to transfer the weight of a building directly into more stable soil or the bedrock.[2]

Piles distribute forces into the ground in two manners. Firstly, a pile can disribute a load acting upon it through friction. Secondly, end

1 Worden, N. 1992: 7.
2 Cornick, H. 1968: 306.

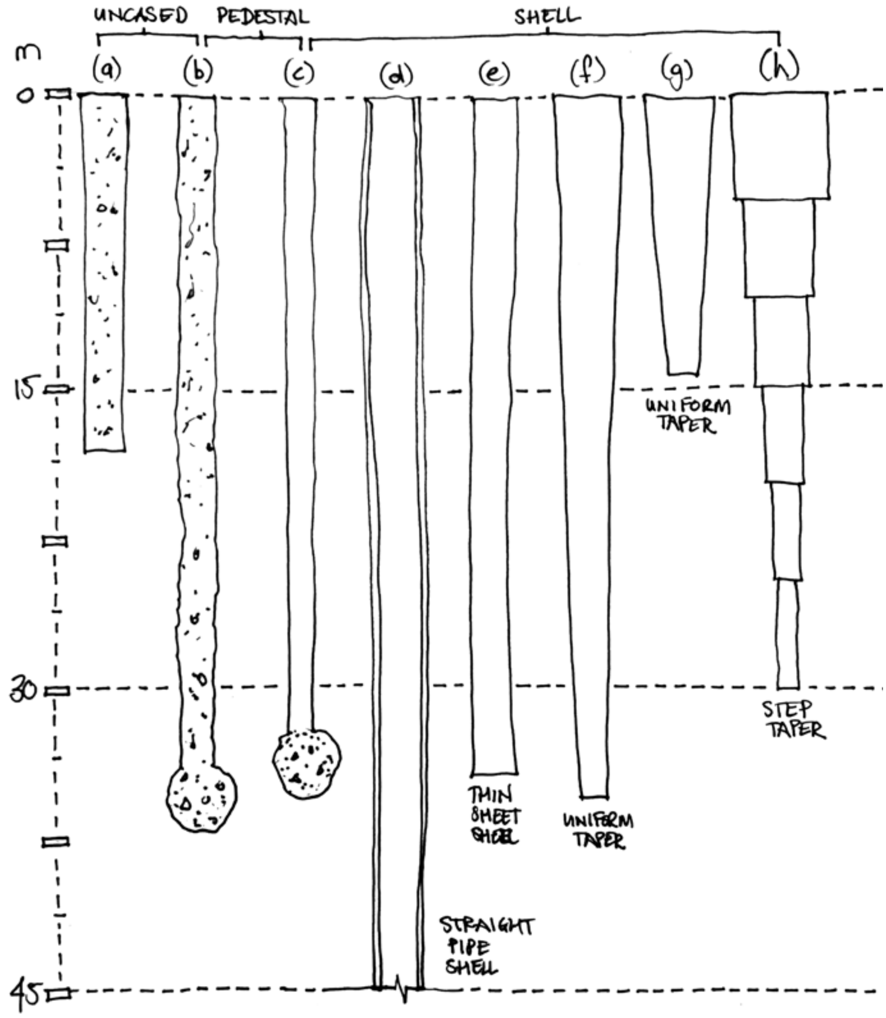



*Fig. 77. Sketch of the many different kinds of piles: (a) uncased pile; (b) Franki uncased-pedestal pile; (c) Franki cased-pedestal pile; (d) seamless pipe pile; (e) cased thin sheet shell pile; ( f ) monotube pile; (g) uniform tapered pile; (h) step-tapered pile. This sketch is based on the work in 'Foundation Analysis and Design' by Joseph E. Bowles, 1997.*

bearing piles act like submerged columns in a way as they transfer the laod straight down into a surface with a good load bearing capacity, bypassing weak soil.[1] There are several different kinds of piles, each used in different conditions (see fig. 77 above). The new maritime museum will need to be founded on the deeper bedrock, therefore, a foundational system using uncased 'Franki' piles will be used.

Uncased 'Franki' piles work both as friction piles (the uncased concrete grips the surrounding soil), as well as end bearing piles. They have a reasonable tensile load capacity as the base toe also acts as an anchor to the building, preventing any lifting of the structure. Another consideration would be their environemntal impact. Construction along the waters edge in Table Bay needs to firstly be approved by the Department of Environmental Affairs due to the high impact such activities could have on the surrounding marine life. As Franki piles have relatively low noise and ground vibration levels in comparision to other types of piles they are the most logical choice for the foundation of the museum.[2]

1 Cornick, H. 1968: 306.
2 Ibid.

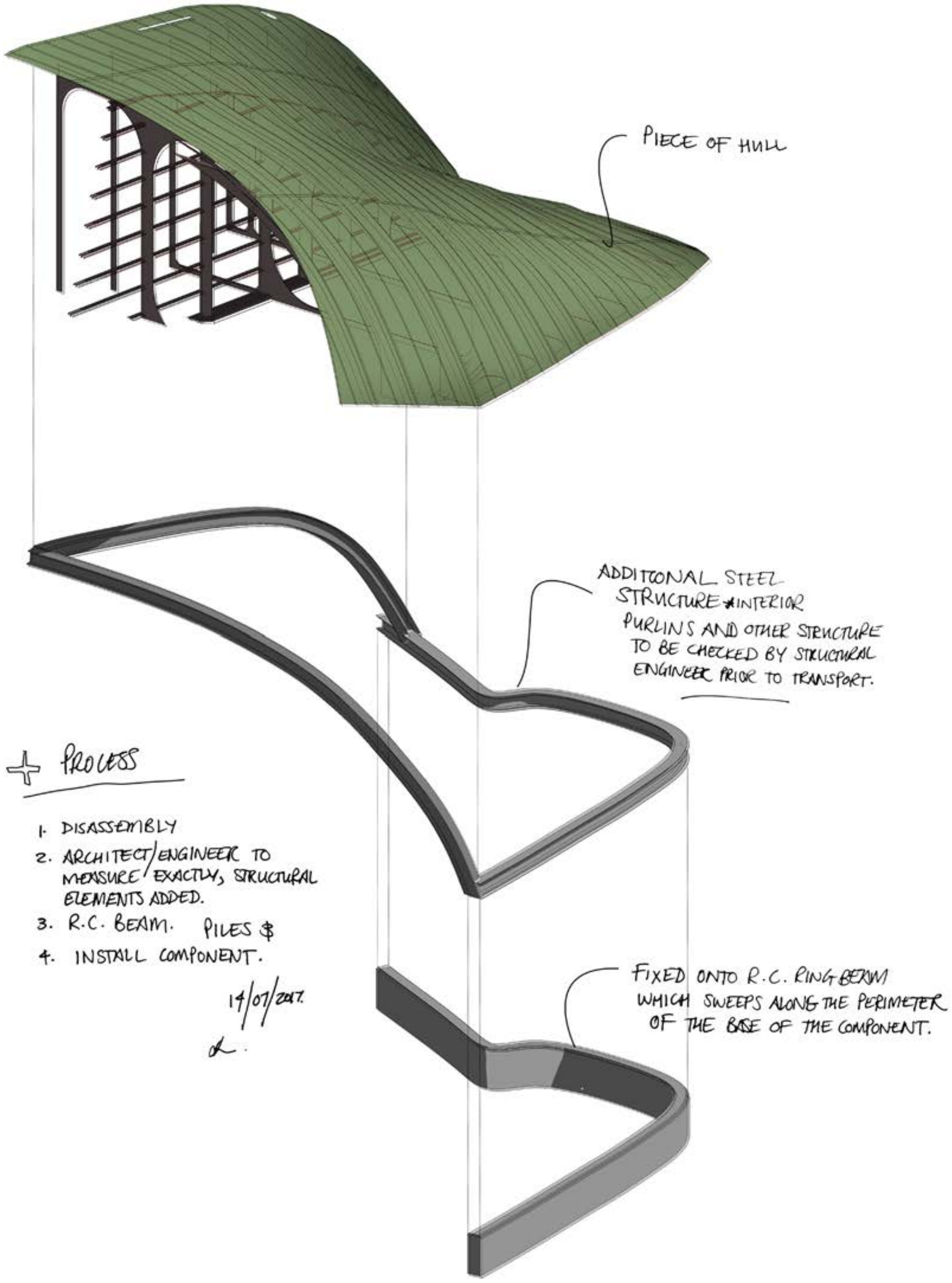



*Fig. 78. Sketch showing how the pieces extracted from the Rose are reinforced with additional steel (also obtained from the ship). The alternative method of disassembly would be to completely break apart every piece of the ship and then rebuild the components again as design on site. This would be far more complicated than the current proposal. With the help of the massive gantry system these pieces will be carefully removed, reinforced and then moved into place on site.*

## 2. STEEL STRUCTURE

This second concern has been included in this geo-technical analysis as the structural resolution of such large components is dealt with using the primary concrete foundation, despite the steel structure being above ground.

The steel structure needs to address three main issues: (a) maintaining structural integrity of each component as it is extracted from the Rose, (b) distribution of structural loads onto concrete foundation, and (c) protecting the steel to avoid corrosion.

*(a) Maintaining Structural Integrity:*

The monocoque structure of the Rose is compromised when the ship is disassembled in the manner which this dissertation suggests. In order to maintain the overall structural integrity of each component as it is removed from the main vessel, additional steel structure will be required. One of the main reasons why the Rose is to be broken apart on site rather than in off site dry docks is the fact that deformation of the disassembled components is drastically reduced by not having to transport these large awkward shapes of steel over a large distance.

As the process of disassembly is largely achieved by engineers manually cutting out the desired form using oxyacetylene torches, human error would have to be factored in. This, among other issues such as potential deformation of the hull prior to disassembly, has been considered in the design process.

Despite the hypothetical nature of this project, a fair amount of room for error is intended in the process of disassembly and construction of the museum. Each component is to be cut out of the Rose as per the architectural drawings, however, there is an allowance for a deviation of form. The process of disassembling the Rose systematically from its bow to stern is not only common practice in the ship breaking industry, but it also has an interesting influence on the construction process.

Each piece is carefully laid in place, and the following piece is then adjusted to fit around it. This is an incremental design whereby human error or deviation from the initial architectural drawings would have to be carefully and individually resolved as each component is placed on site. This is not outside the role of the architect today, as one is typically required to ensure that a building is built as per the construction drawings, however, circumstances occur whereby compromise or alterations to the initial design are made.

With regards to the new maritime museum, the poetic process of using pieces of a ship to build a building is less about a feasible and expedient project, and more about the slow crafting of a structure through a careful and complex process.

*(b) Distribution of loads onto concrete foundation:*

The mediator between the steel monocoque and the pile foundations will be a reinforced concrete ring-beam. The beam will follow the base outline of each of the large steel components. All of the forces will then be evenly distributed downwards onto the pile foundations. This simple method will also be used to keep the main steel structure at least 500mm above the ground level in order to prevent any contact with ground surface water, reducing the chance of corrosion.

*(c) Protection of steel to avoid corrosion:*

The corrosion of steel is the process which occurs when it is simultaneously exposed to oxygen and moisture. The iron content of the steel is oxidised and can expand to about 6 times its original size. This electrochemical process produces hydrated ferric oxide (rust) on the steel and, over time, can significantly reduce structural integrity.[1] In regions where there is a high moisture content, such as that found in Cape Town near the breakwater, steel must be protected by various means if it is to perform structurally. The various atmospheric corrosivity categories and examples of typical environments are shown in Table 2 (top right).

The breakwater site falls into the C5-M category which means that the average steel thickness loss over 5 years could be at least 1mm. Marine steel thickness ranges from 4.5mm to 30mm, with the most economical strength to thickness ratio for hull plating being around 6mm.[2] This average of 6mm will be taken as the given thickness of the hull plates of the Rose, and the structural frame is based on the naval construction drawings on which the BIM model was based.

Certain high strength low alloy steels corrode in such a way that the rust forms a protective layer against further corrosion. Where the rust on normal steel would fall off after some time, starting the corrosive process again, these atmospheric corrosion resistant steels maintain their initial rust layer. Structures built from these steels can have up to a 120 year design life with minimal maintenance due to the extremely low corrosion rate.[3] This is an extremely interesting notion for this development of this design project as the breakwater site is subject to extreme atmospheric conditions, calling for an architectural intervention which needs to be highly resilient as well as have a reduced maintenance requirement.

Although this weathering steel, commonly known as 'Cor-Ten' steel, is marginally more expensive than traditional steel, construction and maintenance costs are significantly reduced as there is no need to paint the steel with protective coatings. It requires very little maintenance throughout the lifespan of the building, reducing

1 Macsteel, 2017.
2 Ibid.
3 World Steel Association, 2017.

*Table 3. Corrosivity Categories and Environments (Based on the information obtained from World Steel Association, 2017.)*

| Corrosivity category and risk | Low-carbon steel Thickness loss (µm)* | Examples of typical environments in a temperate climate (informative only) | |
|---|---|---|---|
| | | Exterior | Interior |
| C1 (very low) | ≤ 1.3 | - | Heated buildings with clean atmospheres, e.g. offices, shops, schools, hotels |
| C2 (low) | > 1.3 to 25 | Atmospheres with low level of pollution (mostly rural areas) | Unheated buildings where condensation may occur, e.g. depots, sports halls |
| C3 (medium) | > 25 to 50 | Urban and industrial atmospheres, moderate sulphur dioxide pollution, coastal area with low salinity | Production rooms with high humidity and some air pollution e.g. food-processing plants, laundries, breweries, dairies |
| C4 (high) | > 50 to 80 | Industrial areas and coastal areas with moderate salinity | Chemical plants, swimming pools, coastal, ship and boatyards |
| C5 I (very high - industrial) | > 80 to 200 | Industrial areas with high humidity and aggressive atmosphere | Buildings or areas with almost permanent condensation and high pollution |
| C5 M (very high - marine) | > 80 to 200 | Coastal and offshore areas with high salinity | Buildings or areas with almost permanent condensation and high pollution |

1µm (1 micron) = 0.001mm

*The thickness loss values are after the first year of exposure. Losses may reduce over subsequent years.

In coastal areas in hot, humid zones, the mass or thickness losses can exceed the limits stated above. Special precautions must therefore be taken when selecting protective paint systems for structures in such areas.

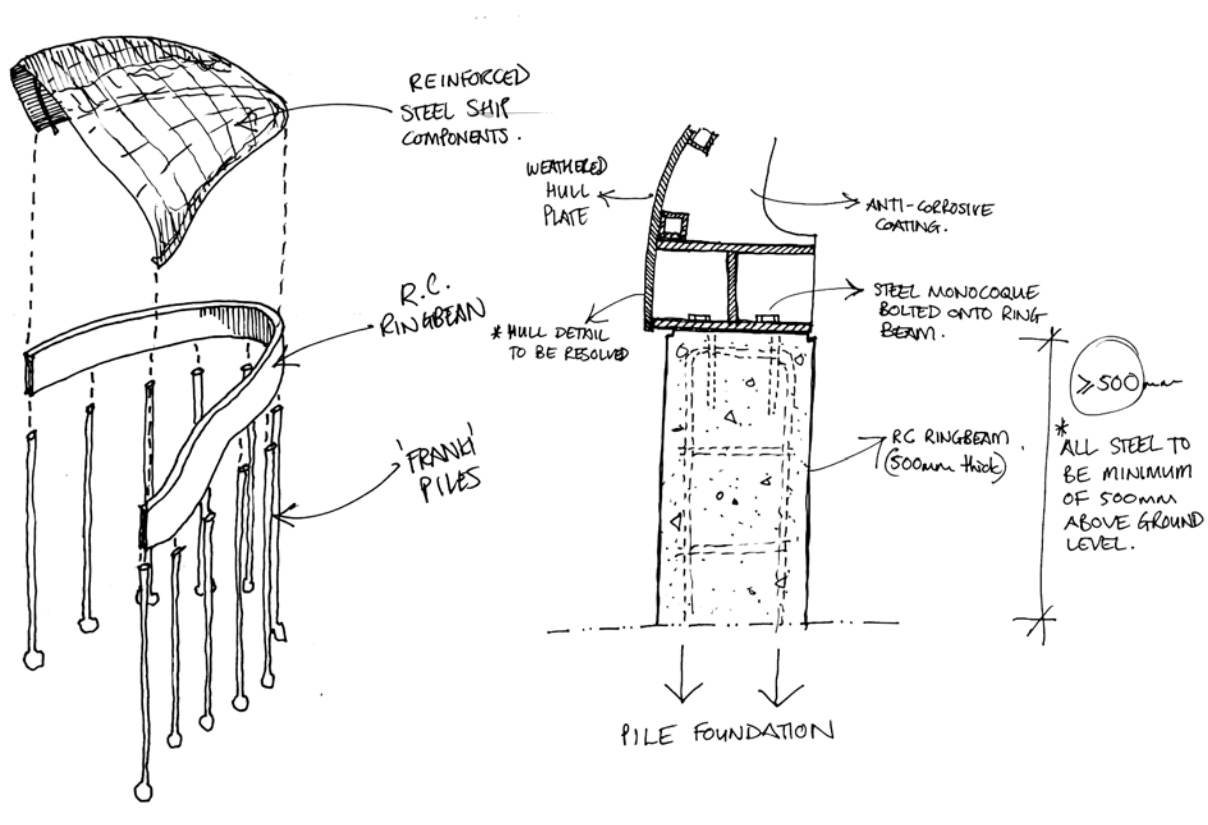



*Fig. 78. Sketch design of the basic structure (piles & ring-beam) and an early detail section of the joint between the steel monocoque and the reinforced concrete ring-beam.*

overall costs.[1] The proximity to the Atlantic Ocean means that there is a constant presence of water and a high salt content. It would be suggested that structural engineers check the major structural elements annually.

Weathered steel has been used in many different ways as it can be rather powerful if used creatively. Instead of trying to completely prevent all of the steel on site from corroding, the design along the breakwater is deliberately designed with corrosion as a material which marks the effects of time on the building, even on the site. As the weathered steel plates near the point of structural instability, additional steel plates from recycled ships could be obtained. This falls in line with the theoretical undertaking whereby this project is not only a single instance by which a ship becomes a building, but it is a building which is maintained by the steady income of recycled steel from ships.

Over time, the museum may grow with the addition of a second vessel, as the architectural design continues turning matter out of place into something which matters.

1 *World Steel Association, 2017.*

*Fig. 79. A collage of materials for the exterior of the museum: it is a search for a synthesis between the materials of both ship and site.*

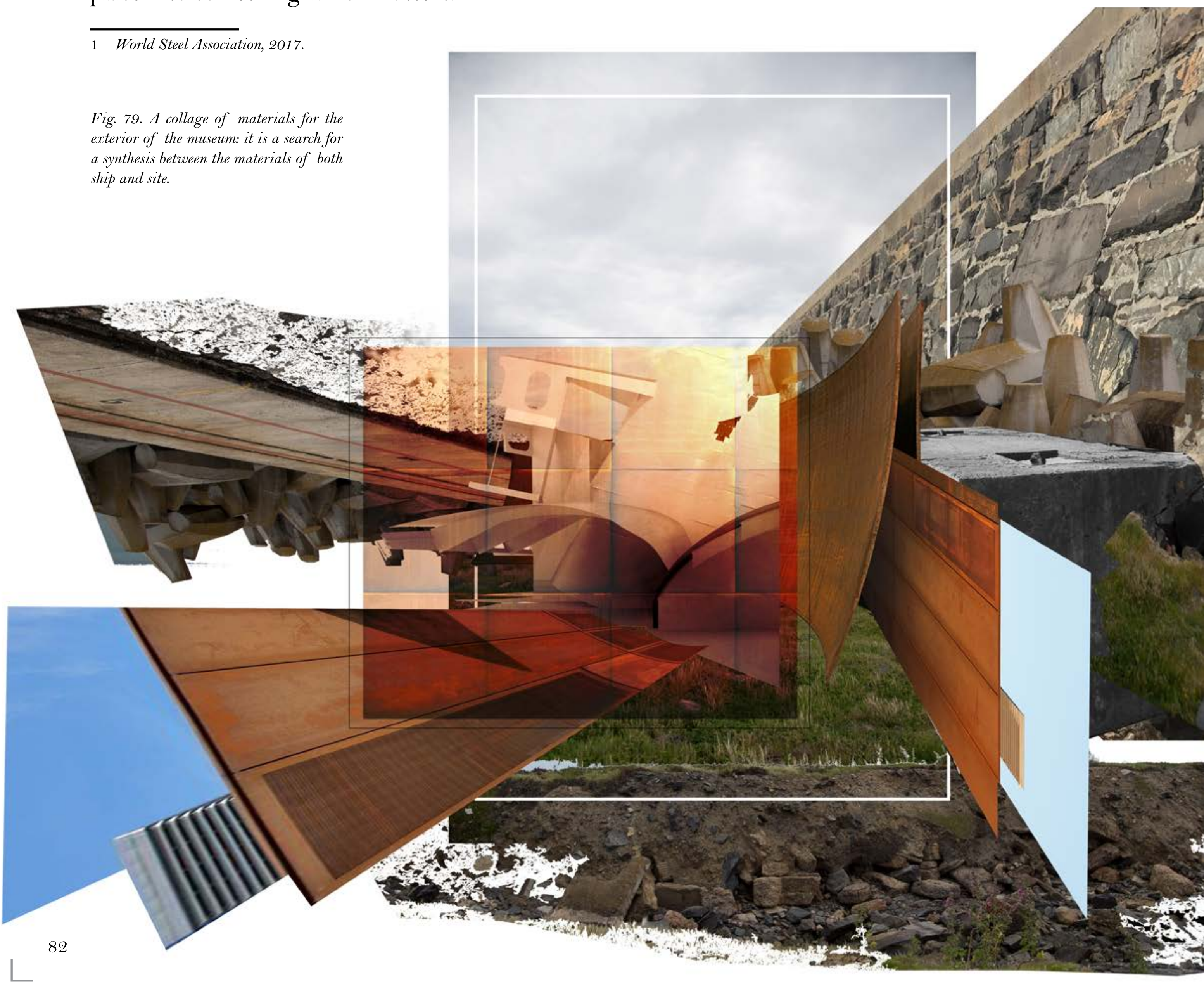


*Fig. 80. Dovecote Studio by Haworth Tompkins with a Cor-Ten addition. Weathered steel may seem so evocative as it is a direct counter to how steel is typically treated, where it is polished, stainless and serious. In this way, the museum takes on the very same rustic qualities found on site and it developes a character with age.*

*Fig. 81. The exposed steel loops used to lift the large concrete blocks rust away, staining the water and the surrounding concrete. Similarly, the rusting of the outer skin of the monocoque of the museum will effect the base on which it sits.*

## CASE STUDY: GUGGENHEIM BILBAO

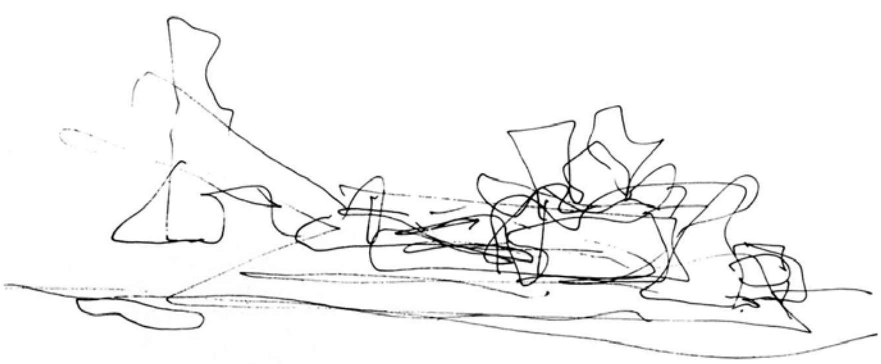
Built in 1997, the Guggenheim Museum in Bilbao was part of a large-scale rejuvenation and development project to address the dilapidated condition of the industrial city, a condition for which industrialisation and murky politics were largely to blame.[1] The museum was designed by Frank O. Gehry and completed in 1997. It sits on the cusp between architecture and art as the architecture warps and folds into its context to make not only one of the world's most famous museums for contemporary art, its positive impact on the surrounding city of Bilbao has become commonly know as the "Bilbao effect".

Where this short case study intersects with this dissertation is not, however, the ambitious assumption that the new maritime museum would have a similar impact on Cape Town, but rather in the exploration of complex and unconventional form, as well as the relationship between form and materiality.

*Form Finding:*

Bilbao's history is embedded in the shipbuilding industry due to its location along the Nervión River. Towards the end of the twentieth century, the diminished shipbuilding industry left many cities across Europe with industrial wastelands close to urban centres. The site which the museum was eventually built on sits amongst freight yards, main highways and the Nervión.[2]

The form of the building was first designed using rolled up pieces of paper and tape. This 'liquid' process of design is typical of Gehry as his expressive work is the manifestation of his desire to search for new forms.[3] Often times, these forms are far beyond the capabilities of conventional BIM programs, and so Gehry adopted the use of a software program called CATIA (Computer Aided Three dimensional Interactive Application) which was first developed for the aviation and vehicular industry.[4] CATIA allowed Gehry to digitise his conceptual models, as well as develop the design within the bounds of those early models.



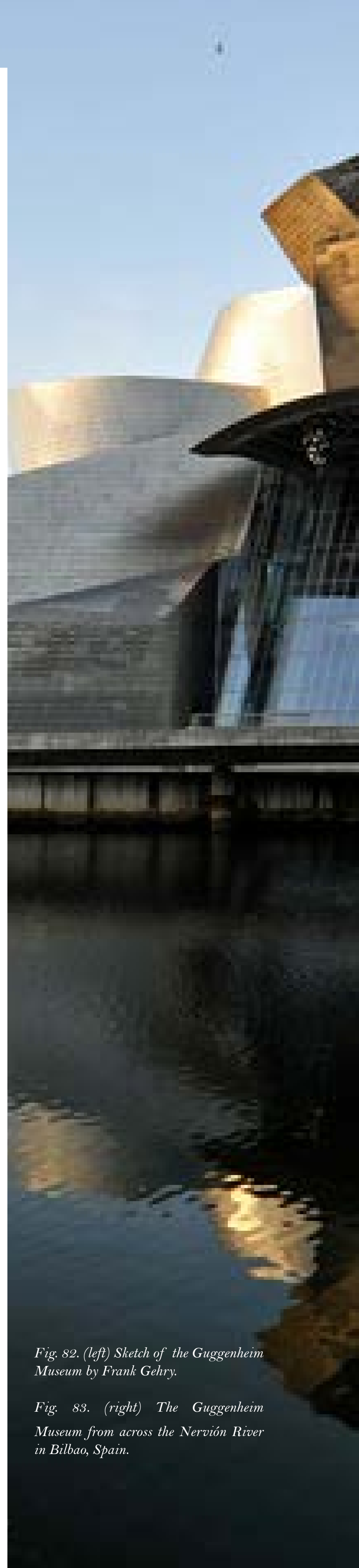


*Fig. 82. (left) Sketch of the Guggenheim Museum by Frank Gehry.*

*Fig. 83. (right) The Guggenheim Museum from across the Nervión River in Bilbao, Spain.*

1 Slessor, C. (1997).
2 Lapunzina, A. (1960), p86.
3 Slessor, C. (1997).
4 Ibid.

One of the struggles in this dissertation was the complex task of breaking apart a ship to build a building which not only meets the functional aspects of its brief but also explores new methods of construction and design. The issues arise with the limitations of conventional BIM software, or, more accurately, the limitations of the user. In this cases, the software tends to limit the design, becoming the architect and the user becomes merely a tool.

In the light of this issue, a significant portion of the time taken to develop this design was spent painfully manipulating the components extracted from the Rose to meet the original sketches and abstractions which were done early on in the project. This anchoring of intent to maintain the fluidity of a sketch was critical to the development of the design as it preserved the fundamental idea of breaking a ship upon a site to make a building - a task which includes a fair amount of chaos and disorder, which are beyond the capabilities of the software at hand.

Similar the Gehry, the struggle and eventual manipulation of software can create architecture which is incredibly unique as well as relatively economical. In the disassembly of the Rose and construction of the maritime museum, the digital model of the rose is accurately based on naval architectural drawings and this would allow for not only an accurate architectural design model but it could also be used by engineers and other professionals to expedite the project.

*Form and Materiality:*

So much of architecture today is like another American investigative drama series. On the surface, each episode seems to employ an elaborate plot, but by the end of episode the conclusion is so predictable that one tends to regret spending the last 30 minutes of their life watching a shallow copied-and-pasted balderdash.

Gehry's method of design alludes to an inherent spirit of discovery whereby program and function are relatively indistinguishable from the outside of the structure. It is only upon entering into the building whereby one discovers a program (see fig. 84). The Guggenheim Bilbao is reminiscent of the historical industrial past of the city, and the design identifies with context through its materiality and form.

The expressive form is an abstraction of the large ships which once were constructed along the banks of the river and cladded with 0.38mm thick titanium scales, indented slightly by fixings, giving them a ripple effect.[1] These plates reflect warped vies of the Nervión River and surrounding spaces. The skin is pulled right down to ground level at times, making the building interactive both from near (touch) and far away (view of the city around the museum reflected by the titanium cladding). A fortuitous drop in the price of titanium around the time of construction allowed for such a typically high-valued material to be used to such a great extent.[2]

1 Slessor, C. (1997).
2 Ibid.

*Fig. 84. Interior view of one of the galleries of the Guggenheim Bilbao. The titanium scales are pulled into the interior spaces as the structure of the building wraps around the galleries. Typical characterstics of a building such as windows, doors, roofs and walls are not visible from the exterior of the museum. This deliberate design method developes idea that the museum houses contemporary art, and is also an art piece itself and not strictly a building.*

*Fig. 85. The exterior of the building is cladding with thin titanium scales.*

The design of the maritime museum in the breakwater takes these ideas explored by Gehry in the Guggenheim Bilbao and explores them further. Gehry's museum is a piece of art which houses art. The maritime museum will be a ship which houses ships (simply speaking). The sculpted forms of both buildings share a desire to engage with a broader audience than just those upon the sight, drawing upon key sight-lines and an omni-presence.

The following section expands on these statements with the introduction of the sketch design of the maritime museum.

*Waves and the Wall*

The Southern African climate is largely dictated by the pressure systems created to the south towards the Antarctic. Cape Town experiences the majority of its annual wind and subsequent weather from the south-east (fig. 86).

The wave patterns are also heavily dictated by the wind from these pressure systems, resulting in the typical wave patterns which we see today in Table Bay (see fig 87). Here the vital wave deflection function of the breakwater wall can be seen, as it not only protects the V&A basins but creates a considerably large 'shadow zone' protecting the southern part of Table Bay from the direct waves.

The projected climatic models for Cape Town point to the strong possibility of radical climatic change impacting the city and the activity within the harbour.[1] Rises in wind speeds and rainfall are expected to happen, and an increase in extreme weather conditions. Policies have been put in place in recent years to adhere to these climate warnings as the realization that these shifts in weather patterns could have a devastating effect on what is the largest city in the Western Cape.

One of the most pressing potential threats for the harbour is the rising water levels due to the increase in temperatures across the world. The sea levels are estimated to rise between 450 - 820mm by 2100.[2] This could result in a significant amount of force acting upon the breakwater wall, and, therefore, this project begins to speculate into the future of the monitoring, maintenance and eventual upgrade of this important structure.

As shown in figures 88, 89 and 90, the breakwater is subject to immense waves at times, which crash over the wall. The maritime museum is, therefore, located partially behind the old wall and the artificial concrete hip for protection.

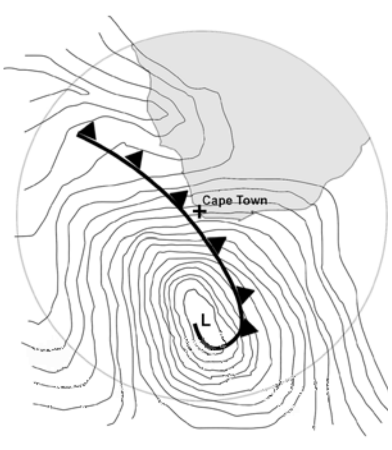



*Fig. 86. Low pressure system, Cape of Good Hope.*

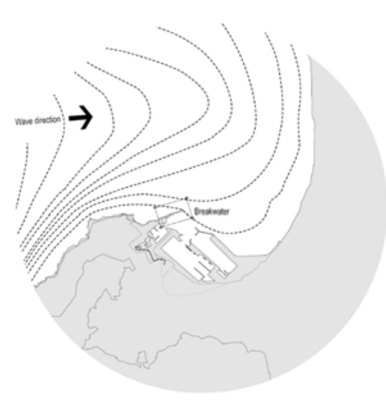



*Fig. 87. Incoming wave patterns in Table Bay.*

1 Hewitson, B.C. (2005), in Western Cape Report: *A Status Quo, Vulnerability and Adaptation Assessment of the Physical and Socio-Economic Effects of Climate.*

2 Gregory, Jonathan. (2016) *'Projections of Sea Level Rise'*, IPCC Report.

In extreme conditions, the waves can crash over the breakwater, making it extremely dangerous. Some original construction drawings included balustrades along the top of the wall, however, these would provide very little protection.

| | 100 years (without climate change) | 100 years (with climate change projected to 2060) |
|---|---|---|
| MHWS | 0.92 | 0.92 |
| Storm Surge | 0.74 | 0.74 |
| Sea Level Rise (2060) | 0 | 0.48 |
| Increase in Storm Surge | 0 | 0.08 |
| **Design Water Levels** | **1.66m** | **2.22m** |

*Table 4. Design Water Levels (based on the information obtained from the City of Cape Town Report: Coastal Dynamics Assessment (2014).*

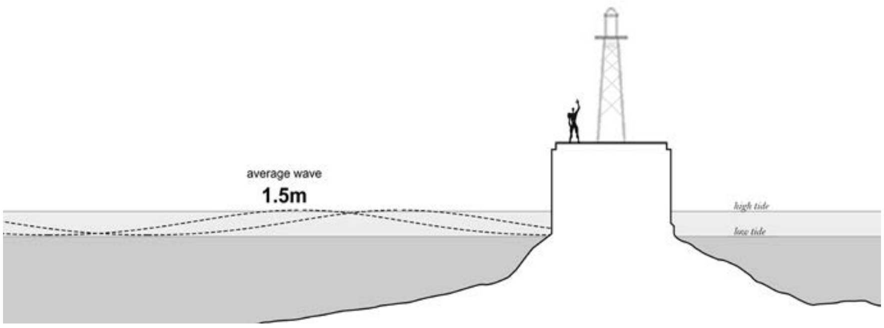



*Fig. 88. Average wave height at the Breakwater.*

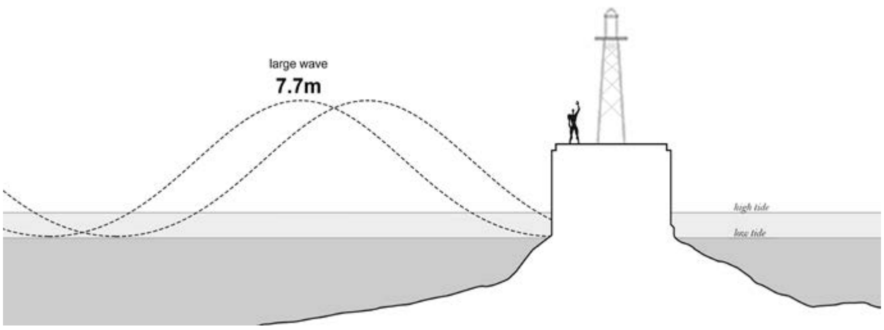



*Fig. 89. Large wave height at the Breakwater.*

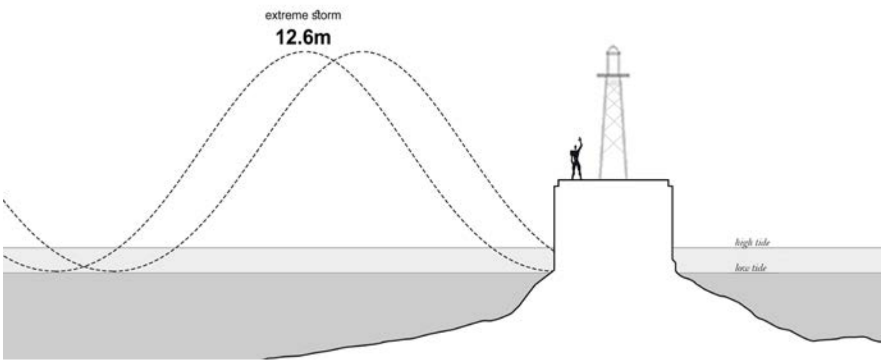



*Fig. 90. Extreme storm wave height at the Breakwater.*

## Dealing with Waves: Structure

The boundary condition between the land and the ocean in which a harbour exists can challenge conventional construction methods due to the proximity to water. The tidal range (average low to high tide) in Table Bay is around 1.5 - 2.0m[1] which means that the construction of a building along the coast must be safe from the effects of high tides and constructed above the Design Water Level as put forward in the earlier section on wave motion.[2] Observationally there are several methods to deal with structure and the proximity to the ocean.

An investigation into the boundary conditions where the built environment meets the ocean was conducted. An important device which is used along the quayside is the floating platform which serves as detachable extension of a pier or a walkway. These structures basically comprise of a deck upon a sturdy steel frame which is fixed to floatation devices such as large drums. The structure is kept in place by being tethered to the quayside with ropes.

More permanent structures, such as that found near the Nelson Mandela Gateway to Robben Island building at the V&A Waterfront, are supported by tall mooring columns which are sunk into the rock beneath the water. A wheel guide system is used to allow the platform to rise and fall with the changing water levels (vertical movement) while the columns hold it in place (horizontal fixing).

Aside from reclaiming more land along the harbour side of the breakwater wall, as has been done in the past, this technique of using sturdy floating structures is intriguing as it extends architecture over a terrain beyond the bounds of solid ground. These structures are easily installed and are detachable, therefore, also have little impact on the environment.

*Fig. 91. (top right sketch) old tyres create a soft edge.*

*Fig. 92. (top right photo) Tyres used to protect the passing ships.*

*As the car tyre is a familiar everyday object, it is a sublte scaling device when viewed beside a less familiar object. For example, the tyres in this photo allow the viewing to understand the thickness of the timber structure below.*

*This is important due to the fact that harbours are made up of machines and objects which are scaled according to purpose (the shipping industry) and necessarily the human scale. These sublte moments allow an otherwise otherworldy environment to be relatable. The opposite experience whereby one's idea of scale and reference is completely lost could be equally as moving.*

*Fig. 93. (middle right sketch) Extending the museum into the water lends itself to the idea of a poetic reintroduction of the ship and the ocean. The structure is also mimicking the rocking of a ship in the waves, making the viewer's experience of discovering the rose physically experiential as well as appealing to the softer narrativs of the poetic.*

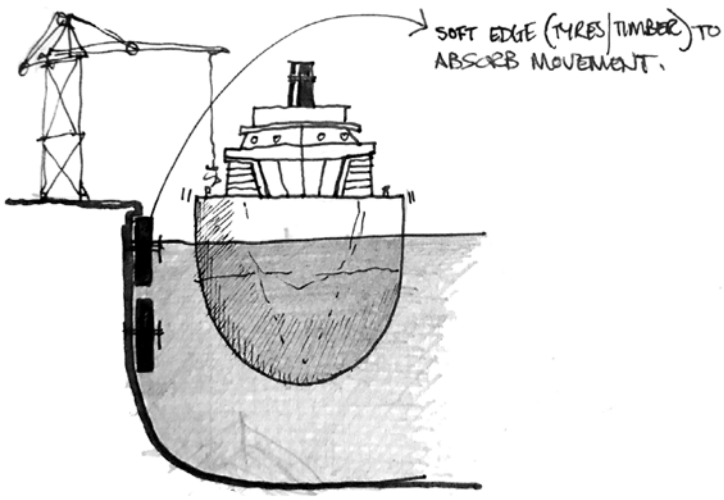
*Fig. 94. (middle right photo) Publicly accessible floating timber platform at the V & A Waterfront.*

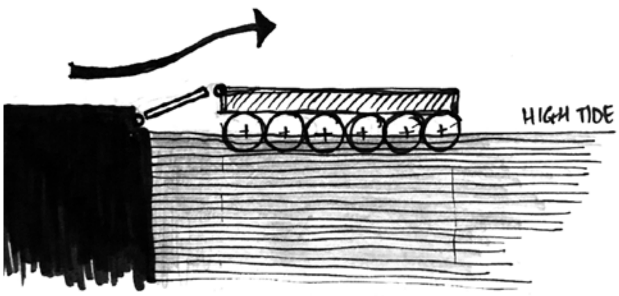
*Fig. 95. (bottom right sketch) rough sketch of the visual connection to the breakwater and the Atlantic beyond, looking through the V & A basins.*

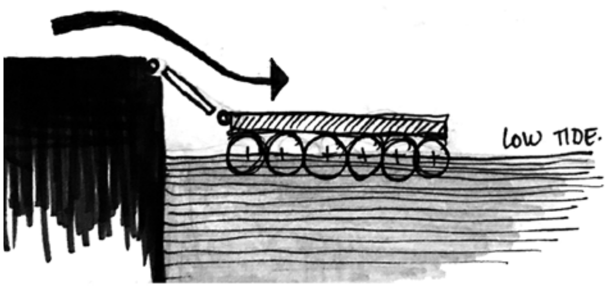
*Fig. 96. (lower right photo) A telescope along one of the popular walkways, V & A Waterfront.*

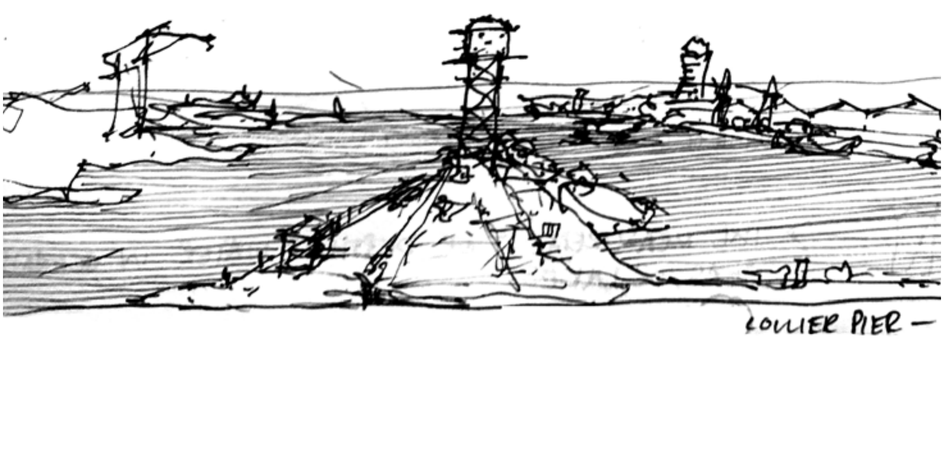
1 Joubert, James (2013).

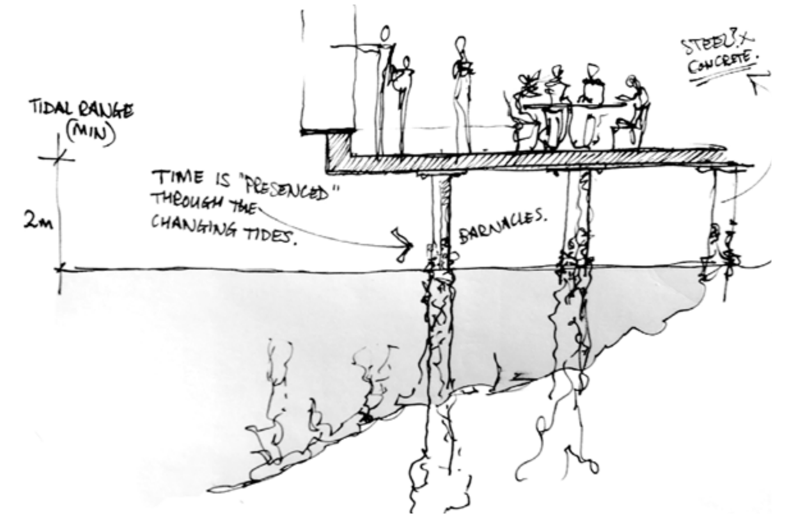
2 Design water levels for Cape Town are between 1.6m and 2.2m above sea-level (City of Cape Town Report: Coastal Dynamics Assessment (2014).

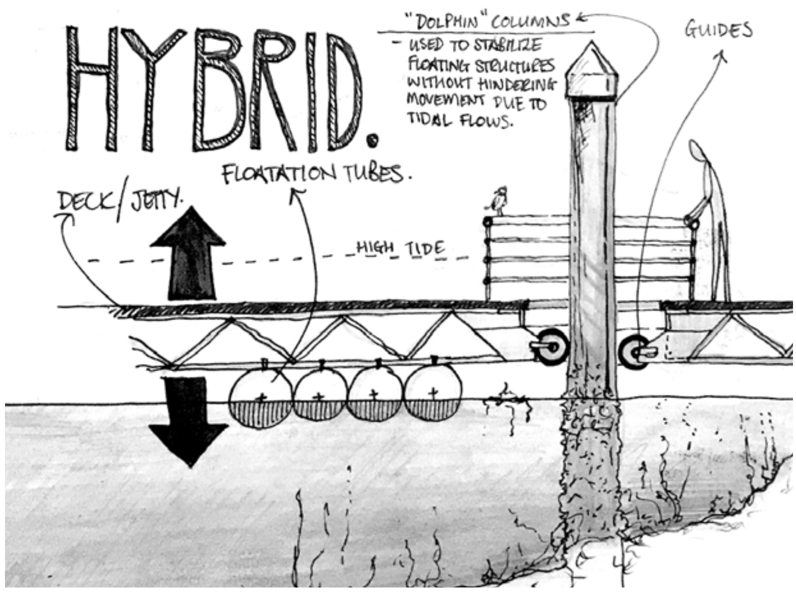

SOFT EDGE (TYRES | TIMBER) TO
ABSORB MOVEMENT.


HIGH TIDE


LOW TIDE.


COLLIER PIER –



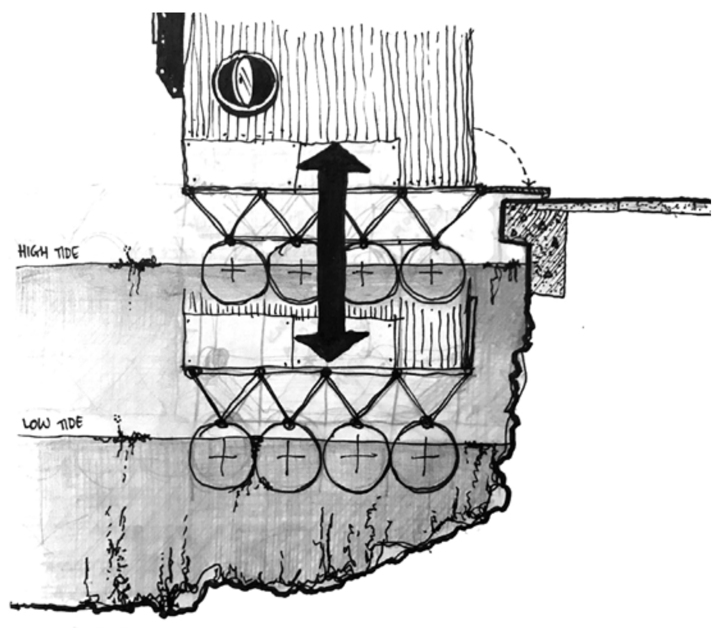




*Fig. 97. (top photo) Precast concrete piles used to extend the building. Over time the piles are covered with barnacles and become an 'extrusion' of the ocean.*

*Fig. 98. (top sketch) The water lines mark the tidal range on the piles.*

*Fig. 99. (middle photo) The guides acting on the mooring column, V & A Waterfront.*

*Fig. 100. (middle sketch) the platform gently creaks as its components adjust to the waves.*

*Fig. 101. (bottom sketch) part of the maritime museum can adopt this technology. The connection of the museum to the ocean again is important, and the mechanics of a floating platform as such goes beyond what an ordinary museum has to offer. Access could also be dependent on the tide, or even the building could communicate the tidal shift to the public/ships through the movement of the floating platform.*

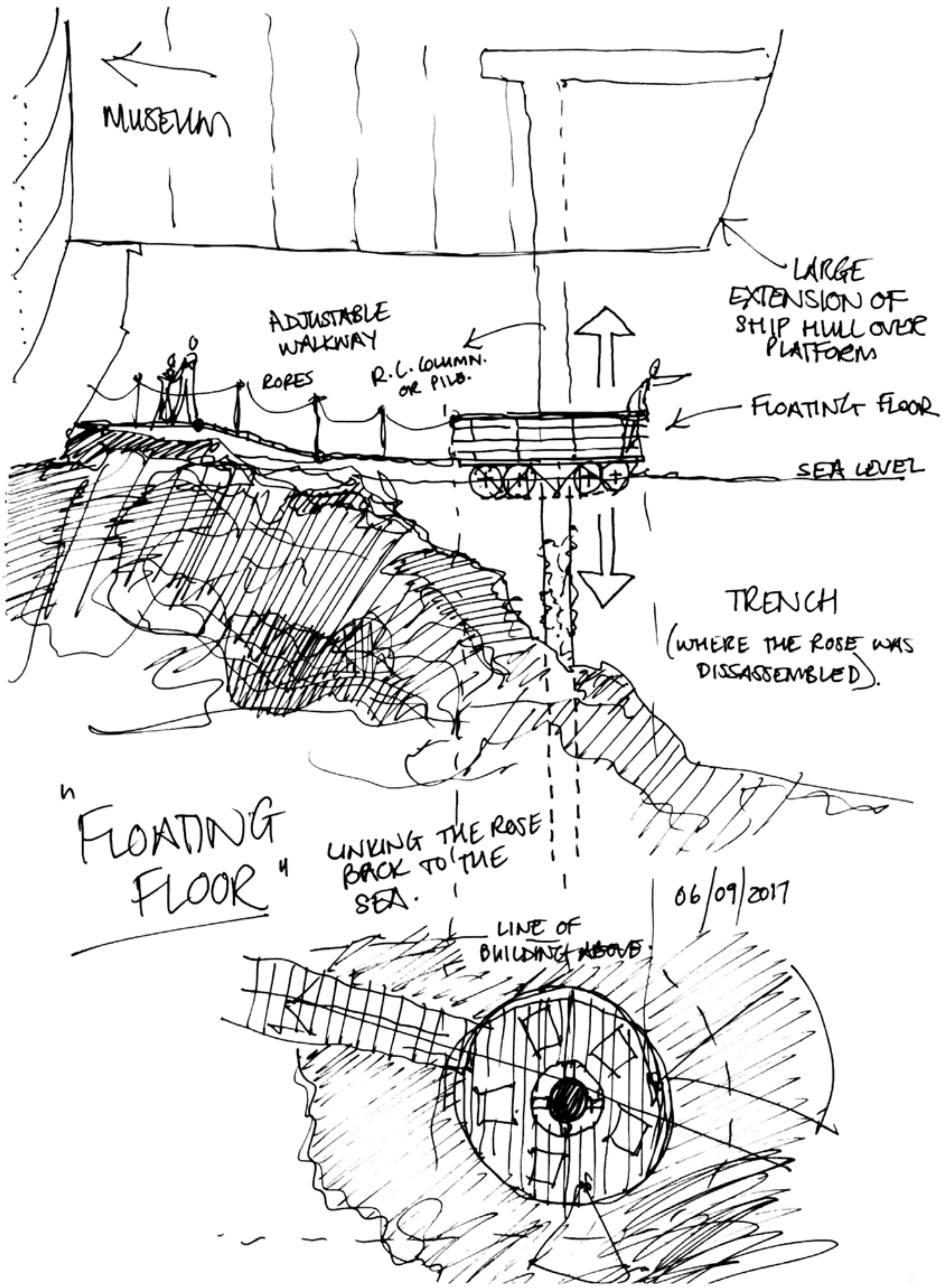



*Fig. 102. Early sketch designs of the 'floating floor' which is the device used to reconnect the building with the ocean.*

# DESIGN

## OUTLINE

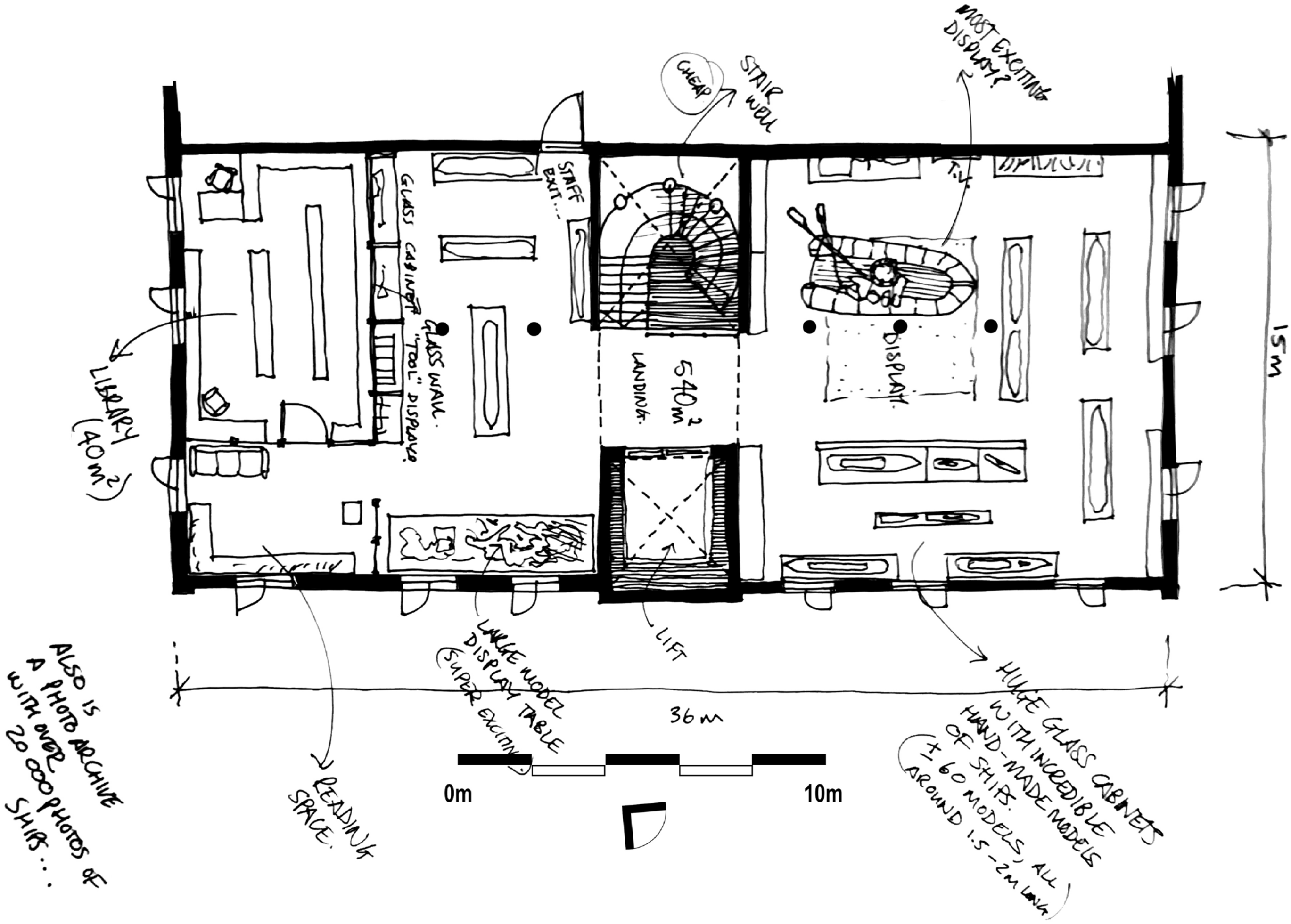
*1. Client*

The client identified in this dissertation is the Iziko Museums of South Africa, an organization which falls under the Department of Arts and Culture. The current Iziko Maritime Museum is in a dismal state for a number of reasons and the brief for the architectural outcome of this dissertation aims to address these issues.

*Fig. 103. The interior of the museum is rather bland and clinical.*

*Fig. 104. (top right) A rough plan of the current Iziko Maritime Museum. The plan was drawn on a visit to the museum.*

*Fig. 105. Photo of one of the incredible hand-made models on display.*




*Information on the current Iziko Maritime Museum:*
*(based on data obtained from the Iziko Museums of South Africa)*

## DETAILS

| | |
|---|---|
| Location: | 1st Floor,Union-Castle House, Dock Road, V&A Waterfront. |
| Capacity: | 4 staff |
| Hours: | 10h00 to 17h00 |
| Tickets: | Adults / R20<br>6-18 years / R10<br>Students / R10 |

## FACILITIES

**Total floor space: 540m²**

Lobby, security desk, storage, elevator, toilets, museum floor space (380m²), library and photo archives (40m²), reading room (8m²).

Notes:

+/- 50 large hand-made models of ships and the CT Harbour.

interesting equipment displays, as well as the models.

## ISSUES

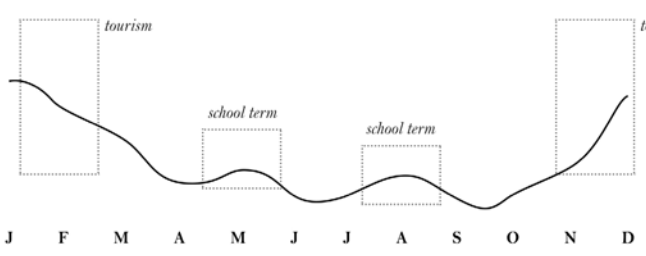
1. Very hidden away from the busy V & A Waterfront. Little or no signage.

2. Understaffed.

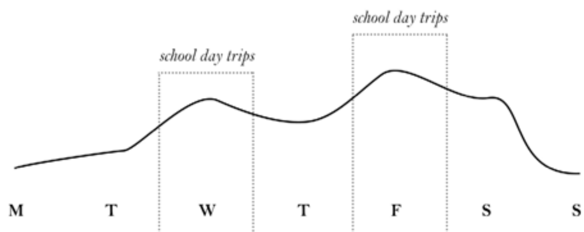
3. Generic displays. It is a building full of models, very little else about CT's maritime history.

4. Cramped spaces (library is too small for the amount of information which is stored in it).

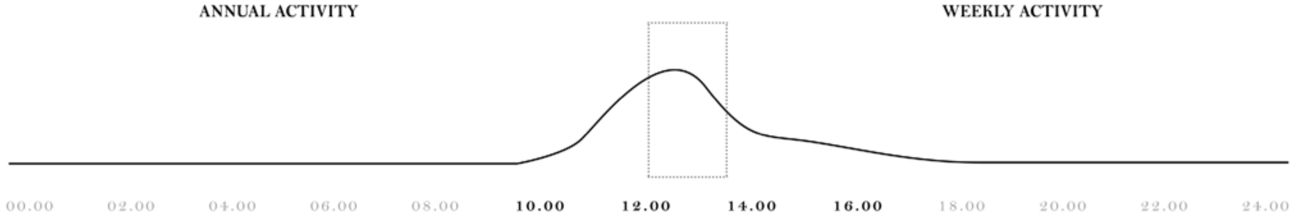
5. Stagnant experience. Graveyard for fantastic, hand-made models.




ANNUAL ACTIVITY




WEEKLY ACTIVITY




DAILY ACTIVITY

*2. Brief*

After analysing the current state of the Iziko Maritime Museum and indentifying the issues at hand, a design brief was established. The brief is as follows:

| | |
|---|---|
| *Location*: | End of E-Pier Road,<br>V & A Waterfront<br>-33.900537, 18.425429 |
| *Staff Capacity:* | 10 - 12 staff |
| *Operational Hours:* | 08h00 to 19h00 (museum) |
| *Facilities:* | Total floor space: 2100m2 |

Lobby, security office and front desk, storage (small, general), storage (large, models/furniture), elevator, toilets, gallery space (m2), library (m2), reading room (m2), digital photo archive & VR room, lecture theatre, museum offices, cafe, mooring station for small engineering maintenance boat.

*Solutions:*

1. Proximity to the new promenade will encourage visitors, as well as the experince not only of seeing the hostorical artifacts, but also that of being sourrounded by a deconstructed ship.

2. The oveall capacity of the museum will be increased.

3. photo archives are digitised and an interactive Augmented and Virtual Reality experience provided.

4. Library capacity increased.

5. Building is a ship which houses ships.

*3. Creating the Museum*

Creating a building out of the complex pieces from the Rose began with an iterative process whereby the different components weremanipulated, moved, rotated and then analysed for their spatial potential. This was approached with the same playfulness permitted in the previous abstraction exercises. An example of this process is shown in figure XX (right), where the first three pieces from the bow of the Rose were manipulated and adjusted on site.

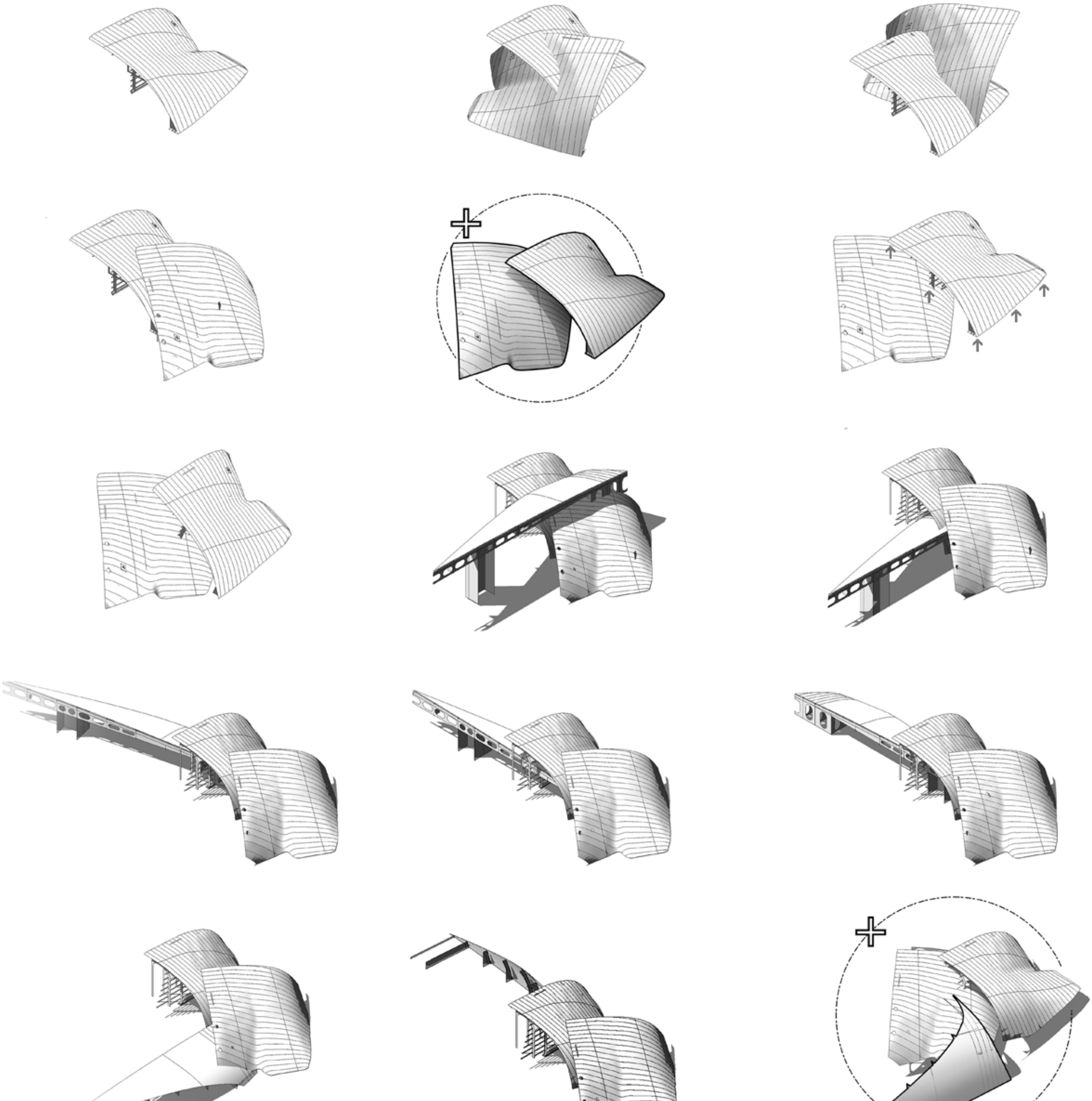


*Fig. 106. A series of  investigations of  form and composition.*

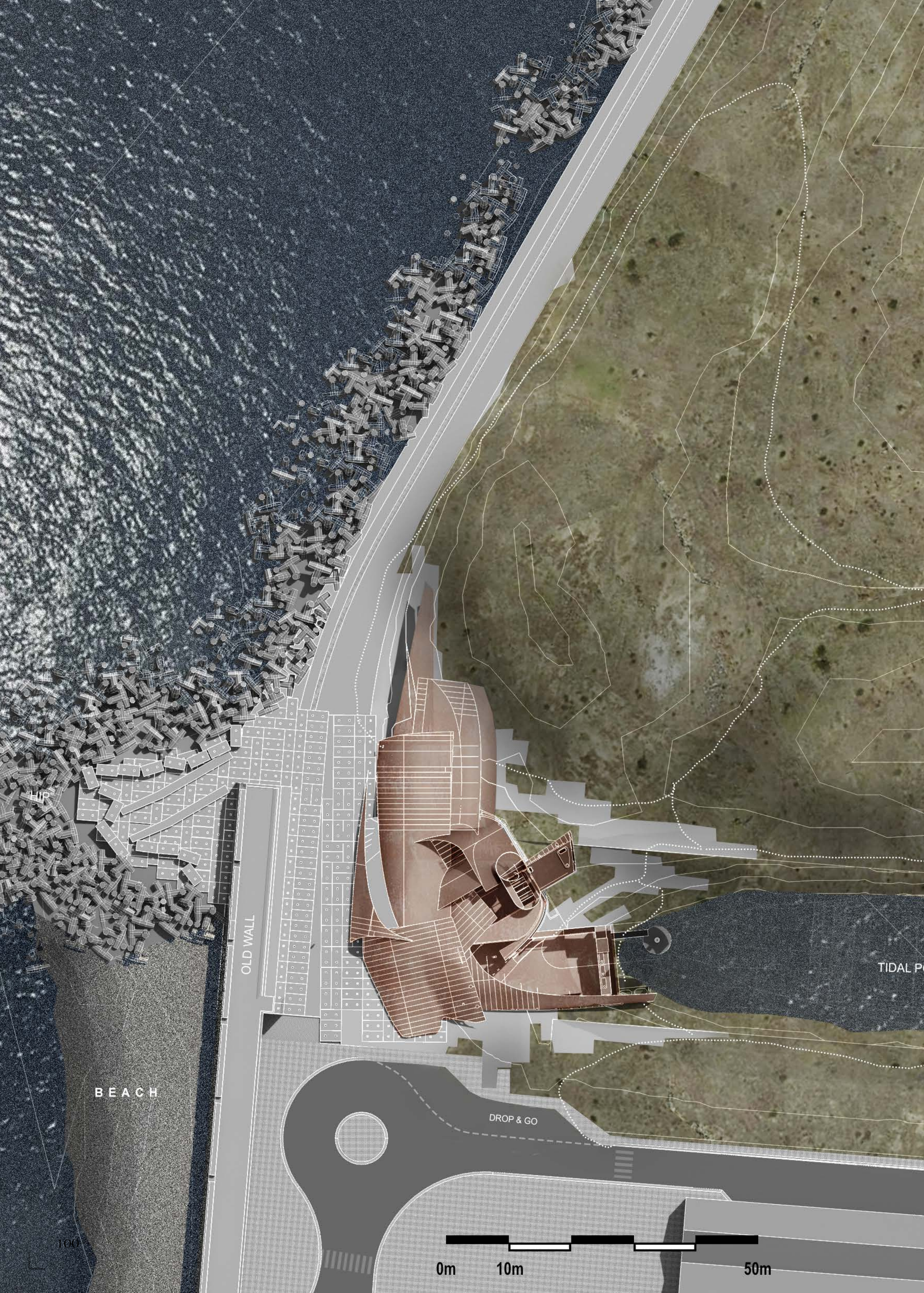

"HIP"
OLD WALL
BEACH
DROP & GO
TIDAL P
0m
10m
50m

*Fig. 108. (left) site plan showing the surface materials of the building and its surroundings. The large concrete units are pulled right through the building as a main floor surface. Some of these blocks are also used as retaining walls.*

*Fig. 109. (right) An exploded isometric view of the new museum.*

*(a) & (b) the monocoque structure, made up of the different components from The Rose.*

*(c) the sturdy concrete foundations and ringbeams which sit into the site.*

*(d) building, as of the current sketch design plans*

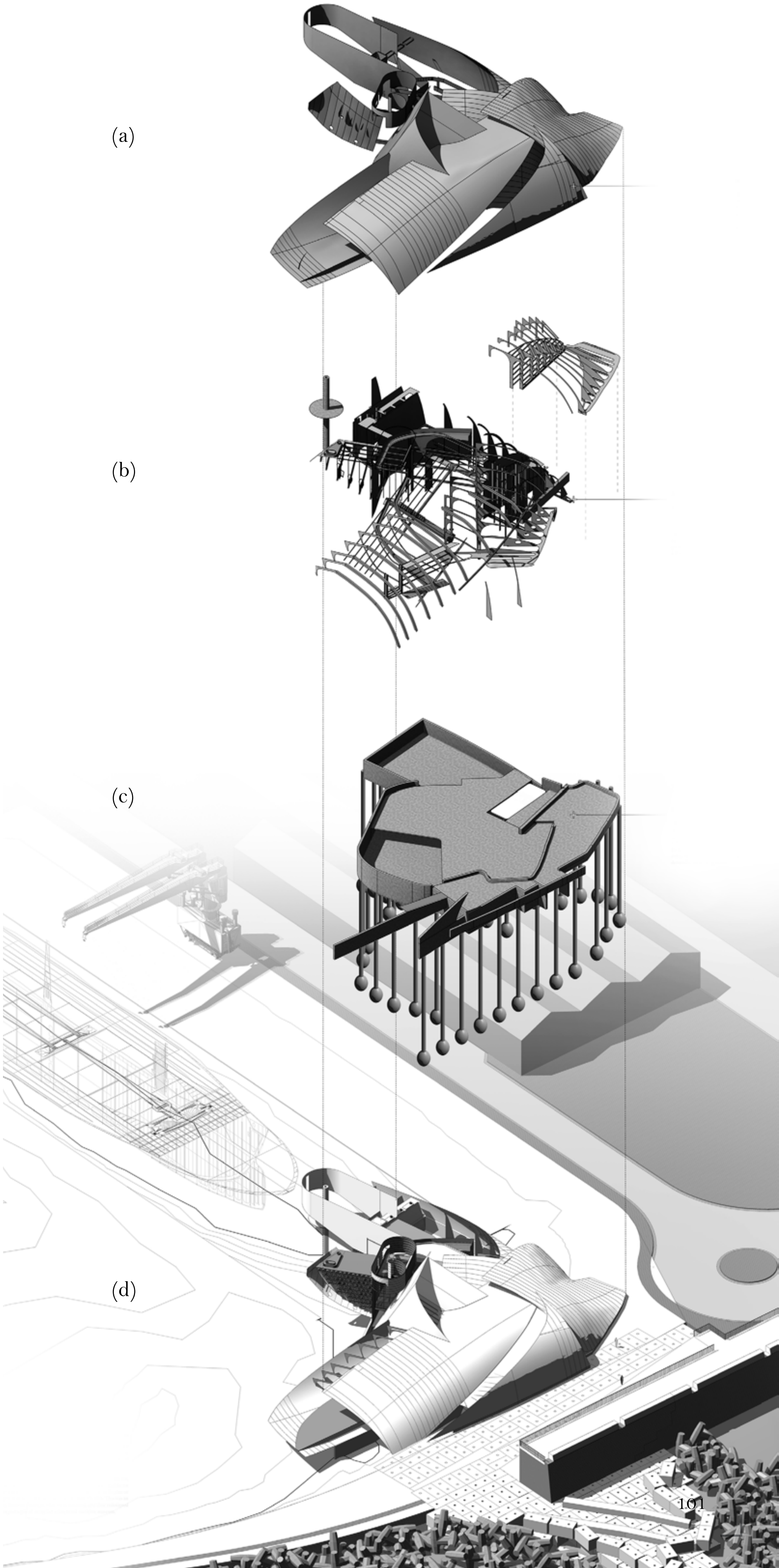
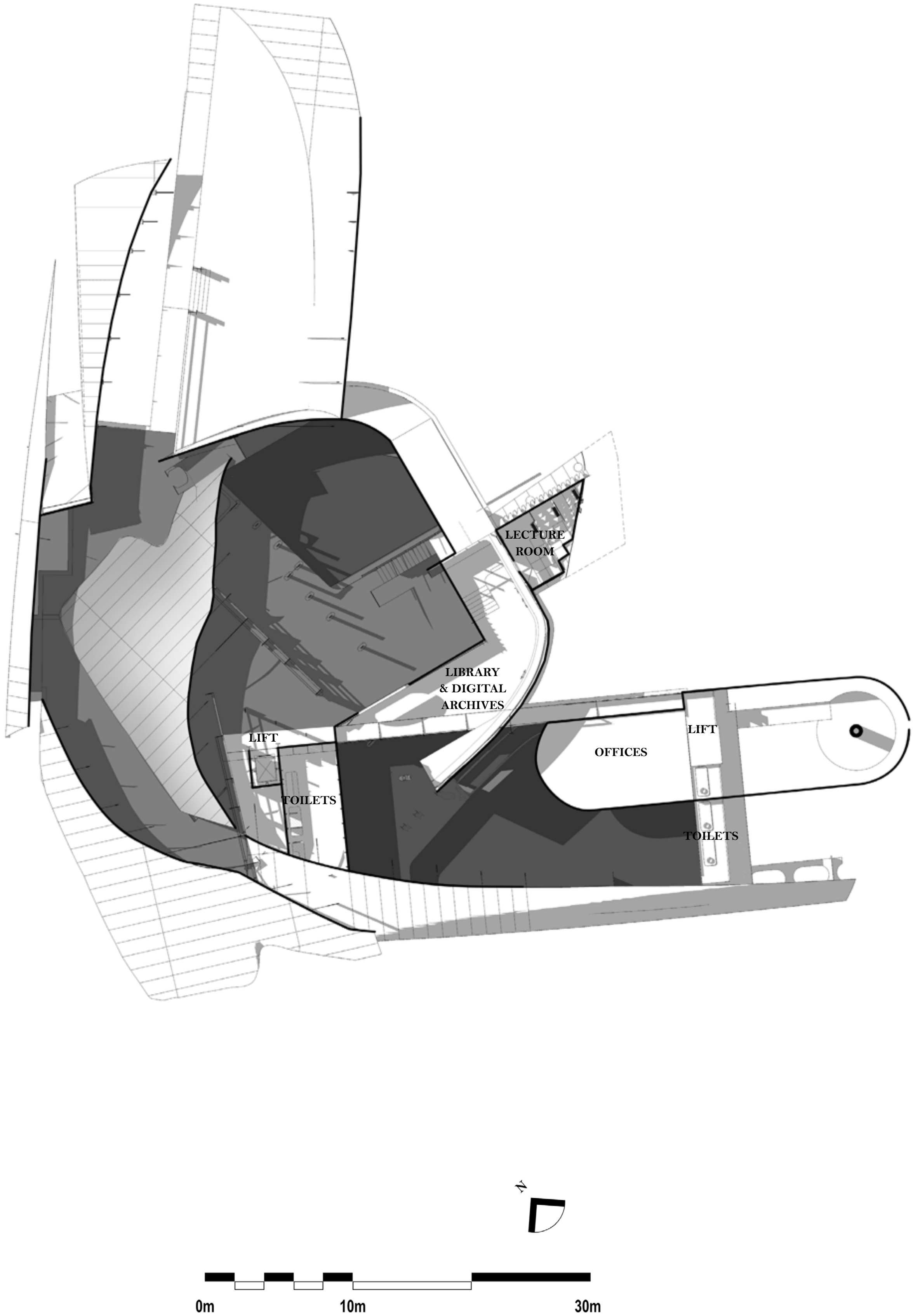




*Fig. 110. Ground Floor Plan*

*Fig. 111. First Floor Plan*



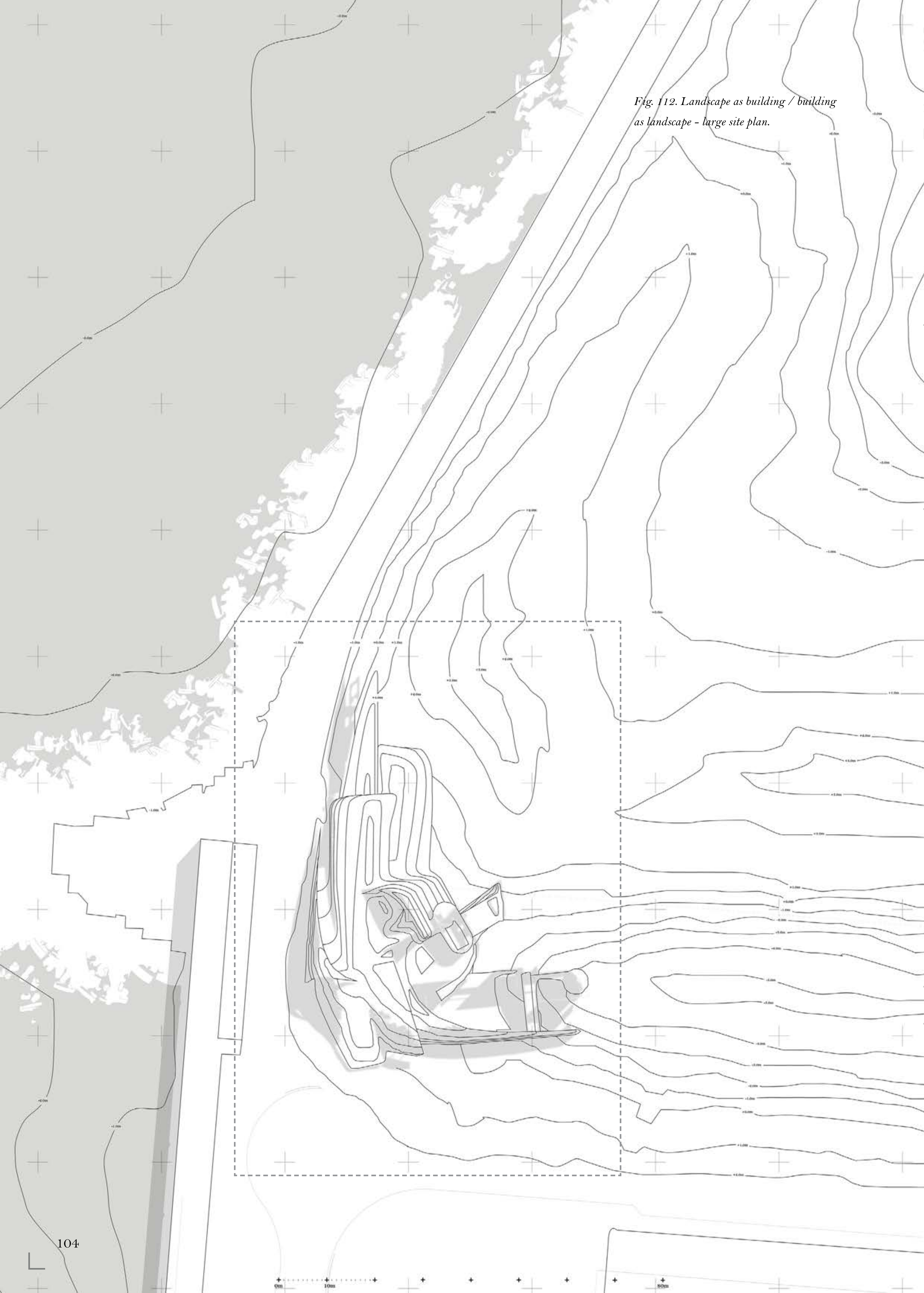


*Fig. 112. Landscape as building / building as landscape - large site plan.*

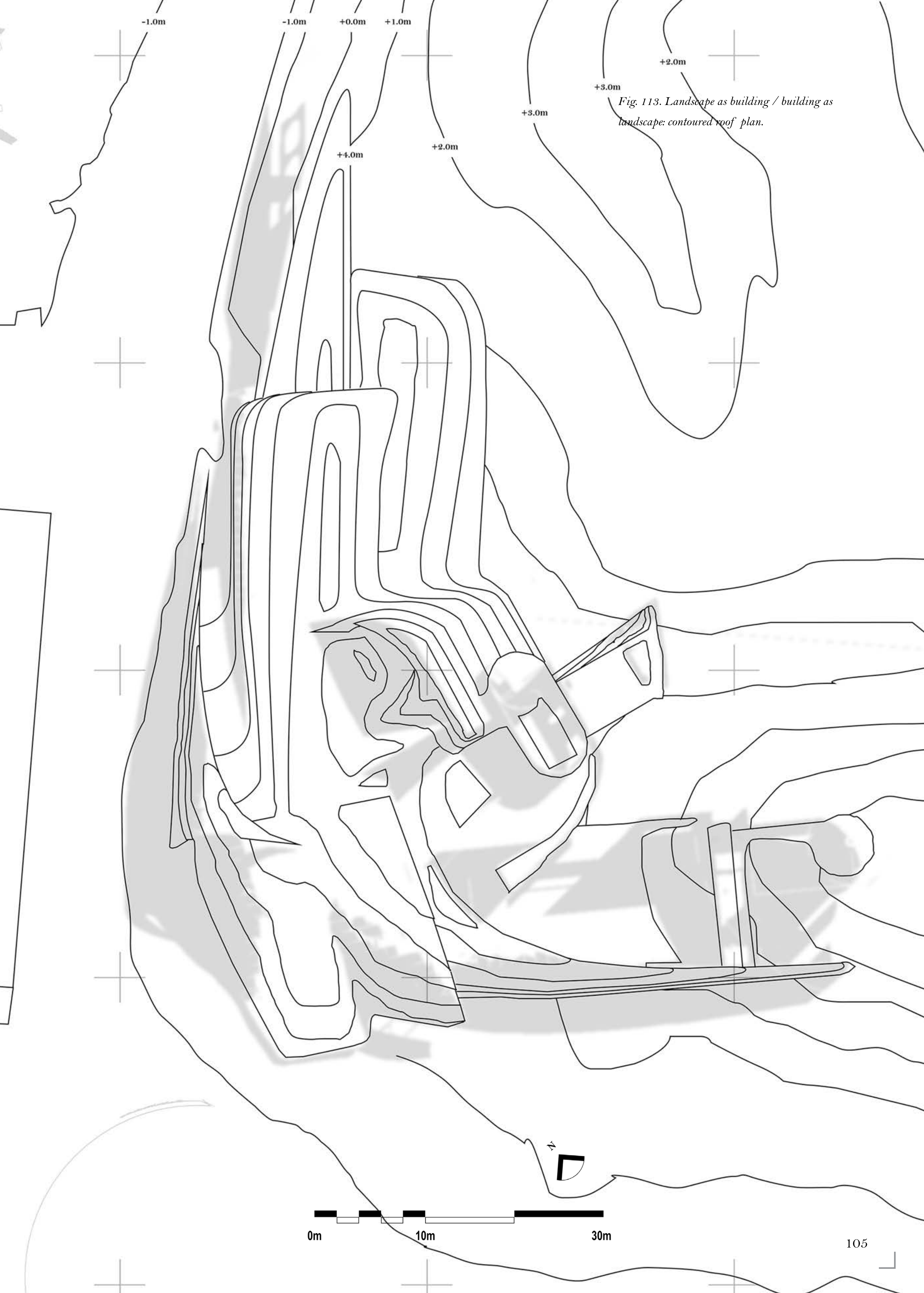



*Fig. 113. Landscape as building / building as landscape: contoured roof plan.*

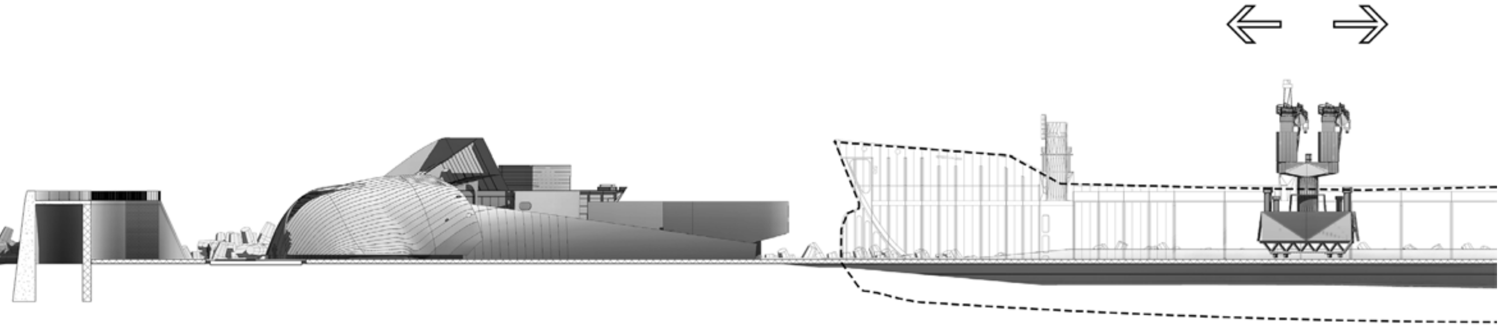


*Fig. 114. South elevation*

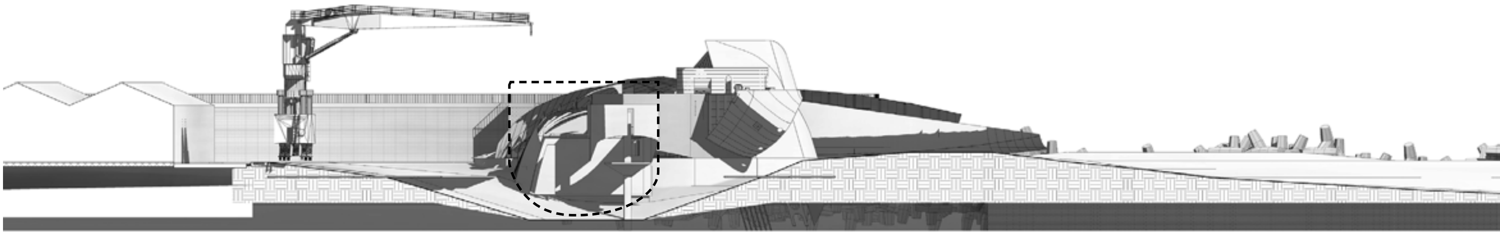


*Fig. 115. East elevation*

*Fig. 116. West elevation*

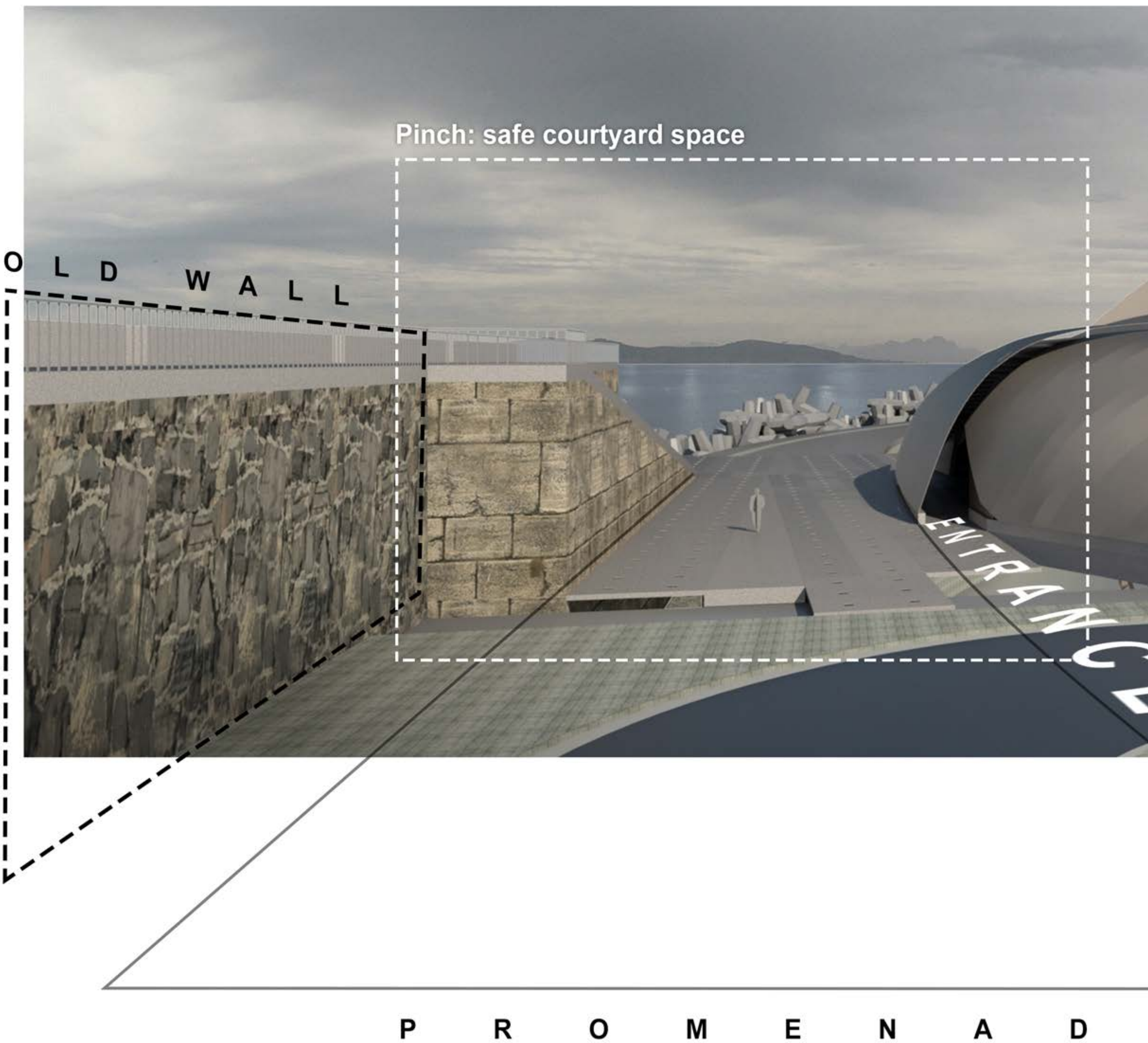

Pinch: safe courtyard space
OLD WALL
ENTRANC
PROMENAD

*Fig. 117. view approaching the museum from E-Pier Road.*

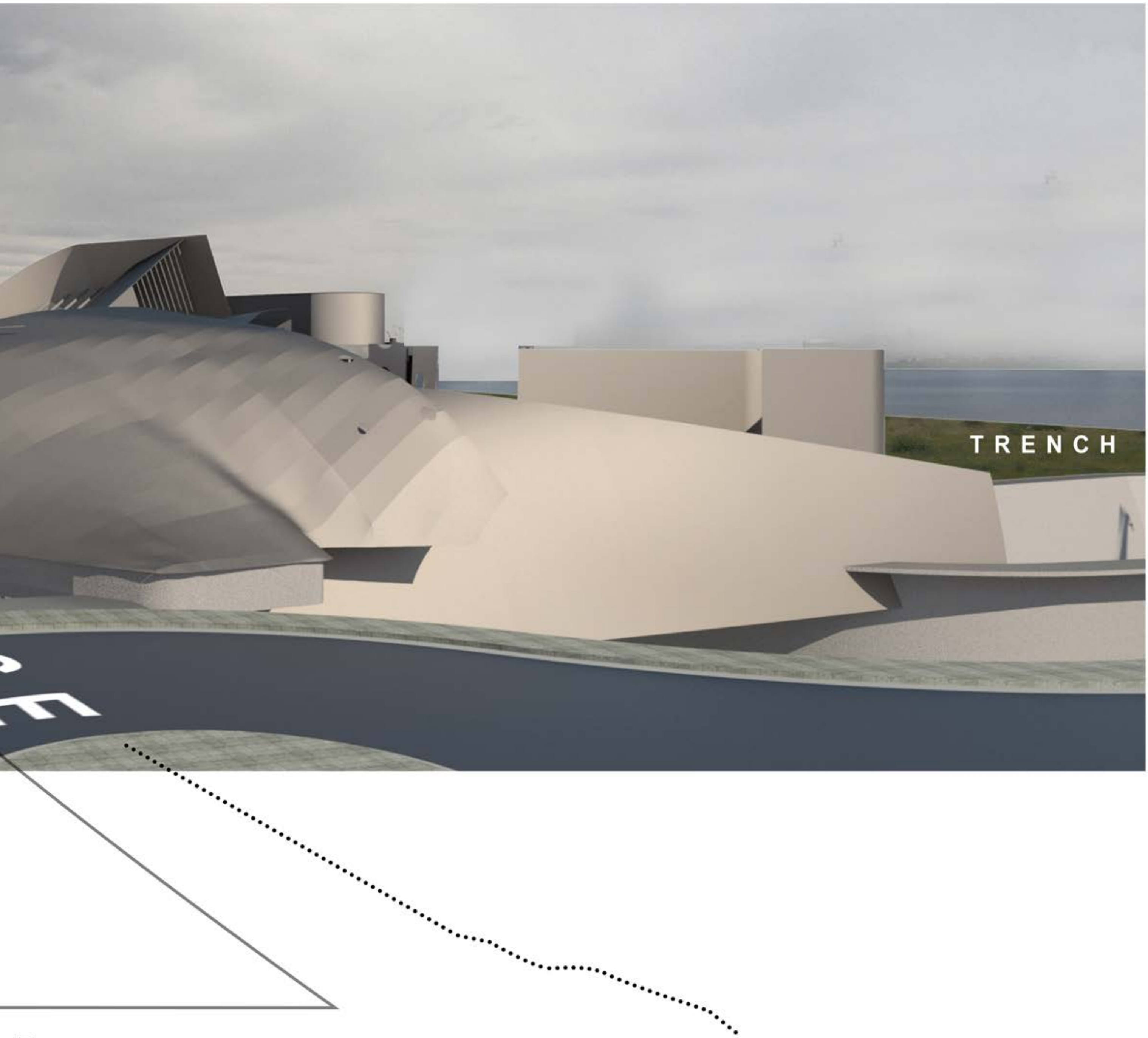


Fig. 118. (right) Render looking up towards the library. The museum's concrete base and surfaces dissolve into the landscape.

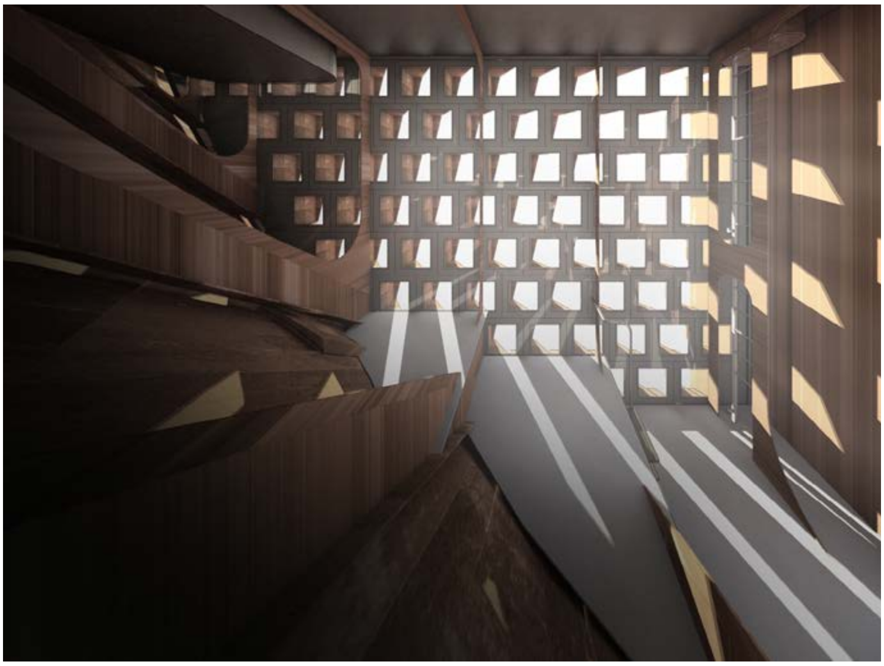


*Fig. 119. Early interior render showing the morning light in the reading room next to the library.*

*Fig. 120. Render of one of the large skylights above the gallery spaces. The light plays off the curved surfaces on its way into the triple volume space*

*Fig. 121. Interior Study 01.*

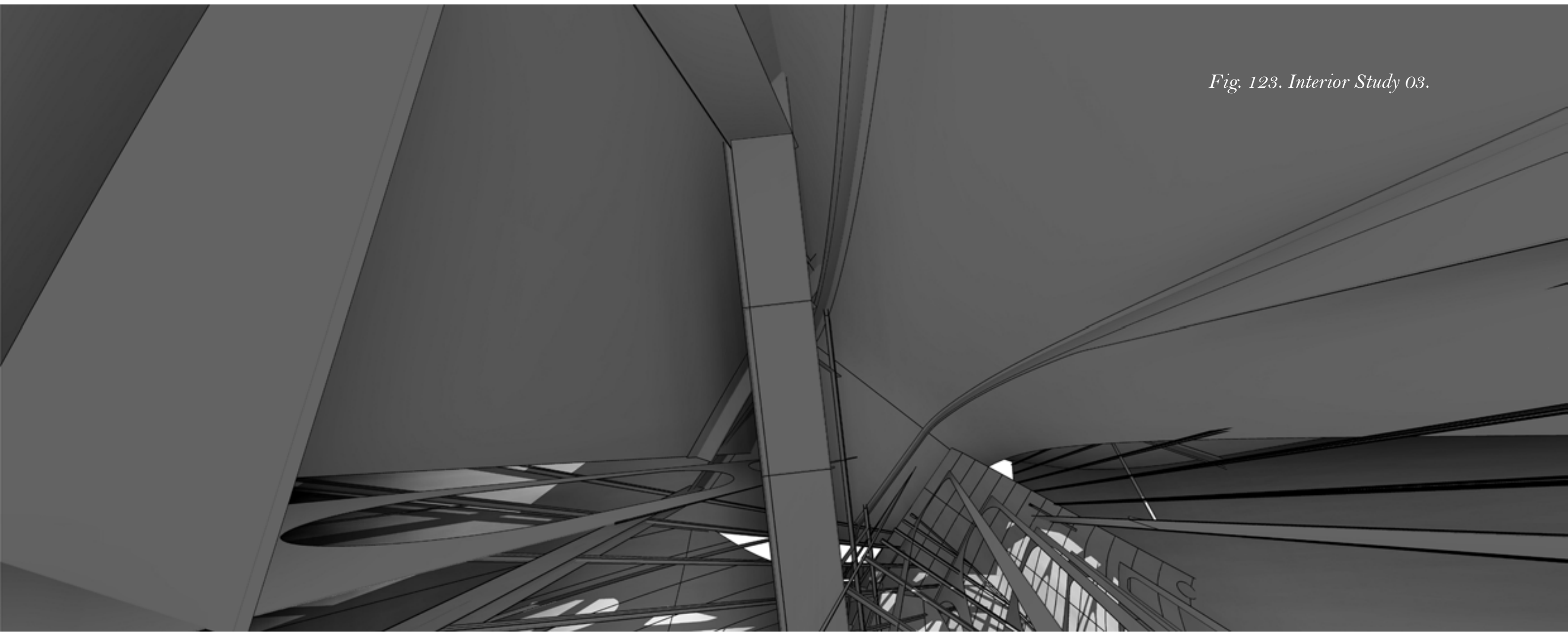


*Fig. 123. Interior Study 03.*

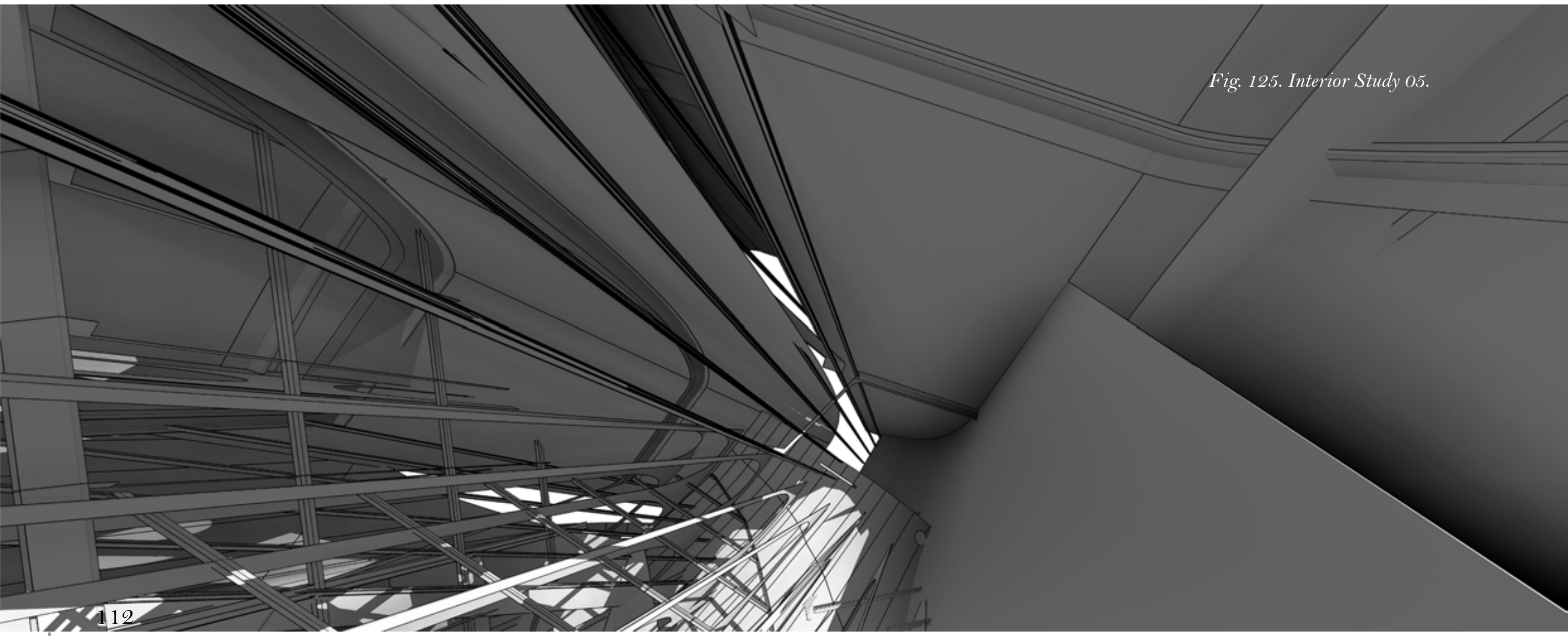


*Fig. 125. Interior Study 05.*

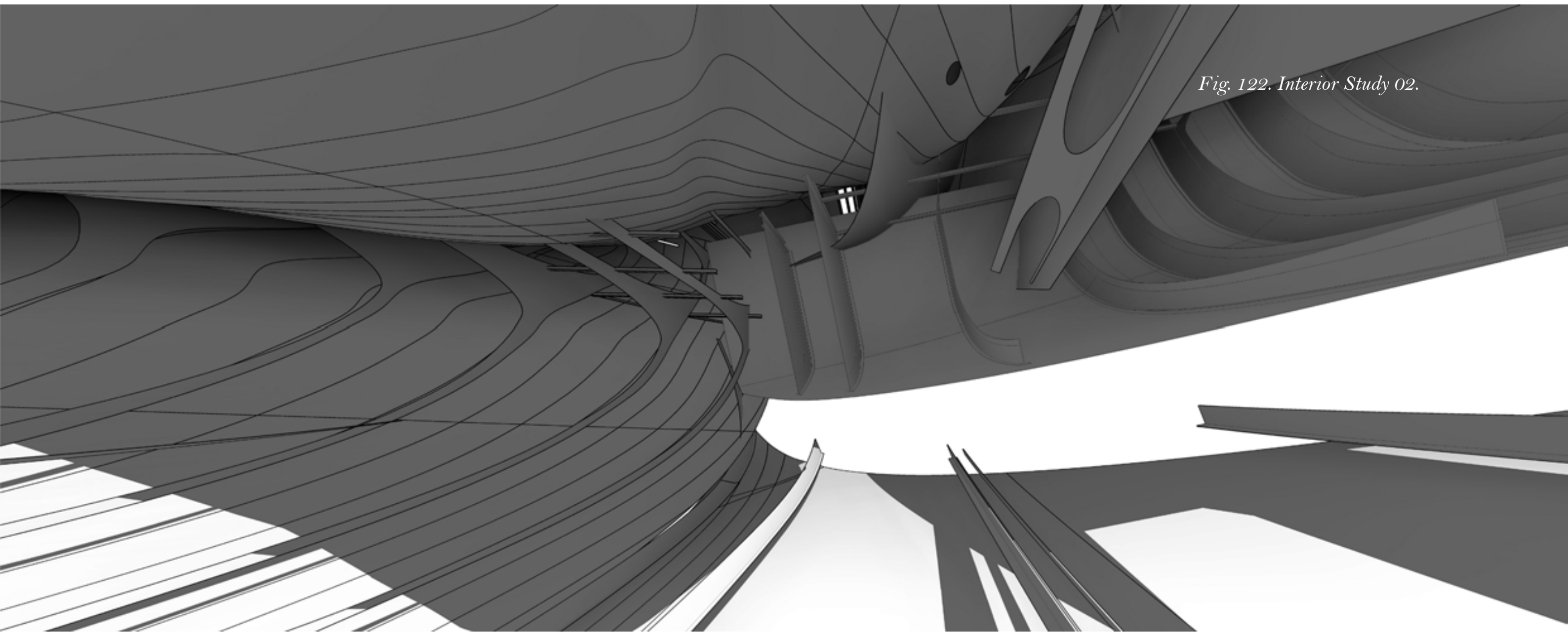


Fig. 122. Interior Study 02.

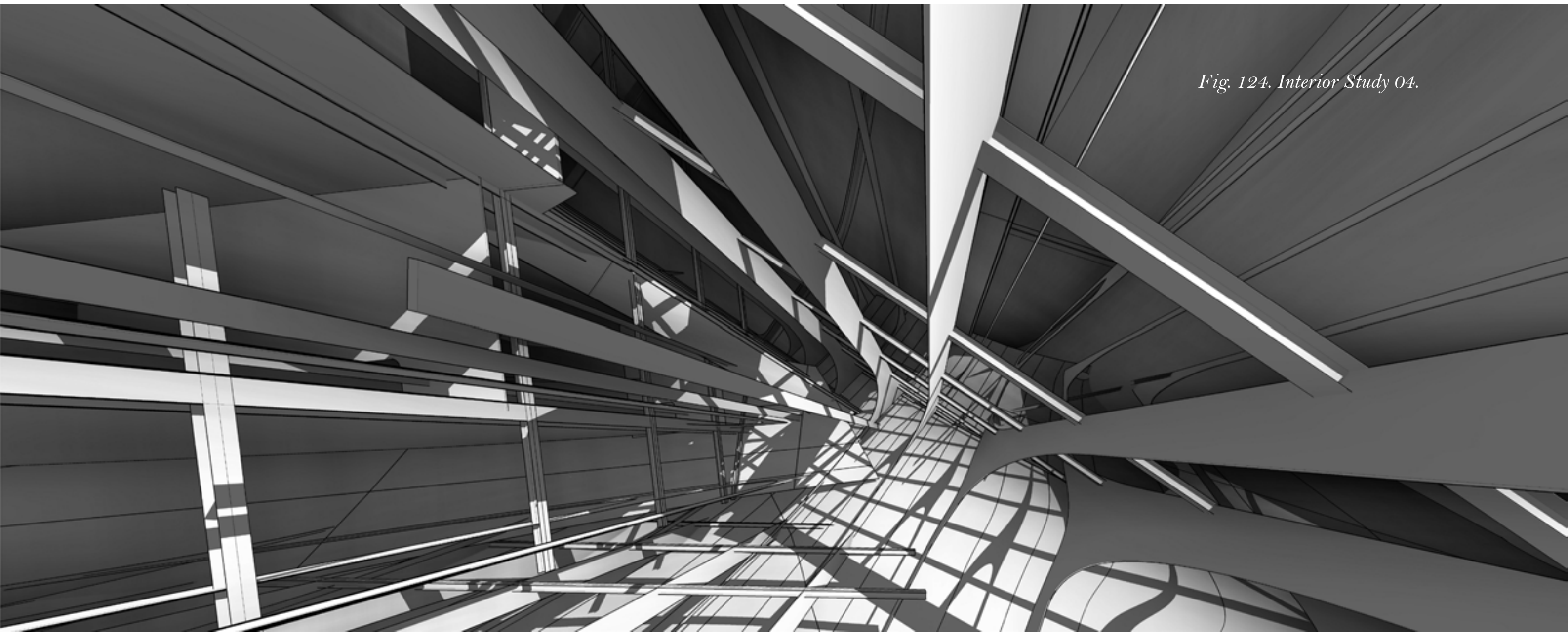


Fig. 124. Interior Study 04.

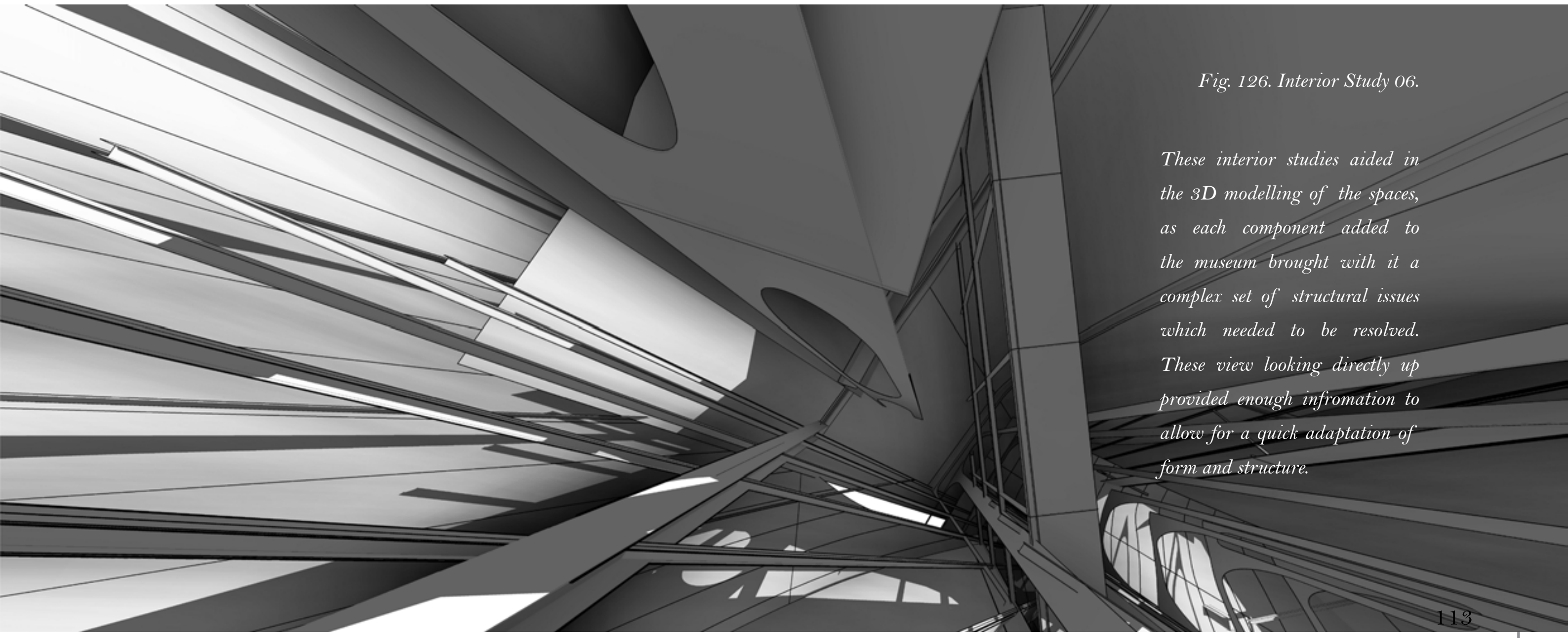


Fig. 126. Interior Study 06.

*These interior studies aided in the 3D modelling of the spaces, as each component added to the museum brought with it a complex set of structural issues which needed to be resolved. These view looking directly up provided enough infromation to allow for a quick adaptation of form and structure.*

*Fig. 127.*
*An artistic impression of the museum in the breakwater site after some time.*

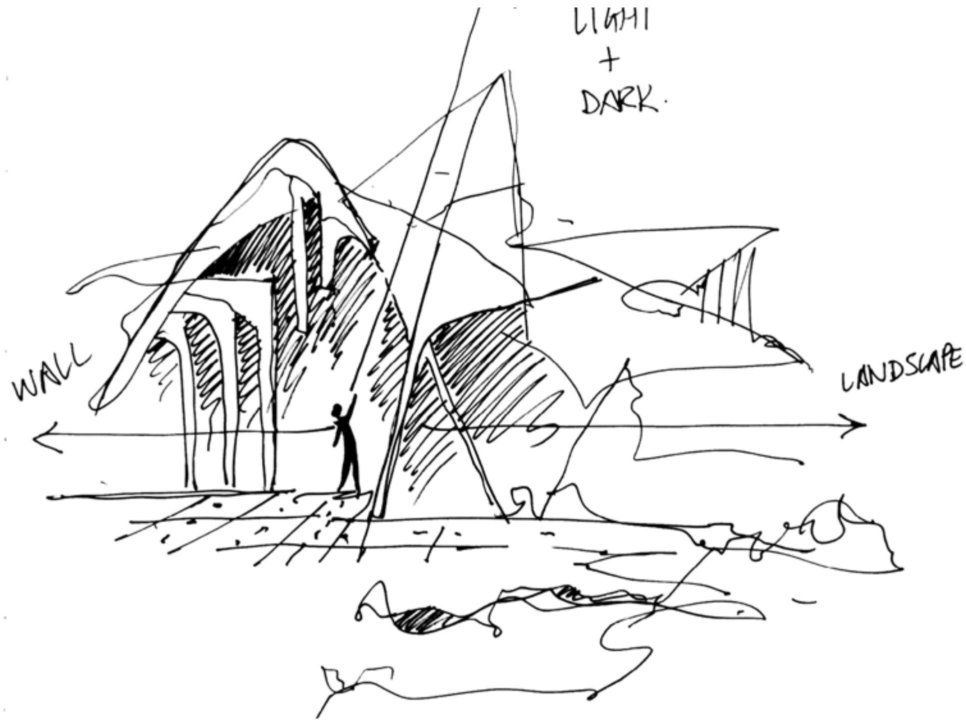



*Fig. 128. Early sketch exploring the sectional aspects of the gallery spaces.*

## REVELATION

This dissertation explored two key ideas towards architecture which were derived from Patrick Geddes' theory of the valley section in *The Valley Plan of Civilization* (1925).

The first idea was that of nature being the primary determinant of culture, whereby the inter-dependant relationship between man and nature is celebrated and used to generate a more sustainable culture. The proposed architectural outcome in the form of the new Iziko Maritime Museum was designed as an extrusion of the narratives which were uncovered at the breakwater site. The multiple layers of culture and history were researched across the Cape Town Harbour in order to establish a contextual foundation from which to begin the design, echoing the regionalist approach called for by Geddes and Norberg-Schulz.

The second idea which was drawn form the work of Geddes was conducted as an experiment to create architecture which was a sustainable expression of nature and, therefore, culture. This idea was based around using waste, defined by Mary Douglas as matter without place, to find value in both itself and its context. The ship breaking industry formed the spine of this idea as the container ship, named The Rose, was to be disassembled and then reconstructed in a new form as the Iziko Maritime Museum.

This process of using The Rose as a generator for architecture allowed for an interesting overlap of these two core ideas as both the breakwater site and The Rose were treated as a single landscape from which architecture was being extruded. The cross-section between theory and architectural resolution was explored and tested through many different methods which lead to the final outcome of the design of the museum.

This dissertation is an exploration of regionalism as the architectural development and outcome is the product of its context, that is, nature. Through this research, the idea that architecture is the mediator between man and nature is expressed in the form of a museum - a space to view historical artefacts where the space itself is also an artefact. The fundamental ideas are explored from their theoretical beginnings to their architectural resolution, the ideas carved out and sculpted, set aside and re-visited. Overall, imagination and playfulness was emphasized over regulation and practicality in the hopes of discovery.

*"Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution."*[1]

- Albert Einstein -

1 As quoted in "What Life Means to Einstein: An Interview by George Sylvester Viereck", in The Saturday Evening Post (1929).

## LIST OF FIGURES

**TABLES:**

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# APPLICATION FORM

**Please Note:**
Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data The objective of submitting this application *prior* to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook**(available from the UCT EBE, Research Ethics website) prior to completing this application form: http://www.ebe.uct.ac.za/usr/ebe/research/ethics.pdf

| APPLICANT'S DETAILS | | |
|---|---|---|
| Name of principal researcher, student or external applicant | | Michael Hobbs |
| Department | | Architecture, Planning & Geomatics |
| Preferred email address of applicant: | | Hobzy.mike@gmail.com |
| If a Student | Your Degree: e.g., MSc, PhD, etc., | MArch |
| | Name of Supervisor (if supervised): | Nic Coetzer |
| If this is a researchcontract, indicate the source of funding/sponsorship | | - |
| Project Title | | The Future of the Past |

**I hereby undertake to carry out my research in such a way that:**

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University,
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism

| SIGNED BY | Full name | Signature | Date |
|---|---|---|---|
| **Principal Researcher/ Student/External applicant** | Michael Hobbs | [signature] | 04 Apr 2017 |

| APPLICATION APPROVED BY | Full name | Signature | Date |
|---|---|---|---|
| **Supervisor** (where applicable) | Nic Coetzer | [signature] | 04 Apr 2017 |
| **HOD (or delegated nominee)** Final authority for all applicants who have answered NO to all questions in Section1; and for all Undergraduate research (Including Honours) | IAIN LOW | [signature] | 23/6/17 |
| **Chair : Faculty EIR Committee** For applicants other than undergraduate students who have answered YES to any of the above questions. | | | |

## ACKNOWLEDGEMENTS

Before beginning this dissertation, I would like to acknowledge those individuals who have been fundamental in this journey.

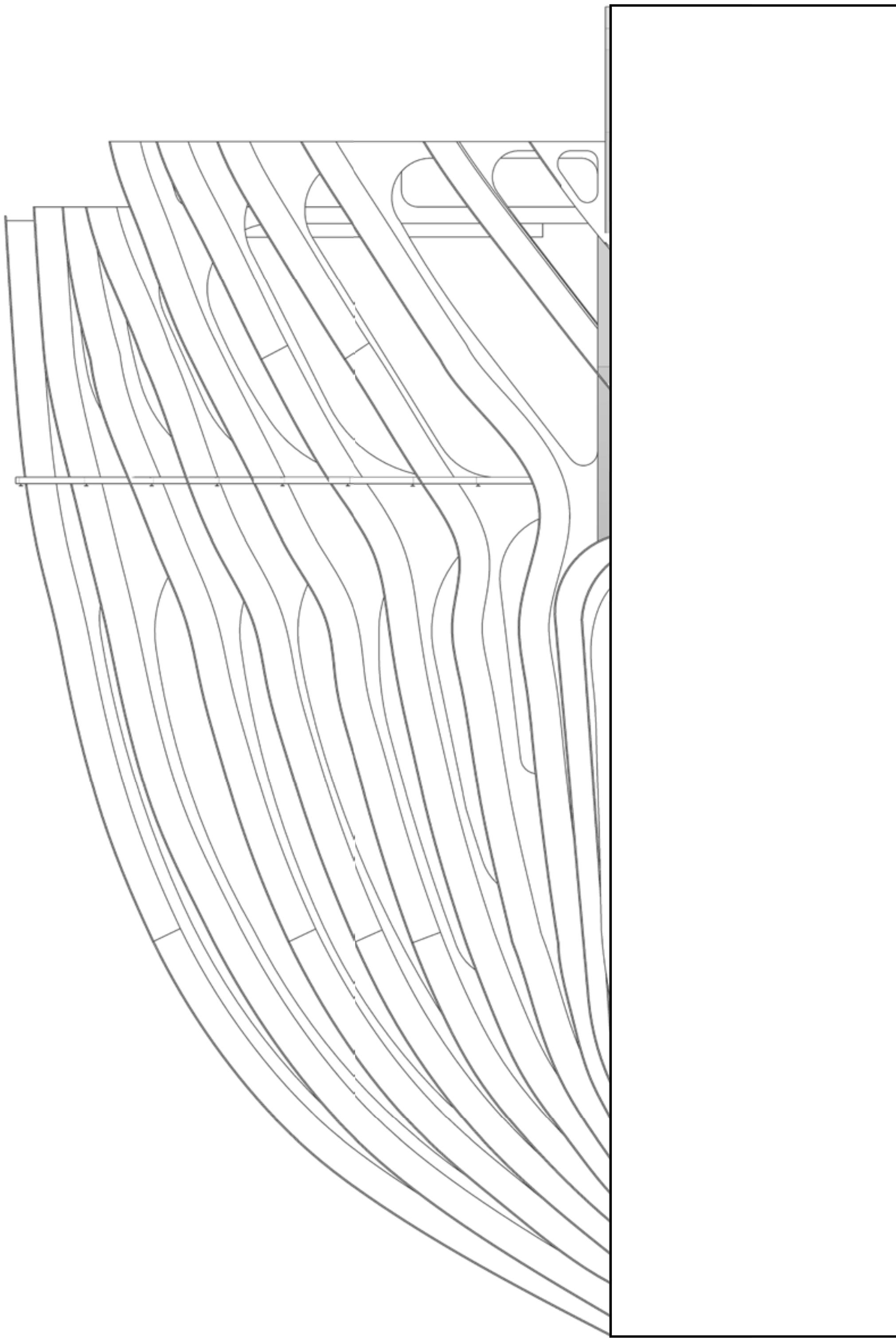
Firstly, all honour must be given to God, the Creator who has inspired my passions and guided my wandering heart. My words fall short of expressing my gratitude towards my parents, Leslie and Sheree Hobbs, who have sacrificed so much of themselves for our family and for me to have this opportunity. You are the reason I strive to be a better person, because your love and support knows no bounds. One day, I will build you a house with your own sewing room, mom.

To my siblings, Kylie, Aimée and Ben, thank you for your support and encouragement of my passion. I am grateful to the support and guidance of Professor Nic Coetzer and Kevin Fellingham. I apologize for my stubbornness, and I thank you for persevering.

I am grateful to Jo Noero and Evandro Schwalbach for having the patience and kindness to teach me more about the world of architecture. Thank you for taking the time to teach, it is truly humbling to be mentored by you. I thank all those friends and family who have journeyed with me on this endeavour.

I am because you are.

Ad dominum, imperium, in aeternum.



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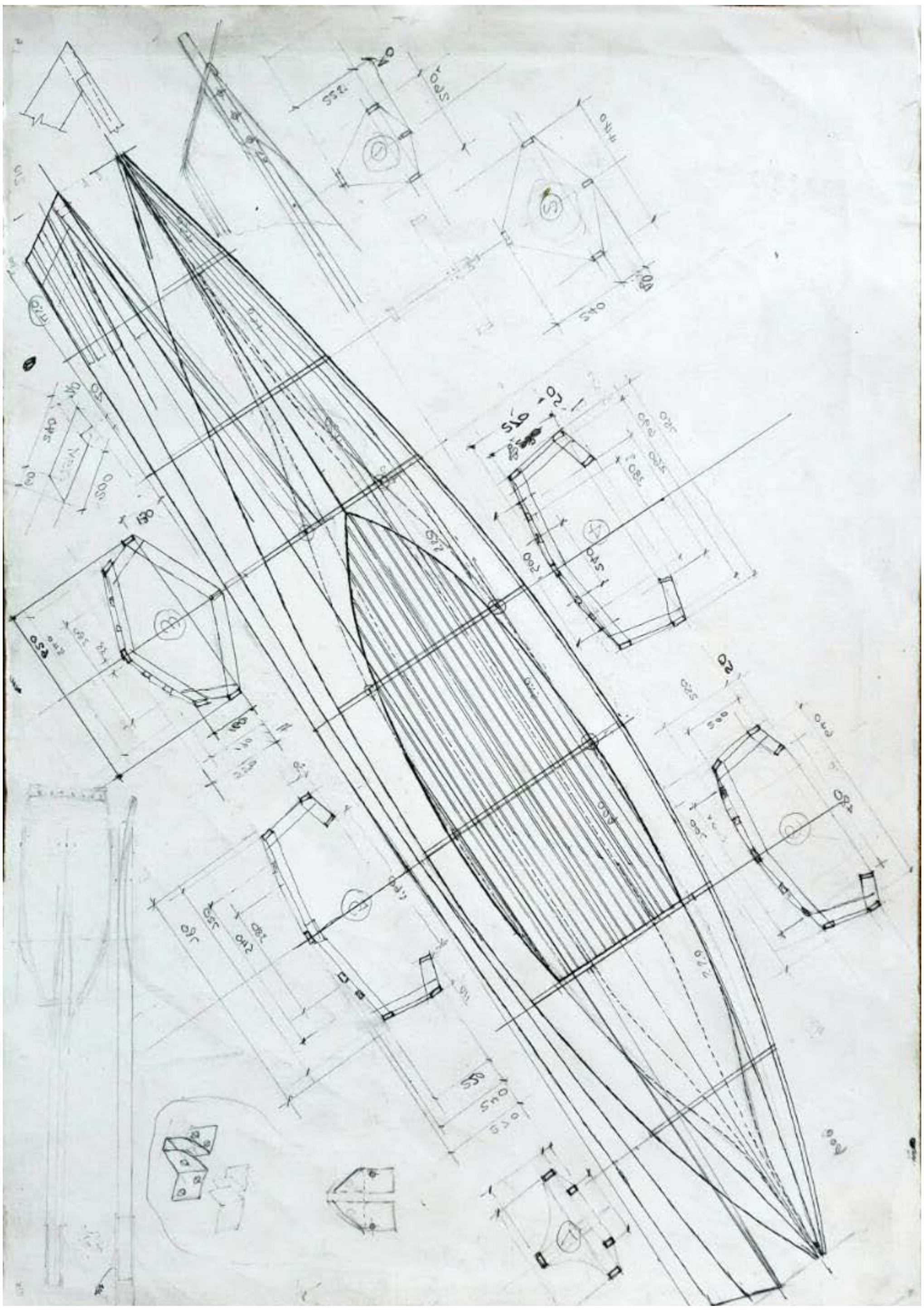


## GENESIS

I was blessed as a child to have spent many weekends with my grandfather, Rodney Middleton Winter, making jigsaw puzzles for Christmas presents and building model aircraft and battleships, some which we also designed ourselves. I watched him lovingly restore several salvaged vintage cars to their former glory. In some cases, he created entirely new hybrid cars from seemingly written-off vehicles which were often as good or better than the originals.

Some would argue that an Alpha Romeo-BMW-Toyota hybrid would be preposterous, but I watched him give these cars a new life, and he made them beautifully. My passion for design was birthed from these memories. It is his life which awoke my interest in architecture, and those early days spent watching and making have guided my thinking towards this dissertation.

*Fig. 01. The design of a small kayak by my grandfather, built as a gift for my mother when she was a child.*

*Fig. 02. The Atlas Slave, by Michelangelo (marble, height 277cm, circa 1530-34). This is one of many unfinished works of the master sculptor which I find as appealing as his completed works. There is a profound tension beyond the human form, as if it is the arrested physical expression of the sculptor's deeper understanding of his craft, suspended in its authentic, unfinished state.*

## PREAMBLE

This dissertation is an attempt to extract architecture from the site itself. Michelangelo, the Italian Renaissance painter, sculptor, architect, poet, and engineer, famously said,

> *Every block of stone has a statue inside it and it is the task of the sculptor to discover it.*

He clearly understood his role as the vessel by which an idea came to life in the physical world. In this light, the chosen site is treated much like a block of marble in the hands of a sculptor (the architect) and this dissertation is the documentation of the slow shaping, polishing, and final revealing of an idea.

The design is conducted within the speculative future of the Breakwater in Cape Town Harbour. Two main interests are outlined:

1. *Landscape:* a desire to better understand architecture as the mediator between man and nature, essentially, and to view landscape as architecture and architecture as landscape through the dissolution of convention and the celebration of the imagination. Architectural space is treated as an extension of the site.

2. *Rebirth:* waste, as a by-product of contemporary consumer culture, is defined as something which no longer has value, something which is superfluous.[1] The technological arm of this investigation is focused on the process of spatially re-imagining the breakwater site through the use de-constructed shipping vessels (machines which have become outdated and can no longer function in the post-industrial/information age).

The main focus on landscape and rebirth filters through into the design of the Iziko Cape Town Maritime Museum to accurately represent the project's development from its theoretical founding to its speculative architectural resolution.

Overall, this dissertation is focused on pushing the boundaries of spatial experience through the adaptation and re-imagining of a decommissioned ship. We know very well how to make good buildings which are comfortable and comply with council and environmental regulations. This endeavour is aimed at exploring new possibilities.

1 Oxford Dictionary, Oxford University Press, 2017.

# INHERENT ATMOSPHERES

## DISSERTATION REPORT

*Iziko Maritime Museum*

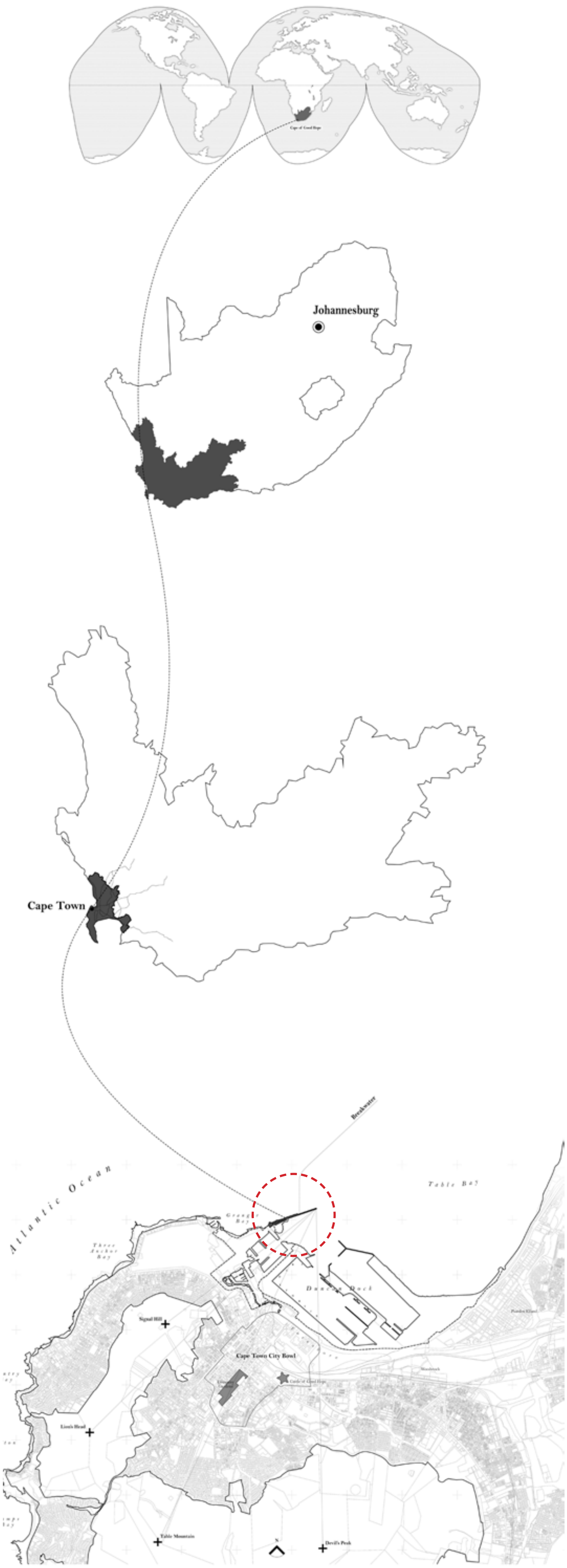



*Fig. 03. Locating the breakwater, Cape Town Harbour*

## INTRODUCTION

The foundations of this design report rest upon the study of the writings of Scottish geographer and biologist, Sir Patrick Geddes. In his theory of 'The Valley Section' he argues that nature is the fundamental determinant for society, hailing for a more regionalist approach to design and a sensitivity to place making. A second area of interest is that of rebirth, that is, the recycling of waste to create architectural space. These two interests intersect within a large site: the Cape Town Harbour, and they are further realized upon a smaller site: the Breakwater wall, at the end of E-Pier Road, in the V & A Waterfront and reimagined as a maritime museum made up through a ship-breaking process.

The historical narrative of the harbour reveals a rich reading of time and its presence across the vast landscape. The breakwater wall is the physical line dividing the tumultuous Atlantic Ocean and the man-made harbour. Research into the present-day shipping industry in the harbour lead to the process of ship breaking and recycling as a generator of architectural ideas.

Ship breaking, a process of material extraction and recycling, is a phenomenon of rapid modernization and is explored through an architectural lens. Anthropologist Mary Douglas refers to waste as *"matter out of place."*[1] An old ship which no longer serves a purpose is arguably matter with no functional value to society. This dissertation attempts to search for a value in such matter and redefine its value to society through architecture. It is this process of 'redefinition' which has driven the design process.

Through investigating the process of ship breaking, contemporary ideas towards waste and recycling are engaged with. This is by no means an argument for a building industry which is blindly based on waste, but it makes a critical statement towards the potential architectural opportunities offered within disruptive and evolving conditions such as rapid industrial transitions, as found in the shipping industry. This dissertation stands as the beginning of a conversation on how shipping vessels can be made in the future, with their afterlife in mind and not just their immediate functional shipping use.

1 Douglas, Mary. *Purity and Danger.* (London: Routledge & Kegan Paul Ltd, 1966).

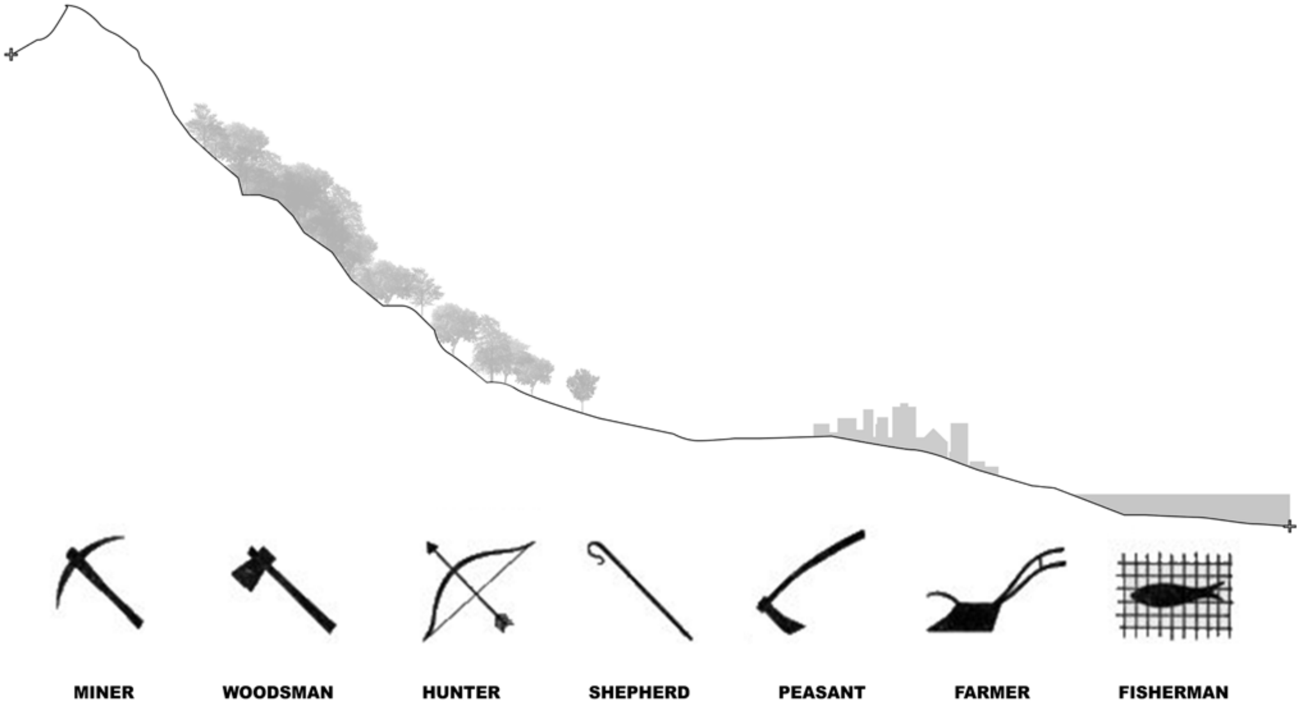



*Fig. 04. The Valley Section.*

## REGION

The work of Sir Patrick Geddes largely addresses the interdependancy between culture, economics and nature. He advocates for a integration of people and place, arguing that social and economic decline is inevitable without a respect and understanding of the natural environemnt in which we live.

This regionalist approach is expressed in his theory of 'The Valley Section' whereby, societal practice is viewed as a direct response to regional location. The elevation and nature of the section determine the occupations of his protagonists. For example, the woodsman is reveered as the "primal engineer" for the availibilty of timber nurtures his craft of making and building. Similarly, the shepherds dwell on the lower open lands which allow for the mass grazing of large heards.

The architectural ideas behind this theory are pertinent today, perhaps even more so than in the time of their conception. In Geddes book where this theory is explained, titled 'The Valley Plan of Civilization', he makes a case for his emphasis on the relationship between a place and society in saying,

> The kind of place, and the kind of work done in it, deeply determine the ways and institutions of history...[1]

The sensitivity to place has a direct impact on architects and designers as it architecture stands as a mediator between man and nature. The adaptation of the built environment then is not only architectural but must also, therefore, be a cultural, social and economical issue. This is seen in his comparison between a wheat-based individualistic society commonly found in Eurpean culture, and the rice-based cummunity which echoes the traditions of the Far East. A wheat farmer only needs help around harvest time, whereas the practice of farming rice must involve a whole village, the social nature of this process having a ripple effect on society.[2] In this way, cultures are defined by the region, and are seen as either a sustainable or unsustainable expression of nature.

Defining architecture as the "concretization of existential space"[3], Christiaan Norberg-Schulz, argues that existential space is the basic relationship between man and environment. He views architecture as the medium through which man locates and identifies himself in an environment, and finds being in space and time. Both Geddes and Norberg-Schulz argue for a more hightened sensitivty to place and culture, and their ideas are explored within this dissertation. The historical, economical, and cultural aspects of the chosen site are researched intently in order to extrude narratives which would serve is instigators in the design process.

1 Geddes, P. *1925*. p289.
2 Ibid.
3 Norberg-Schulz, 1980. p21.

## BOUNDARY AND BEGINNING

In spatializing his ideas of place, Martin Heidegger explores the idea of a 'boundary' as a means of defining a spatial experience. "A boundary is not that at which something stops but, as the Greeks recognized, the boundary is that, from which something begins its presencing."[1]

The breakwater site represents such a boundary. Essentially, it is the device from which the harbour begins its presencing. As mentioned in the introduction to the site, the breakwater is critical in maintaining the Cape Town harbour and has been for many years. It represents the beginning of the place, the gateway to the harbour. For those within the harbour, it is also the line representing the beginning of the untamed Atlantic Ocean.

Founded on this idea of place, the art of place-making then begins with a sensitivity of these components. Time and space, the natural and the man-made, all make up the characteristics of place. Traces of these components are found across the chosen breakwater site.

Although the Breakwater site can be seen from many prominent places in the city, its proximity to the dangerous waves of the Atlantic and exposure to the elements make it inaccessible to the general public. It takes on a binary identity by which it is both a prominent component in the harbour's identity but is rendered dangerous and relatively barren. It is this conflict which first set the site apart from other options in the early moments of this dissertation, and it is this conflict which shall permeate into the final outcome.

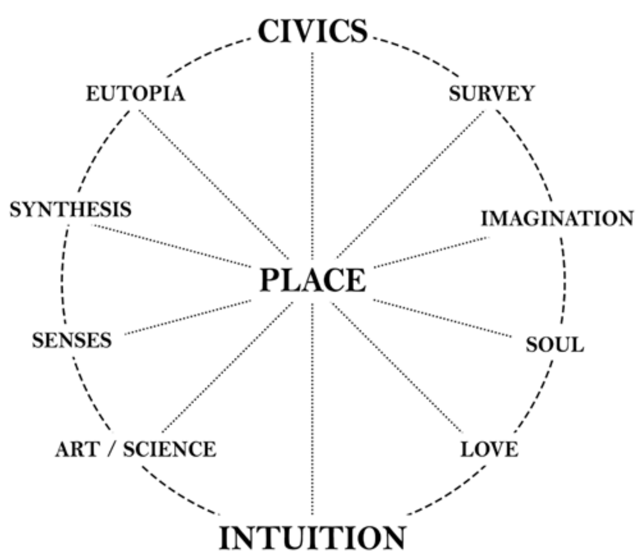



*Fig. 05 (a.) From 'Cities in Evolution' by Patrick Geddes.*

1 Heidegger, Building, Dwelling and Thinking.

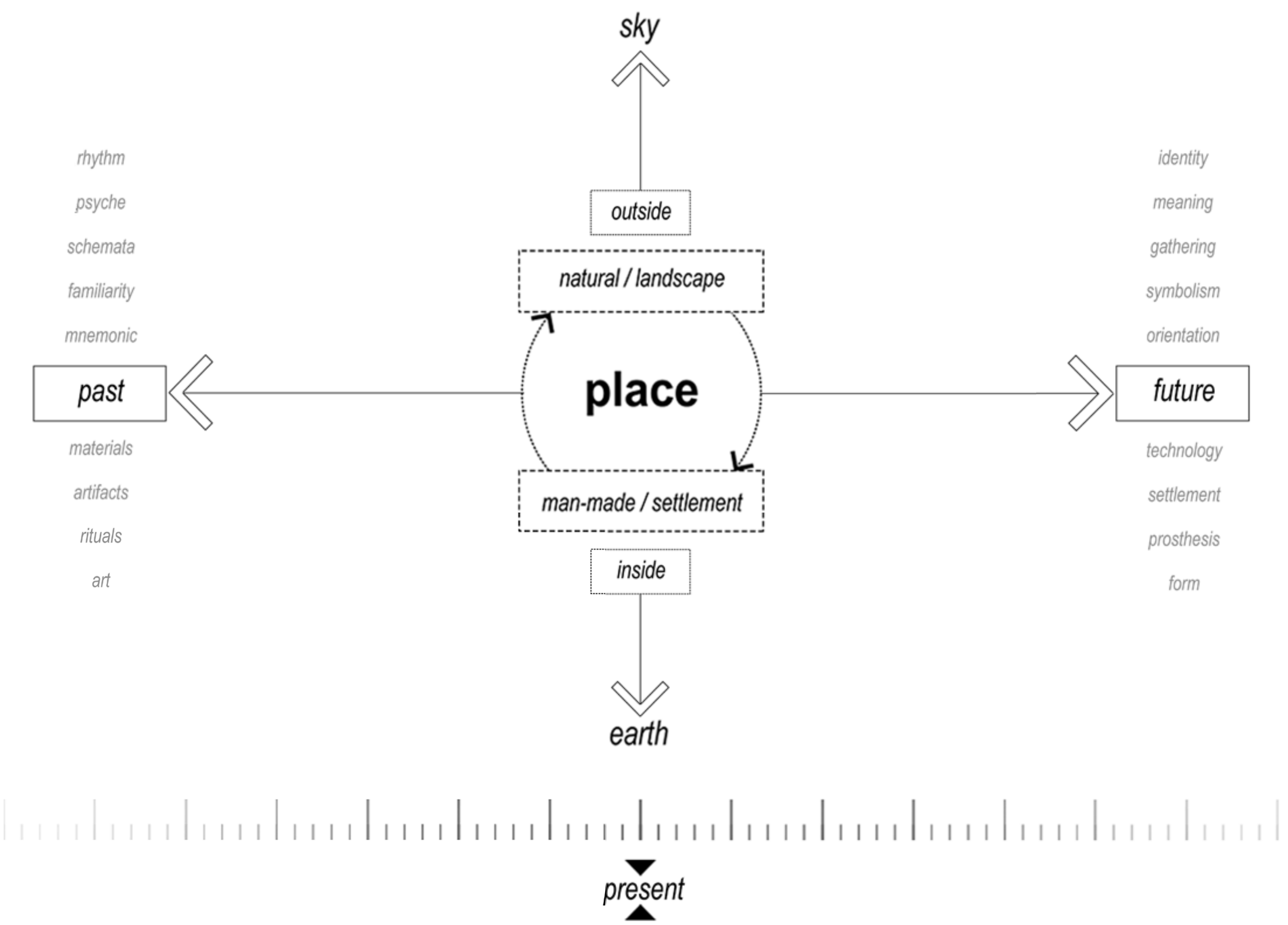



*Fig. 05 (b.) A diagrammatic summary of 'place' by the author, based on the theory of Norberg-Schulz.*


1660 - 1860
1860 - 1900
1900 - 1920
1920 - 1933
1933 - 1945
1945 - 1966
1985 - 2017
2030 - 2040

## THE BREAKWATER

Established as a port city, Cape Town's harbour in Table Bay has provided relative shelter from the harsh weather conditions surrounding the Cape of Storms. In the 1940s, the construction of the Foreshore in Table Bay served to provide around 194 hectares of land designated for the new rail system and Duncan Dock. At the time, it was considered to be the most ambitious land reclamation project attempted in the world. The scale of this undertaking serves as evidence of the global importance of the Cape shipping route at the rounding of the African continent.

Table Bay experienced its 'golden age' for some time before the construction of the Suez (1869) and Panama (1914) canals reshaped the global shipping routes. The harbour is well protected by the 1.4km long Breakwater wall, arguably one of the most important structures in Cape Town.

My interest in this site stems from several key aspects. It is one of the very few sites around the Cape Town Harbour area which remains undeveloped, largely due to its exposure to the harsh weather conditions on the rather exposed site. The broader site is made up of the super-structure of the Breakwater wall and reclaimed earth which was deposited there in the late 1980s. Much like the extensions of Manhattan Island, the majority of Duncan Dock and the V & A Waterfront is constructed upon reclaimed land consisting of construction rubble and quarried stone (see fig. 07 and 08 overleaf).

Currently, the Breakwater wall is in a state of disrepair, and the land beside the wall remains raw, and untouched. The northern edges of the wall are protected by concrete Dolos which are designed to absorb the majority of the impact of the waves. These structures are both beautiful and haunting as their weathered and broken state stand as testament to the forces of nature acting upon them.

Behind the Dolos wall rests a peculiar landscape constructed from 80 tonne concrete blocks which are laid around the termination of the old wall in a kind of 'larger-than-life' paving pattern. The scale of these massive components was taken into consideration in the design process as their immovable presence, so as to say, was tangible. The existing coastal armour and earth works formed this fascinating terrain of concrete, rusted steel and reclaimed rubble, weathered and entangled in the tough cape shrubs. The reclaimed earth is pushed up against the south face of the wall forming a mound to further bolster the defences. During spring, the bright colourful flowers soften the landscape to make it seem almost safe.

*Fig. 06. (right) Mapping the growth of the Cape Town Harbour (1652 - 2040)*

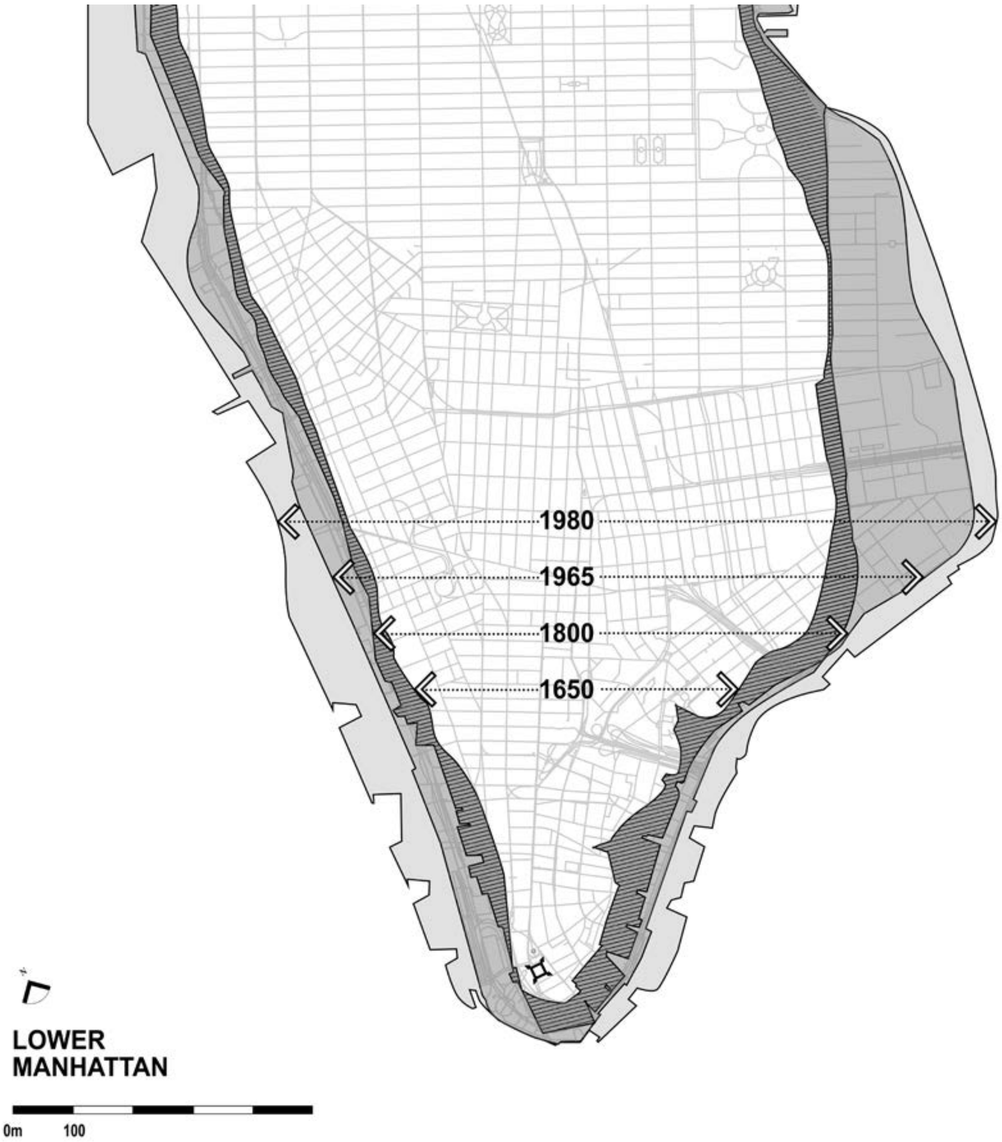



*Fig. 07. Land Reclamation over the years, Lower Manhattan Island, New York (by author).*

*Fig. 08. Park Street in Bristol, UK, after WWII.*

*New Yorkers were encouraged to use as much of their left over waste from construction projects as landfill along the Manhattan coastline. Rubble, rock and dirt from subways and foundations dig sites were systematically dumped to make room for more development. A lot of the rubble came from the bombed cities in Europe post WWII.*

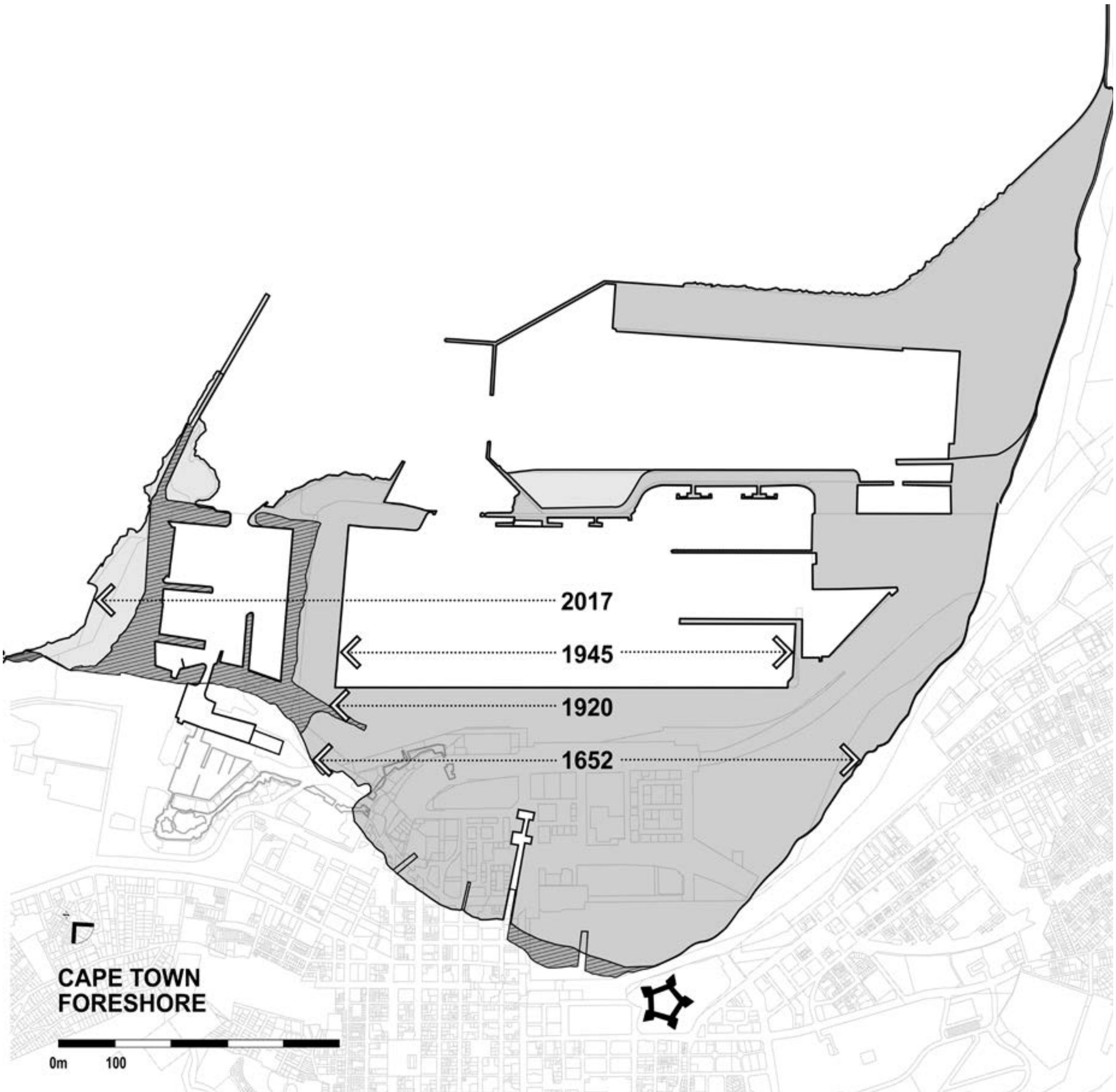



*Fig. 09. Land Reclamation over the years, Foreshore, Cape Town (by author).*

*In order to complete one of the largest land reclamations of the time, tonnes of lands had to be dredged up by large dredging vessels from Holland, and dumped into the area which is now known as the Foreshore. Over 194 hectares of land was reclaimed using the dredged up materials, as well as the rock removed from the construction of the V&A Waterfront and breakwater wall.*

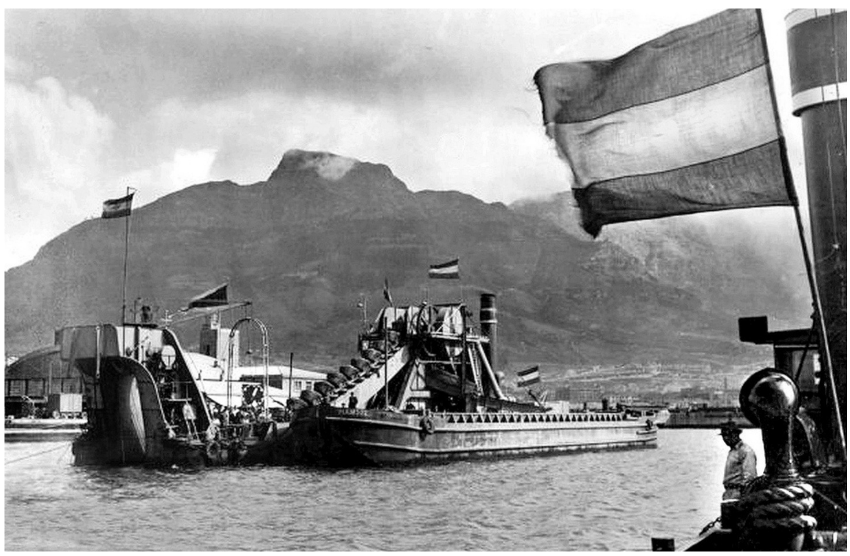


*Fig. 10. Dredging vessels constructing the Duncan Docks in Cape Town, 1939.*

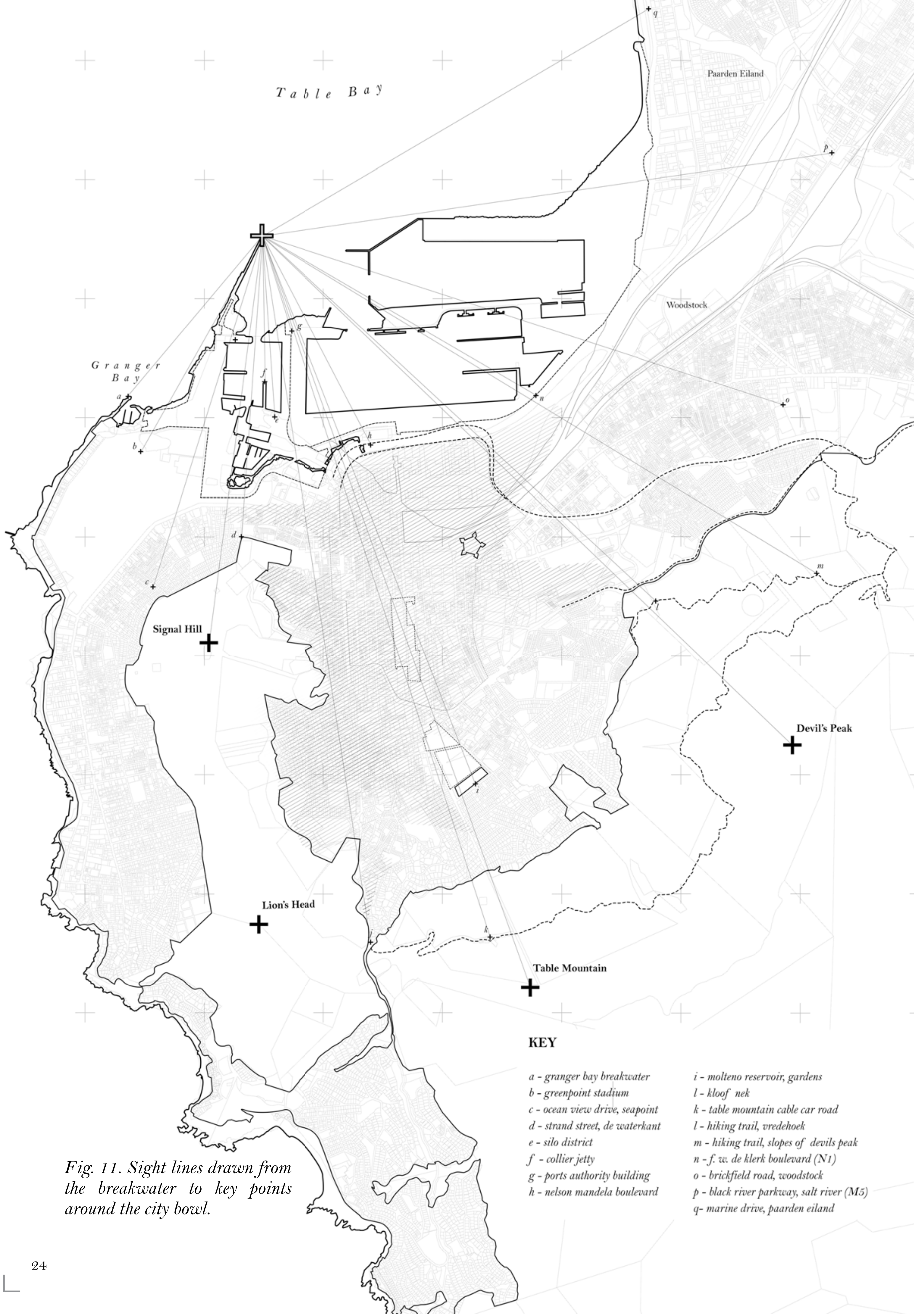



*Fig. 11. Sight lines drawn from the breakwater to key points around the city bowl.*

This site has a visual link to the harbour and key landmarks around the City Bowl area. There is a profound quality in the omnipresence of the Breakwater wall as its presence far exceeds the boundaries of site. This quality began to define the kind of building which could potentially be built here, more accurately, it began to clarify what *not* to design.


*Fig. 12. View of site from Table Mountain.*

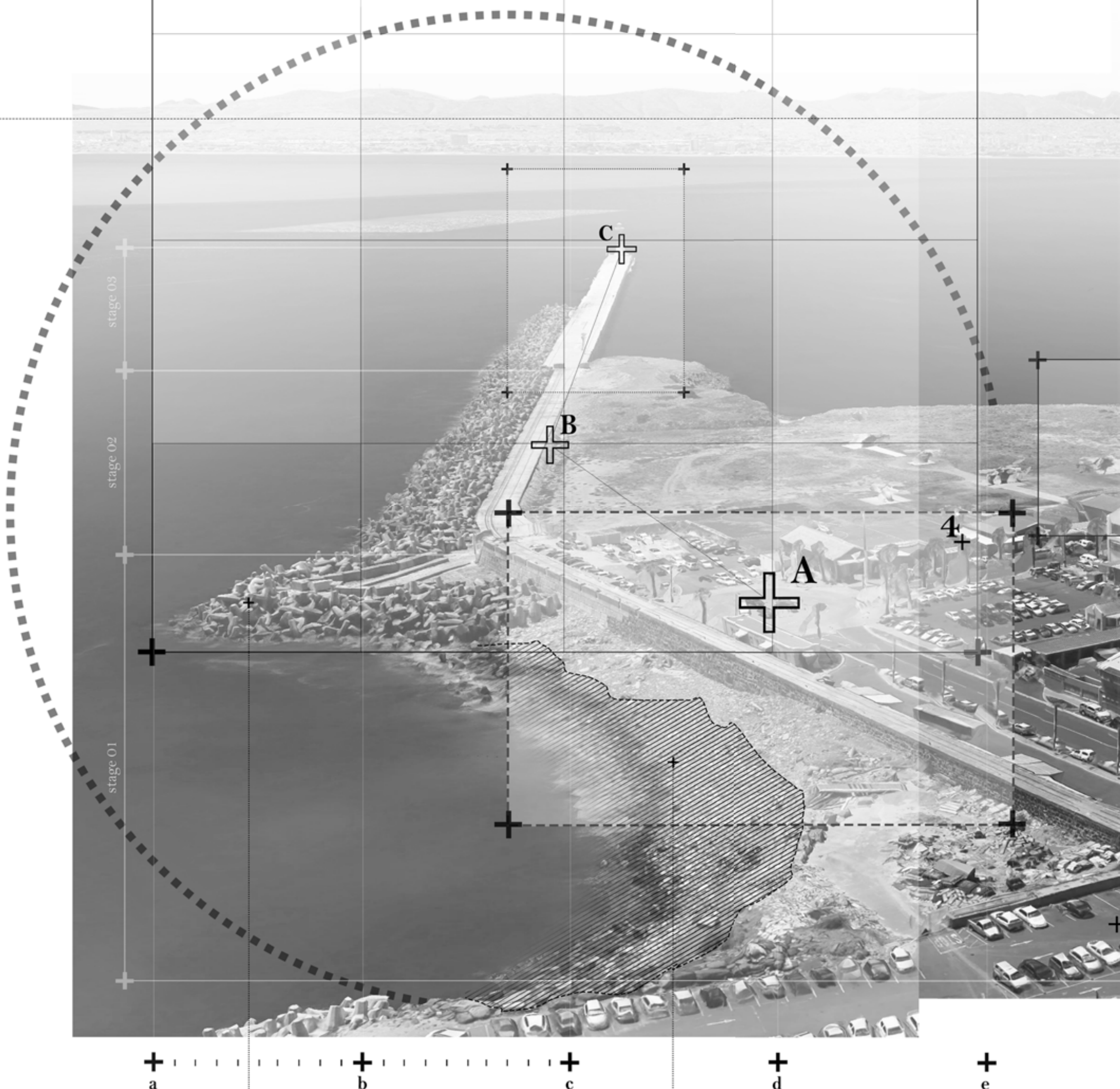

*Fig. 13. View of site from Lion's Head.*


*Fig. 14. View of site from slopes of Devil's Peak.*

## Cabo das Tormentas

Attracted by the riches to be found in Asia, Portuguese sailors rounded the Cape of Storms ('*Cabo das Tormentas*') in 1488, however, it was the Dutch East India Company who first settled in Table Bay in 1652. The settlement was originally intended to serve as merely a refreshment station for trading vessels on their way around Africa to India.

Table Bay offered very little shelter for the growing number of ships seeking to replenish their supplies, and each day spent in the harbour was a considerable risk. It was only in 1860 when Prince Alfred commissioned the construction of the breakwater, marking the beginning of the attempt to tame the tumultuous environment and secure Cape Town as a more permanent settlement.

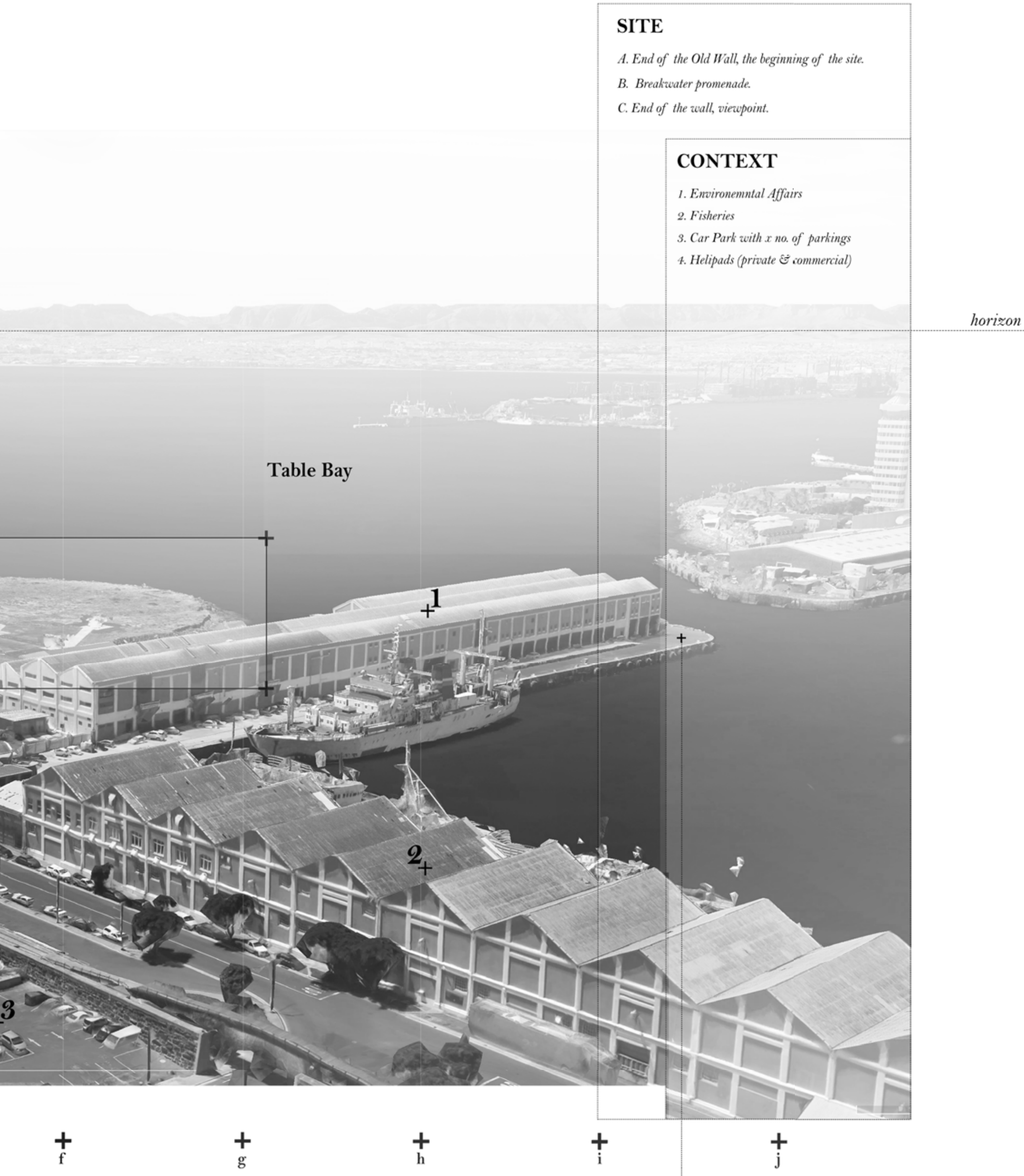



### Dolosse

Concrete wave breakers which can weigh up to 30 tonnes. Invented by engineer Eric Merrifield after a storm ripped into the Eastern Cape coast of South Africa in 1963 and tore off 60% of East London harbour's armour.

### Exposed Beach

Portion of the breakwater system which has been largely exposed to tidal damage due to a lack of dolosse or wave motion distrupters.




**E-Pier**

Constructed as part of the Victoria Basin in 1895 after the lengthening of the breakwater wall in 1890

*Fig. 15. An introduction to the breakwater site*

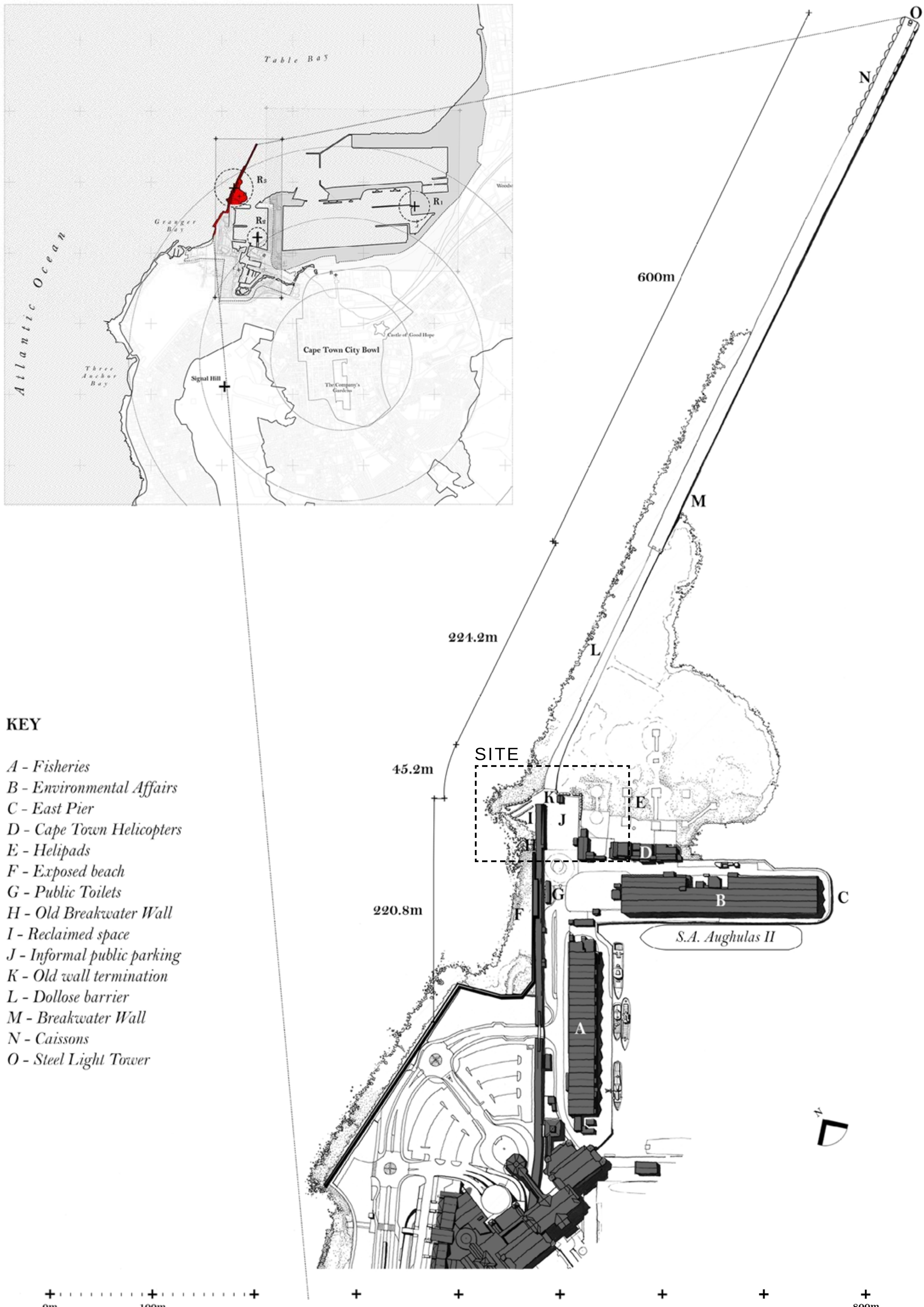



*Fig. 16. Contextual site plan.*

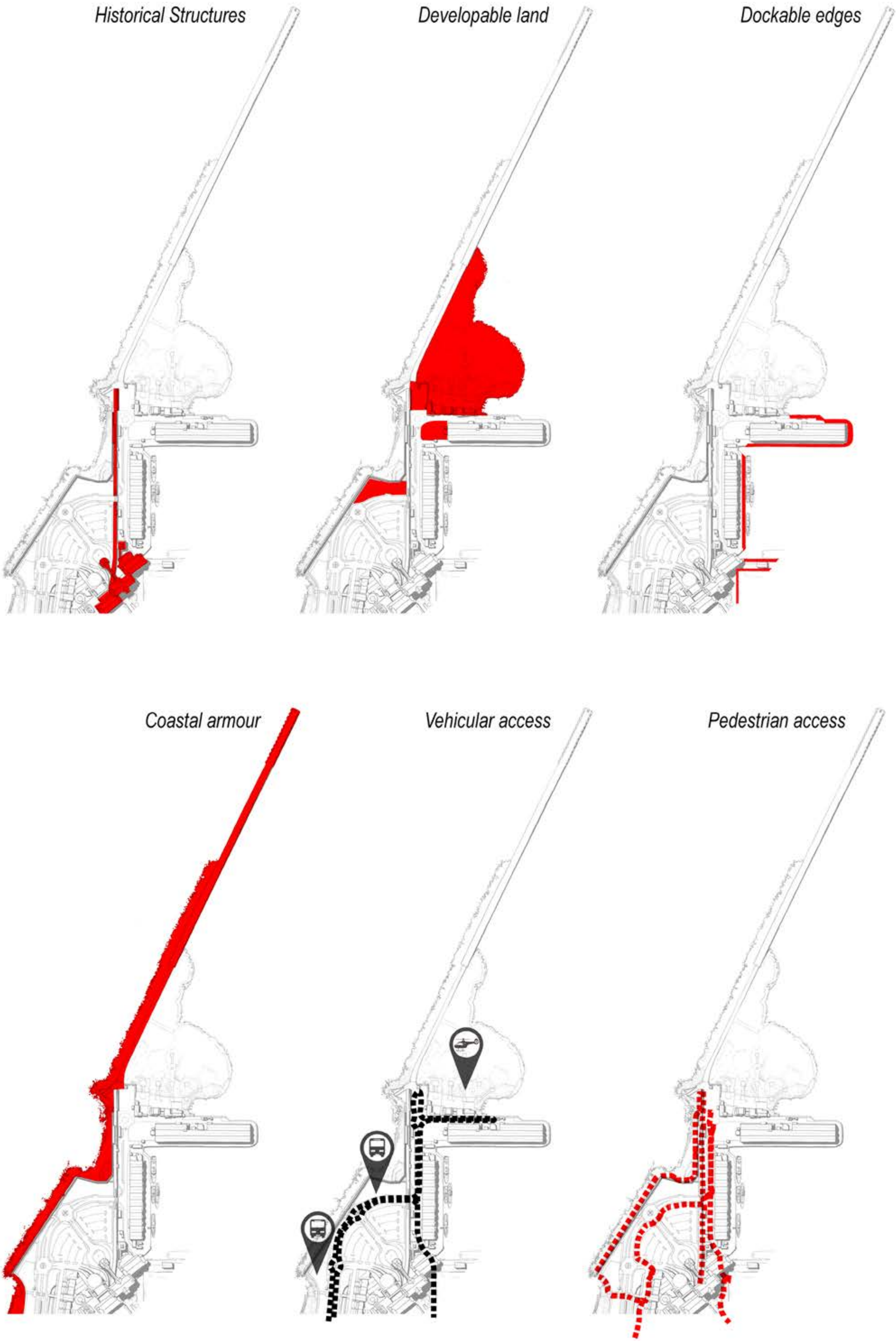



*Fig. 17. Drawings showing the basic readings of site.*

*Fig. 18. View from the site towards the light tower at the end of  the wall.*

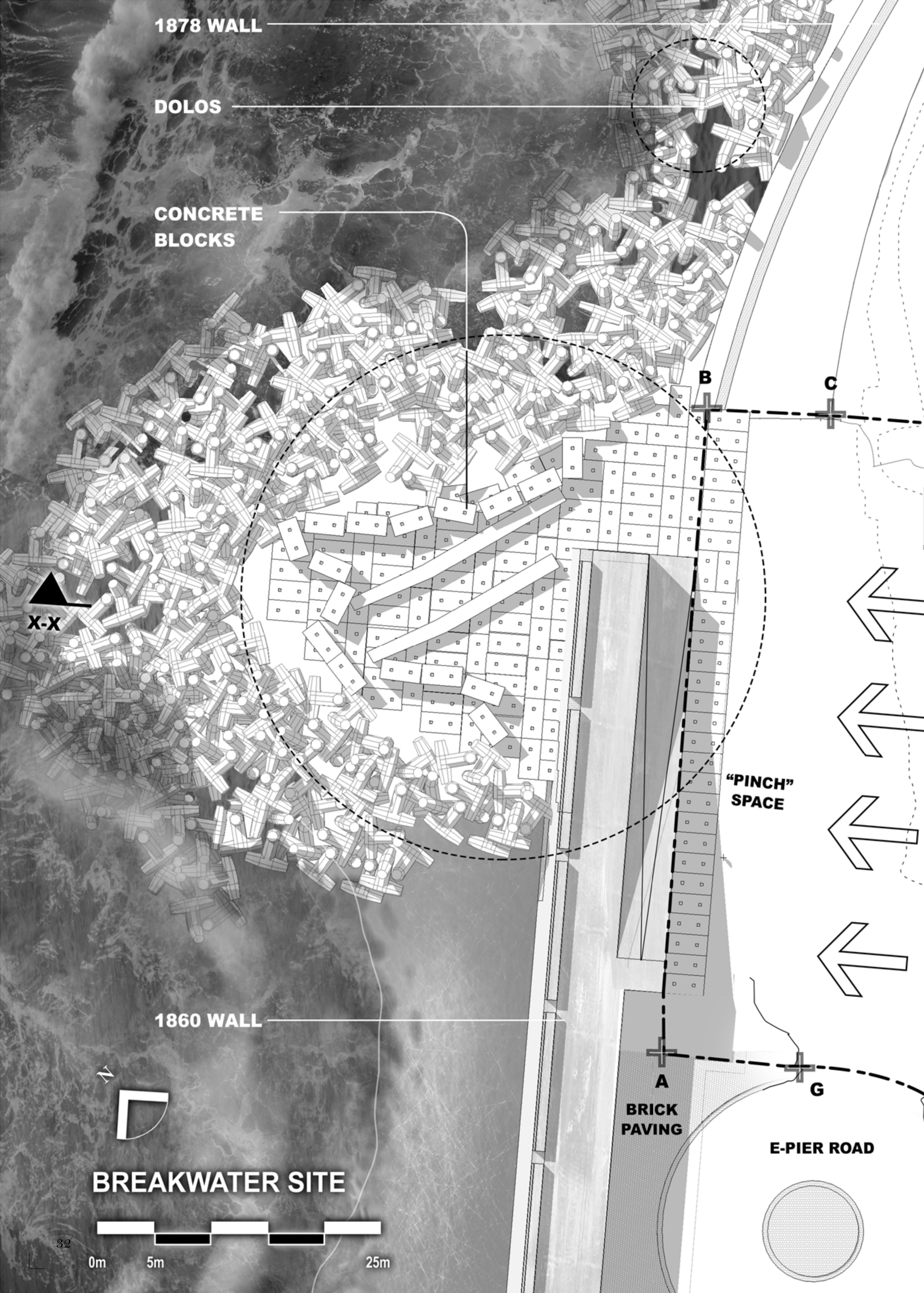
*Fig. 19. Coastal armour along the northern face of  the wall.*

*Fig. 20. View looking back over the old wall at the Greenpoint Stadium.*

*Fig. 21. Rusted balustrade set into the old breakwater wall.*

*Fig. 22. Peculiar clip-on timber structure as a shelter near the bus stop.*

*Fig. 23. Debris on the shores infront of  the wall, a place where boulders and concrete is reduced to smooth stones and sand. The beach is also littered with tangled and rusted steel from the reinforcing of  broken dolos.*


1878 WALL
DOLOS
CONCRETE
BLOCKS
B
C
X-X
"PINCH"
SPACE
1860 WALL
A
G
BRICK
PAVING
E-PIER ROAD
N
BREAKWATER SITE
0m
5m
25m

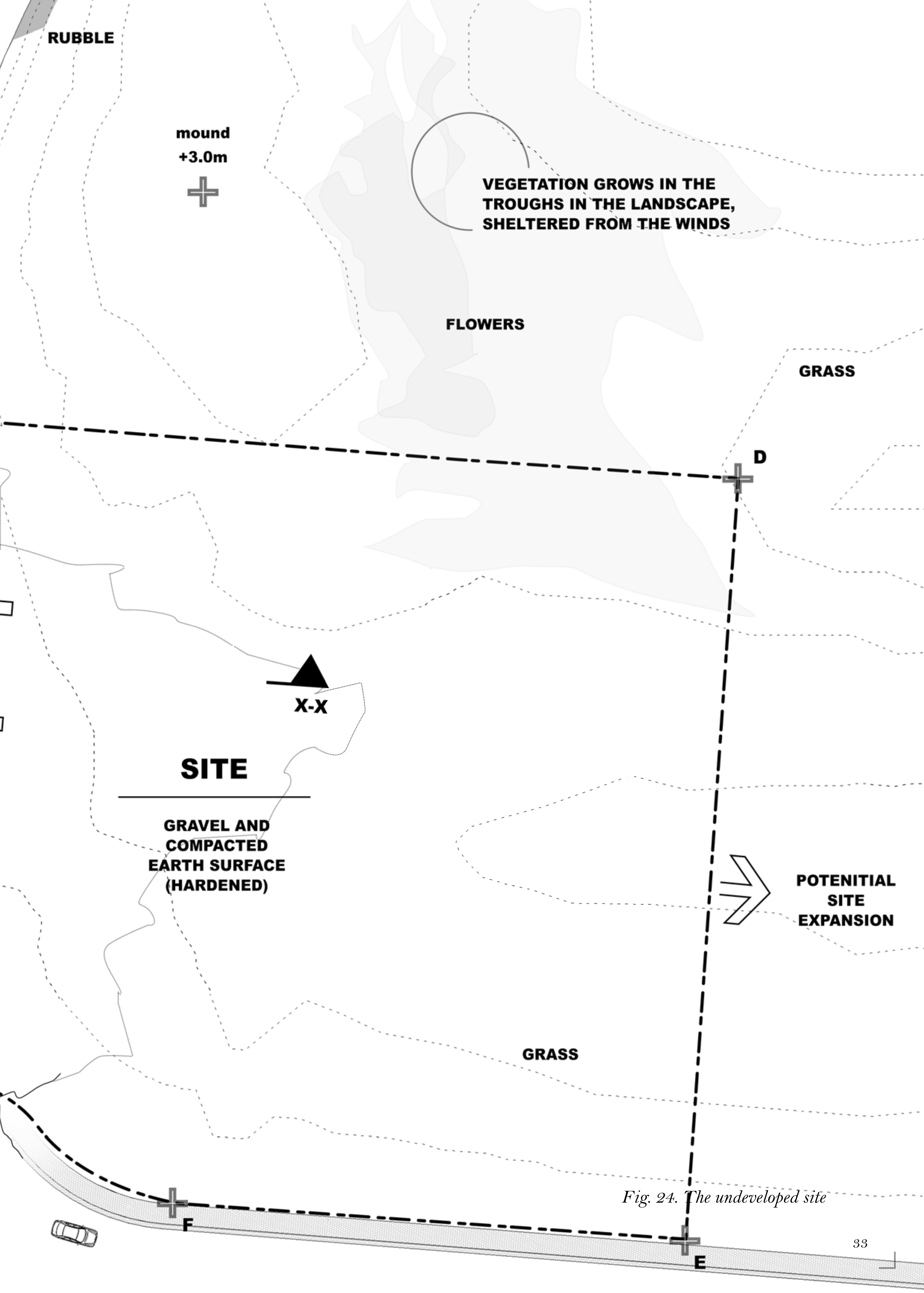



*Fig. 24. The undeveloped site*

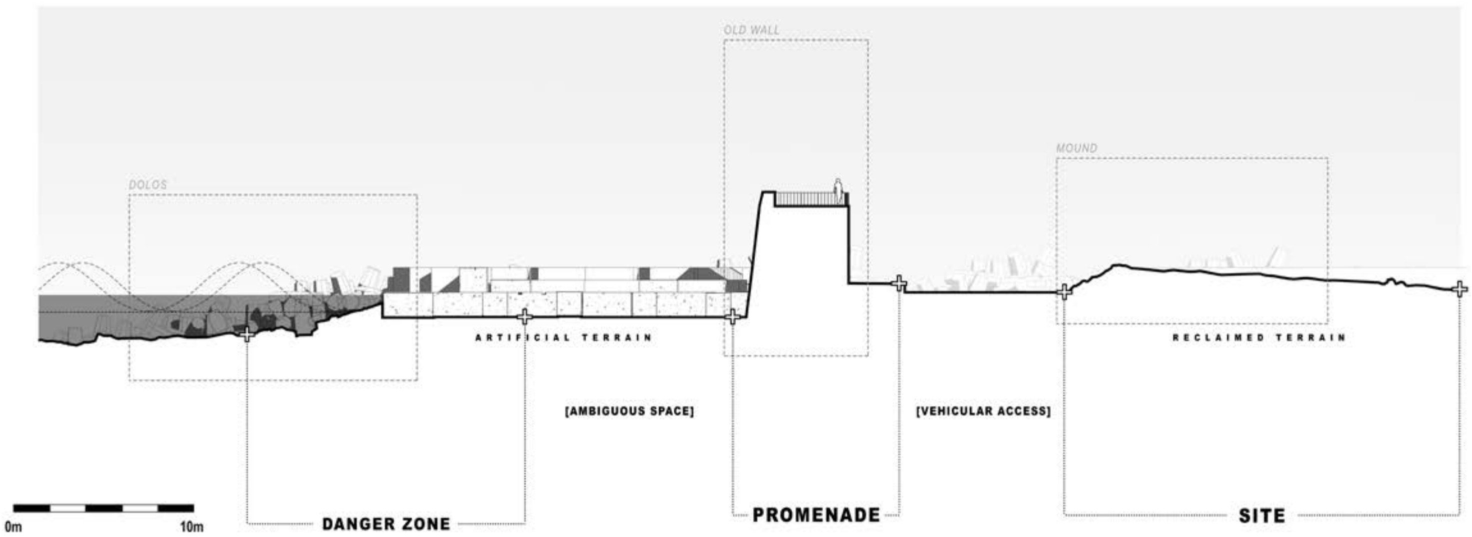



*Fig. 25. Section X-X cutting through the 'hip' area between the old and the new walls.*

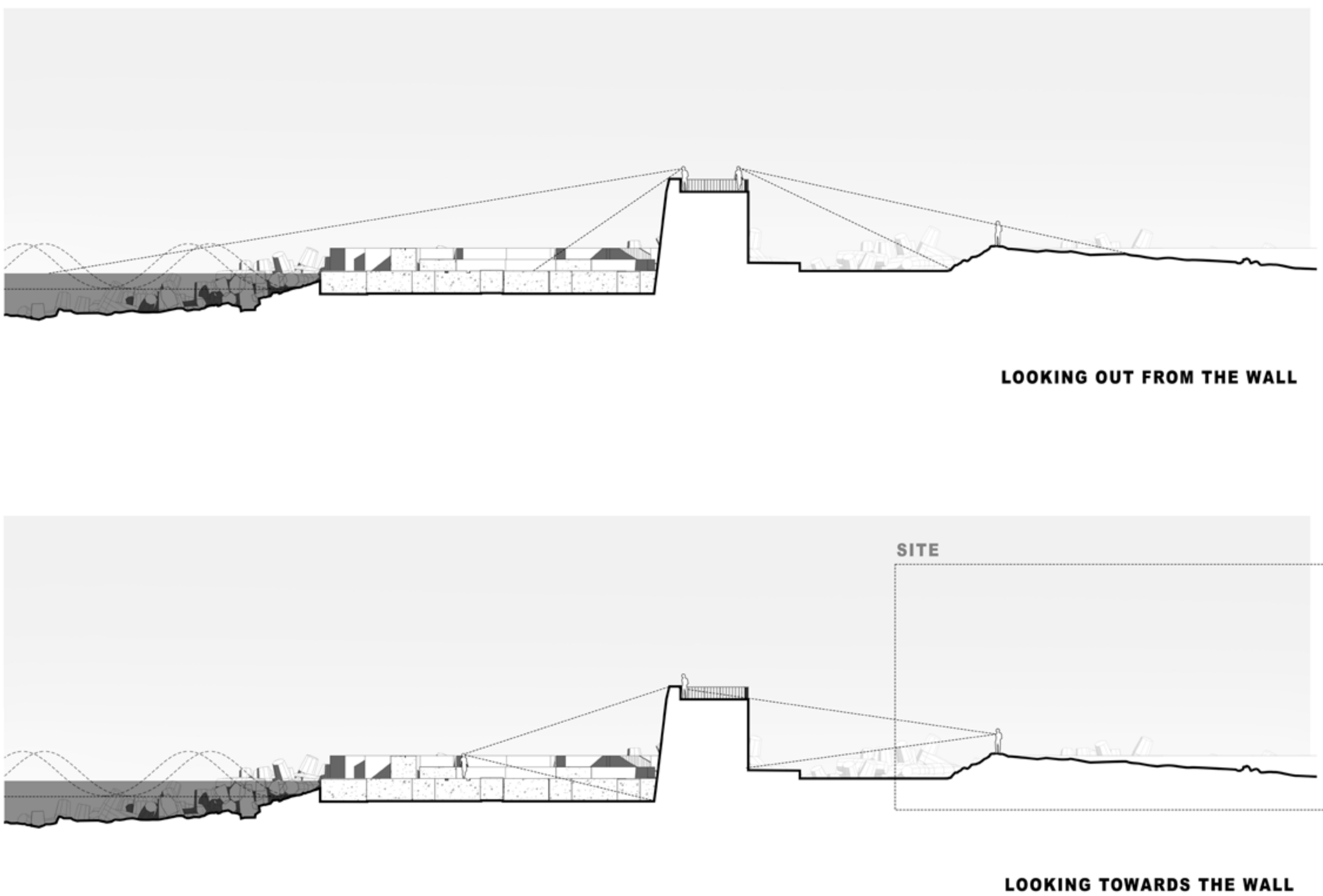



*Fig. 26. & 27. Adaptations of Section X-X above depicting the sight lines based on the different vantage point. The wall is a structure to look out from but, from the chosen site, it is a monument to admire.*

## THE PRESENCE OF THE WALL

A key experiential moment lies in the overpowering presence of the Old Breakwater wall. Unlike the newer extensions to the wall which are capped off at ground level, the Old Wall stands 5.7m above that level.

Looking back on the Old Wall is an experience which is currently not afforded to the public as the site is inaccessible. The idea of designing a building which sat behind the defences of the wall but which also created an awkward 'pinch' between the old wall and the new building developed. This space between the structures would become a boundary, of sorts, similar to that described by Heidegger. It would be the point at which the Old Wall ends, and the New Wall begins, celebrated by the extruded design amidst the walls.

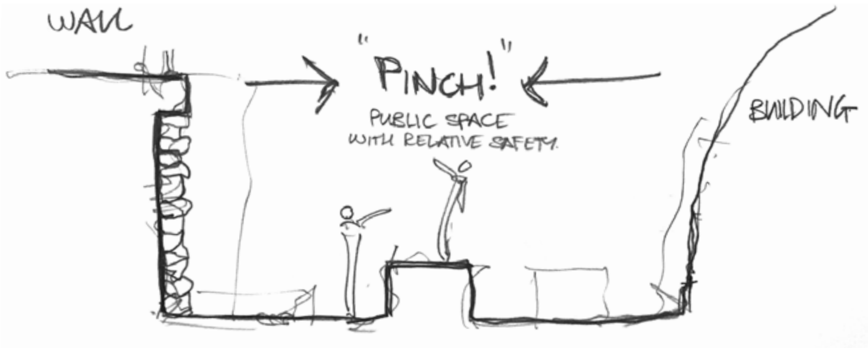



*Fig. 28. (above) early sketch of the void between the Old Wall and the new building.*

*Fig. 29. From ground level the sheer size of the Old Wall dominates one's experience. Currently there are very few safe places to stand back and view the wall from.*

*Fig. 30. The view from the mound across the site focuses on the bizarre artificial landscape rather than the Breakwater wall. The landscape in the foreground begins to hide parts of the city behind it.*

## MONOLITHIC LANDSCAPE

The extended breakwater wall is 500m long and is defended by 2865 concrete dolos, each weighing around 25 tonnes.[1] Dolos are used to absorb the force of waves as their collective structure is designed to dissipate the wave action rather than directly counter it. The reclaimed terrain between the old and the new walls is constructed from reclaimed rubble and massive concrete monoliths. The Old Wall is then seen to be extruded from this strange environment as it is rendered in the same quarried stone from which the land reclamations were accomplished with.

This is a key design incentive going further as there is great merit in designing a building which appears to be an extension or extrusion of the landscape. A decision was made here to design a building with a heavy monolithic structure set within the artificial mound of the site. The scars of construction and the heavy weathering upon the concrete surfaces are devices by which time is presenced on the site, as the newer blocks of concrete can be clearly distinguished from the old.

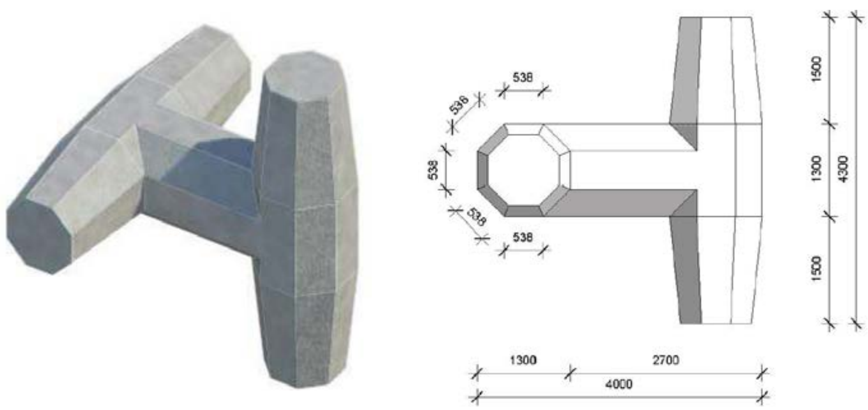



*Fig. 31. (above) Basic construction drawings of the Dolos.*

*Fig. 32. (below) The Kuoai No, a Taiwanese fishing trawler, rammed against the Breakwater dolos (1977).*

1 Tulsi, K & Phelp, D, *'Monitoring and Maintenance of Breakwaters which Protect Port Entrances.'* CSIR, 2009. p. 318.

Fig. 33. The Dolos form an unusual terrain along the northern face of the wall.

Fig. 34. Photo of one of the massive concrete blocks used to create the 'hip' at the end of the Old Wall.

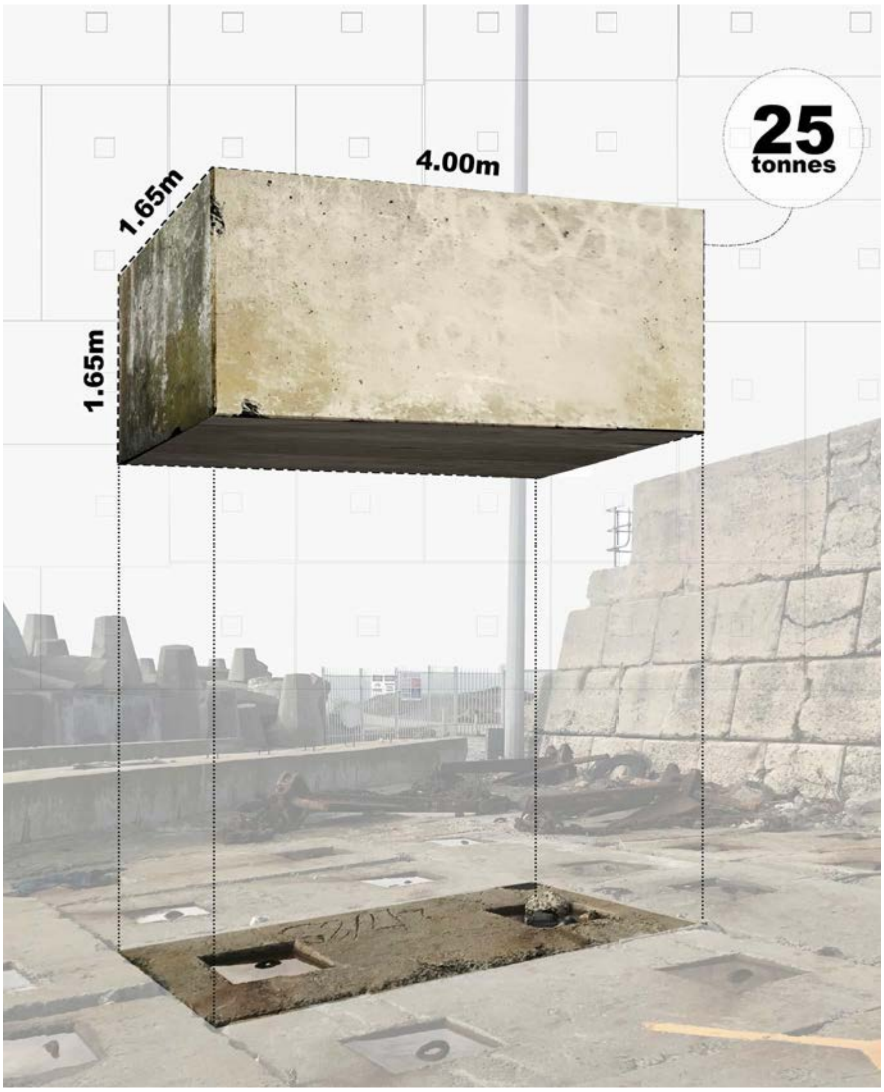



Fig. 35. The large concrete blocks weigh around 20 tonnes and are laid out in a parquette pattern to create a somewhat alien and peculiar environment.

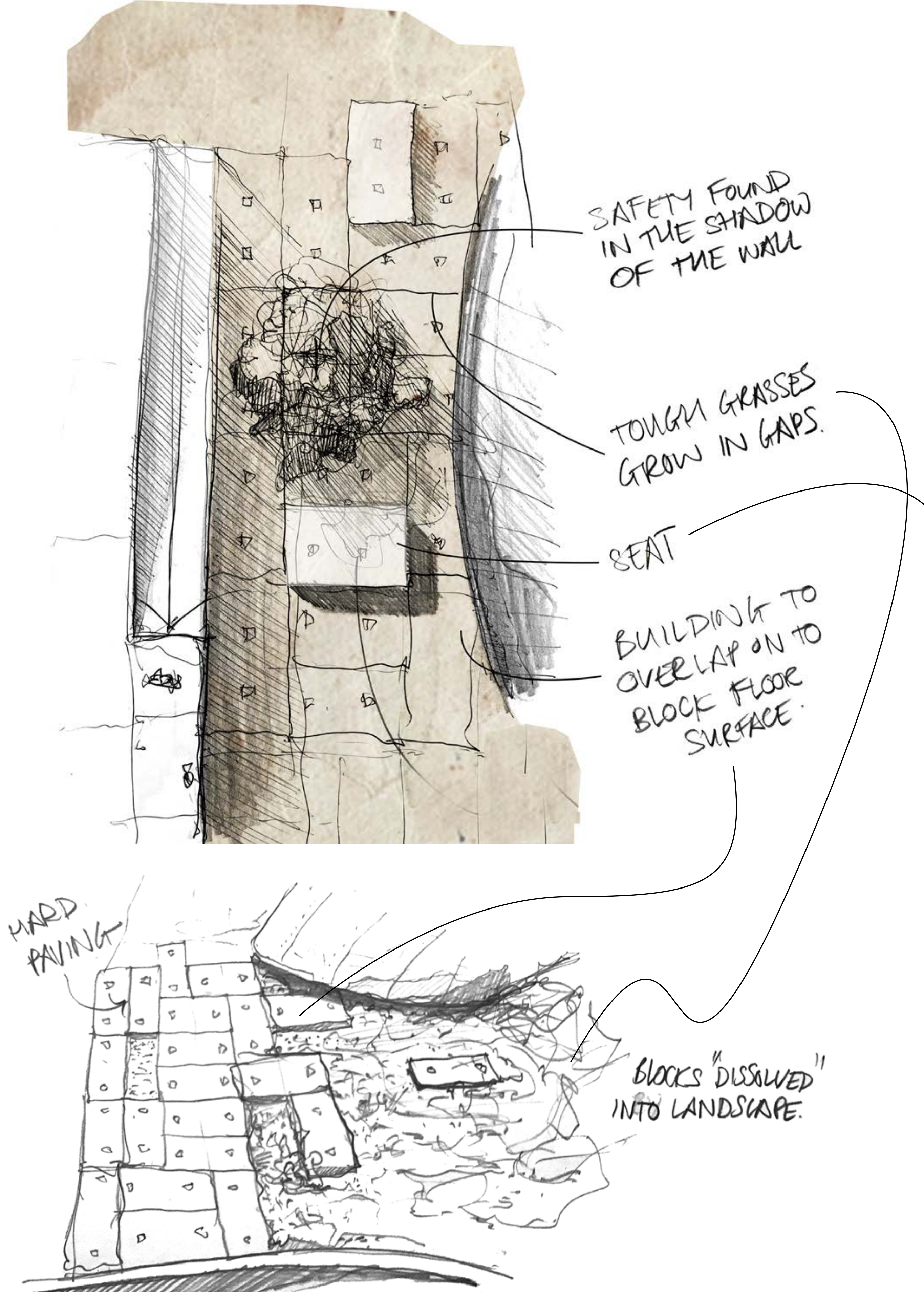



*Fig. 36. Sketchees from site visits and the first few design inklings.*

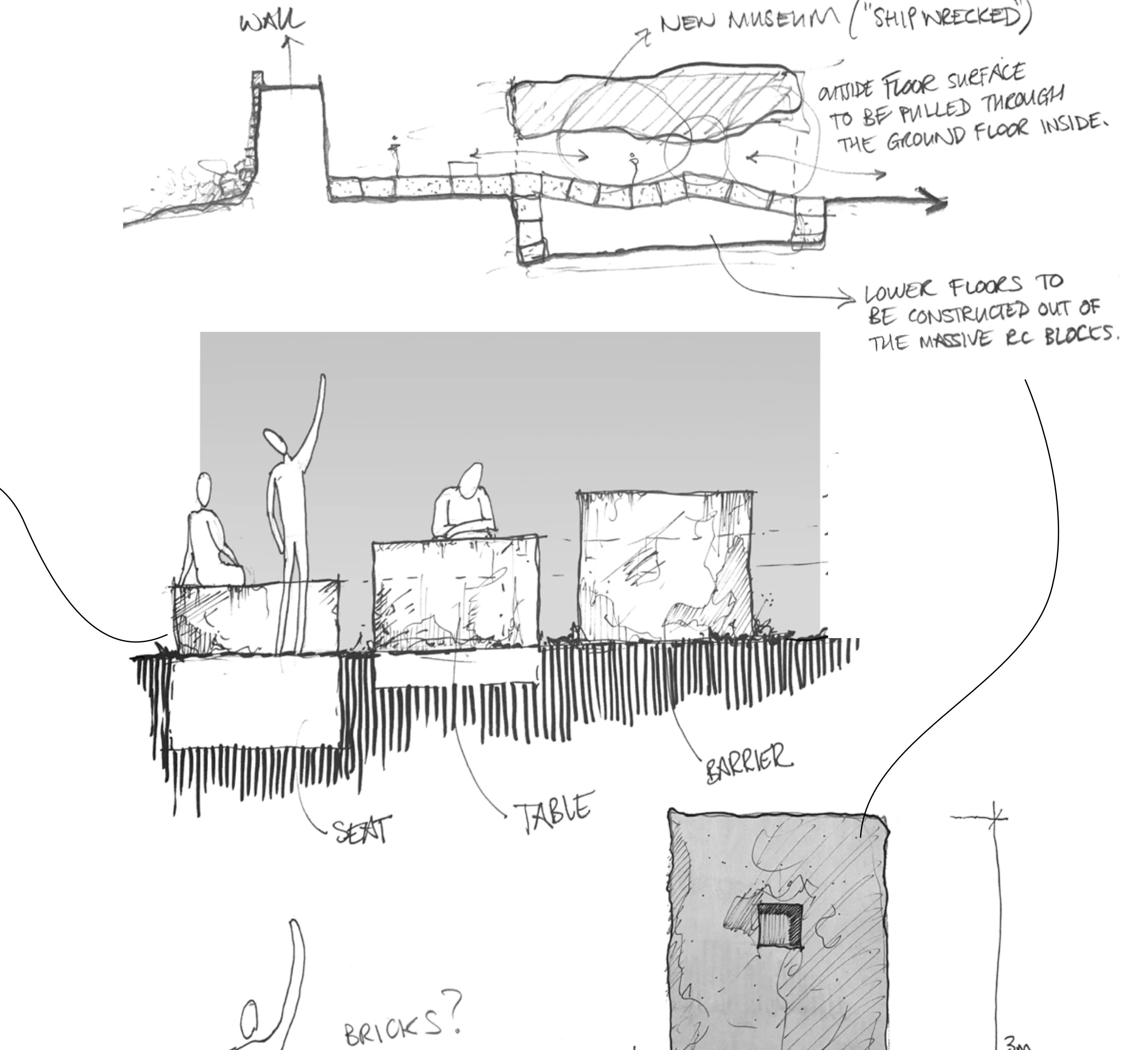



*Fig. 37. Sketchees from site visits and the first few design inklings.*

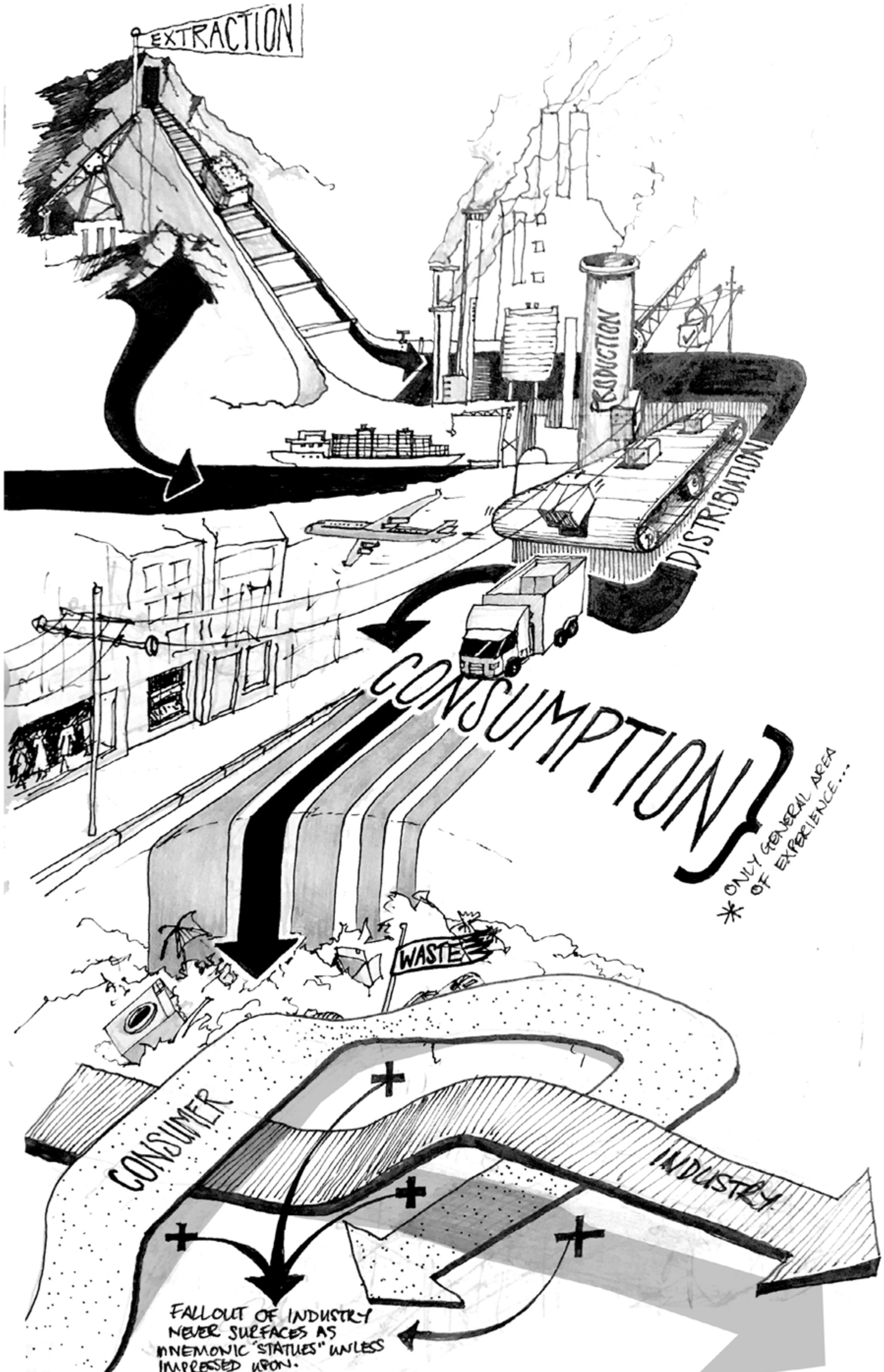



*Fig. 38. Early sketch depicting the global consumer culture and the process from extraction, manufacture, consumption and then waste (by author).*

The research into the broader context in which the chosen site sits lead to several key findings. Following the Valley Section idea of Patrick Geddes, an architectural program or language, so to say, should be derived from the conditions of the soil upon which it is built. The historical narratives across the site seemed a strong beginning to defining a language, and, as the site was formed through the use of large ships and heavy machinery, those instigators bore the brunt of the remaining research.

The primary question: What happens to these machines and ships when they no longer serve a purpose?

In *Purity and Danger*, Mary Douglas analyses the importance of dirt and cleanliness in different cultures. She argues that cleanliness and dirt may seem to be dichotomous, yet they really exist as a Möbius Strip of sorts. Her views towards cleanliness and dirt correlate with the views towards order and chaos, usefulness and waste.

> Order implies restriction; from all possible materials, a limited selection has been made and from all possible relations a limited set has been used.[1]

Where one might not think twice when seeing a pair of shoes on the floor in a hallway, if those same shoes were left on the kitchen counter while food was being prepared they would be considered dirty. In the same way, one is expected to keep their toothbrush in the bathroom but it would be considered rather unhygienic to keep it on the bookshelf in the living room. Essentially these examples bring about the notion that dirt is something which sits within an ordered system but does not belong in it. Douglas refers to it as "matter out of place".

Waste is the unwanted in the place of the wanted. In the same way, an old fishing vessel which has served many hard years at sea reaches the end of its operational life, and its dilapidated condition renders it as 'unwanted'. Its function becomes too costly and it becomes obsolete to its user. As a 'machine for floating in' (to take on Le Corbusier's idea that 'A house is a machine for living in') it no longer serves it purpose and, therefore, becomes matter which is out of place.

During times of global recession, such as the financial recession in 2004 to 2008, obsolete ships become liabilities and are sold to be turned into scrap. Although this kind of global economic fluctuation benefits these third world economies (one man's obsolete ship is another man's re-rolled steel rebar), the operational hazards of informal and unregulated shipbreaking are somewhat atrocious and have been under heavy scrutiny in recent years.

Organisations such as International Maritime Organization (IMO) and Greenpeace International, have developed a global stance on the

1 Douglas, Mary. *Purity and Danger.* (London: Routledge & Kegan Paul Ltd, 1966), p. 95.

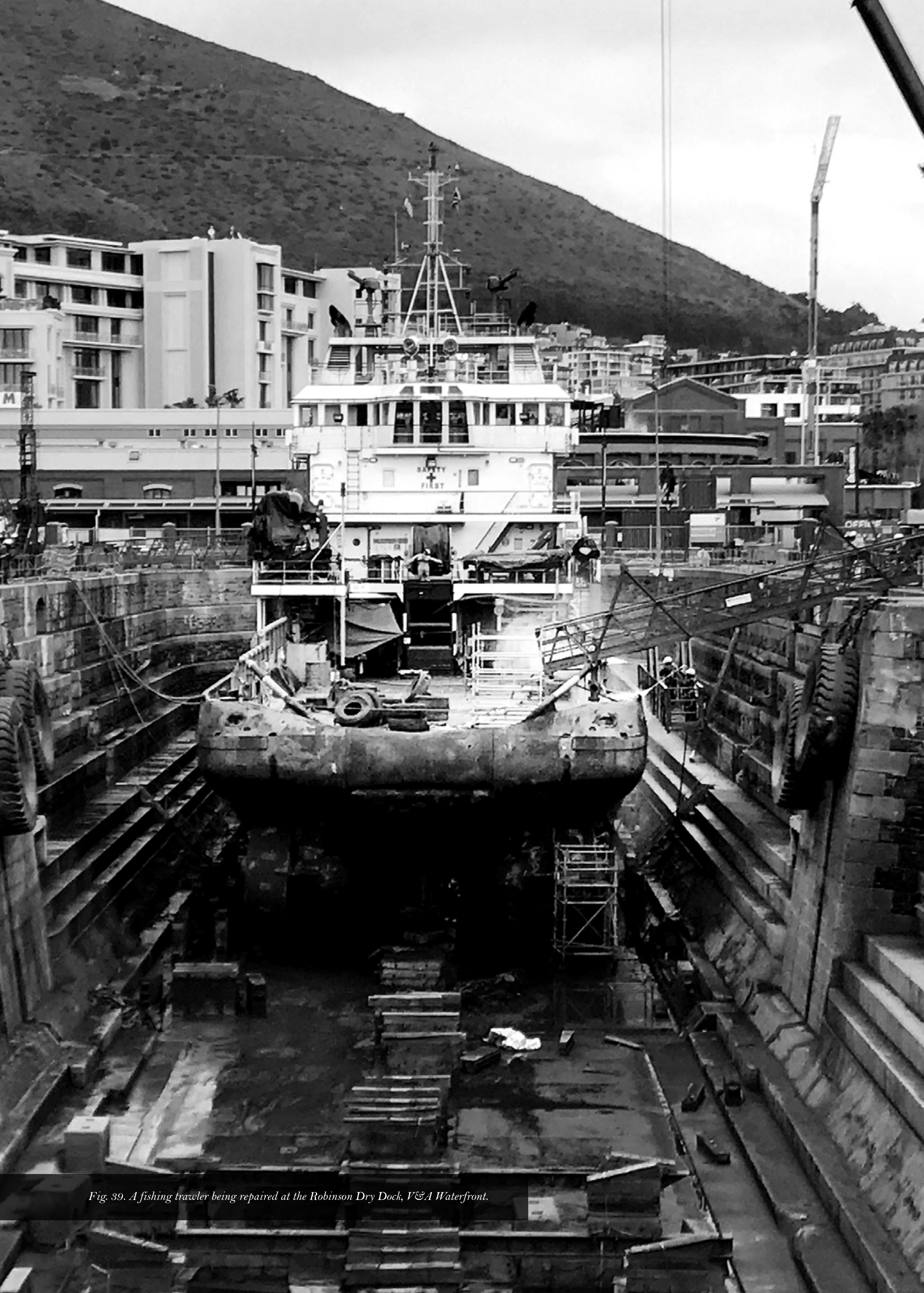


*Fig. 39. A fishing trawler being repaired at the Robinson Dry Dock, V&A Waterfront.*

system of shipbreaking in order to implement strict environmental and human rights laws. In 1989, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal[1] began developing shipbreaking regulations which were legally binding and globally applicable, whereby the process of dismantling a ship could be achieved as efficiently as possible without compromising on the safety of those involved.[2]

Environmental regulations across the world have isolated one of the key factors which could reduce the impact of the shipping industry and that is the double hull. Most steel container ships before 1998 were constructed with single hulls. When the outer skin is punctured, a double hull provides a secondary barrier to prevent the ship's ballast and fuels from contaminating the environment, as well as preventing the ship from taking on more water.[3] International insurance companies no longer insure single hull vessels for this very reason.

As corporations are not willing to operate without insurance, a huge number of single hull ships are no longer operational. The majority of these vessels sail their final voyage to the tidal beaches of the global south, where labour is cheap and environmental legislation is loosely suggested rather than enforced.

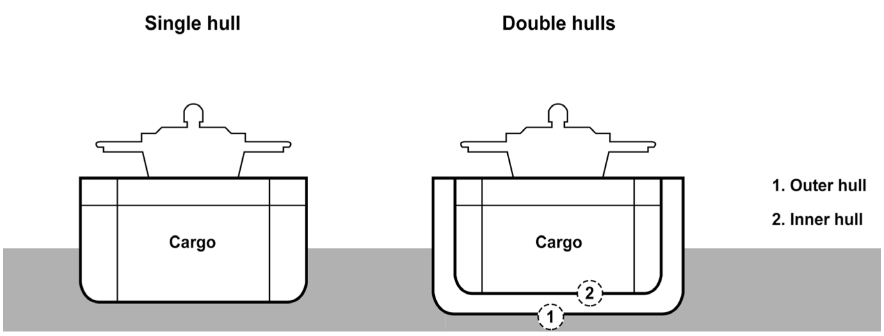



*Fig. 40. Single hull v double hull ships.*

A medium sized single hull container ship serves as the protagonist in this dissertation. The 'Feeder' sized container ship is one of the most common vessels to frequent the Cape Town harbour, aside from the much larger 'Panamax' (240m long) and 'Post Panamax (300m long), which are both double-hulled and were considered far too large for the scope of this project. The fictitious ship, named The Rose, was built using BIM software and based on naval architectural drawings.

| Vessel | Side view | Dimensions (LOA x Beam x Draft) | SB | CT | PE | Ng | EL | Dig-out | Dur | RB |
|---|---|---|---|---|---|---|---|---|---|---|
| Container: Feeder 3 000 TEU |  | 135m x 30m x 11,0m | | √ | √ | √ | √ | √ | √ | √ |
| Container: Panamax 4 500 TEU |  | 240m x 32m x 12,0m | | √ | √ | √ | | √ | √ | |
| Container: Post Panamax 6 600 TEU |  | 300m x 40m x 14,5m | | √ | | √ | | √ | √ | |

*Table. 01. The Duncan Dock has a relatively broad container ship capacity, rivalled only by the much larger and deeper port in Durban.*

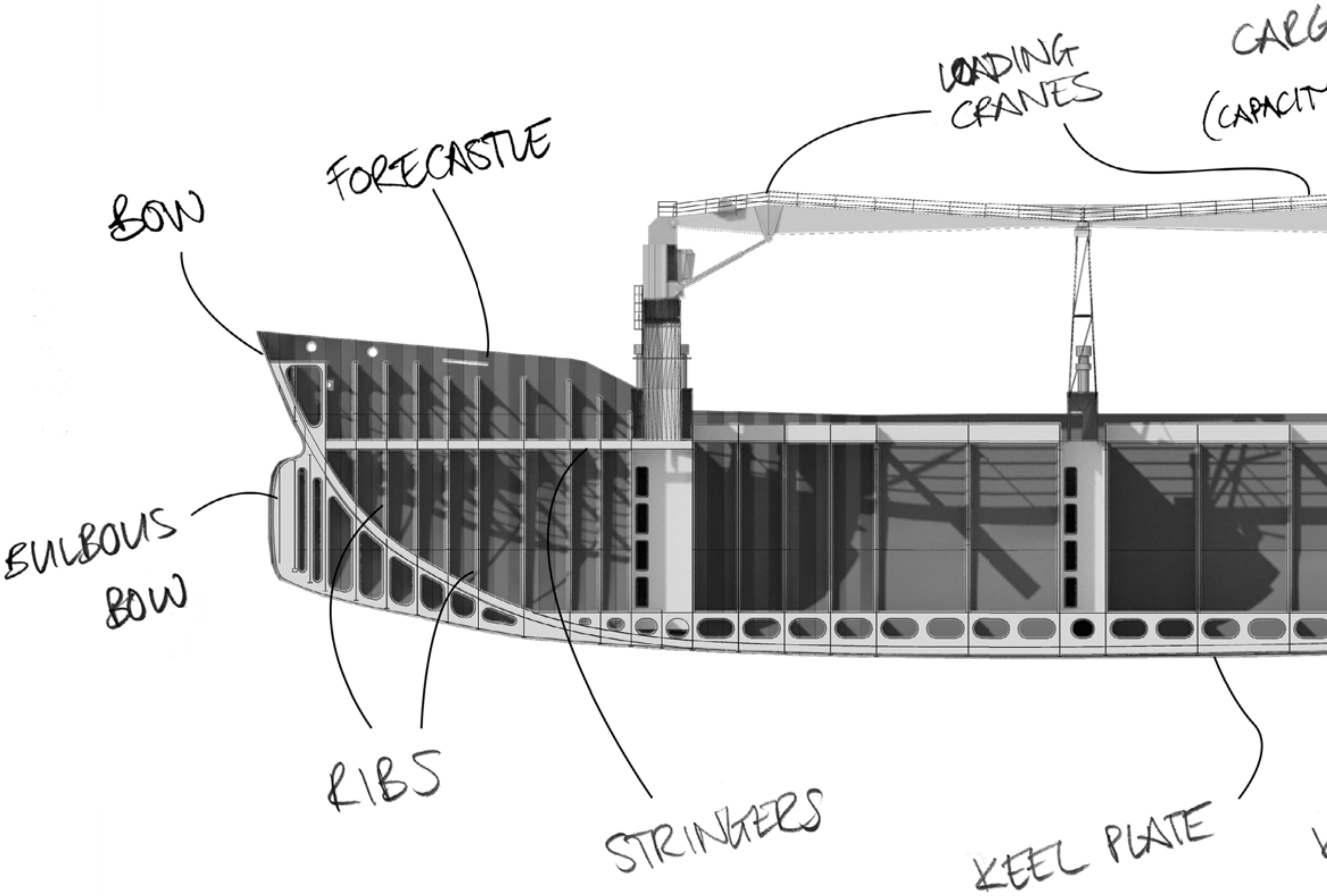
1 Basel Convention, 2011. The Basel Convention aims to regulate export and import of ships across the world.
2 Ibid.
3 Ibid.

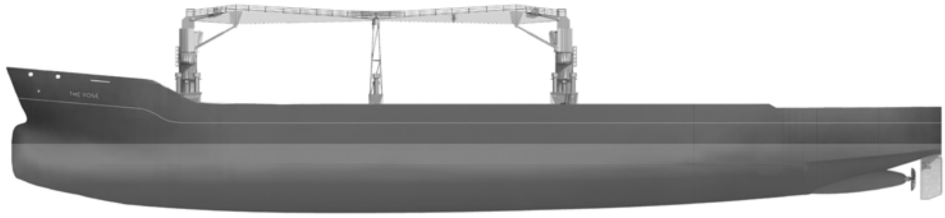
| 850 TEU vessel ('Feeder') | |
|---|---|
| dimensions | *134.60m x 21.30m x 9.00m* |
| engine | *MAK 9M 43 9-cylinder (8,400 KW)* |
| capacity | *836 TEU max. – 526 TEU at 14 tonnes* |
| deadweight | *8,900 tdw* |
| tonnage | *GT 7,600* |
| speed | *19.0 knots* |
| holds | *open top (centre) and covered (front)* |
| description | *Gearless feeder with two large open-top holds amidships. Forward holds covered by hydraulically operated hatch covers. Aft bays equipped with cellguides above deck. Type 168 ships provide electricity for 204 reefer containers. Single Hull. Moderate speed at 19 knots. Large number of ships built.* |

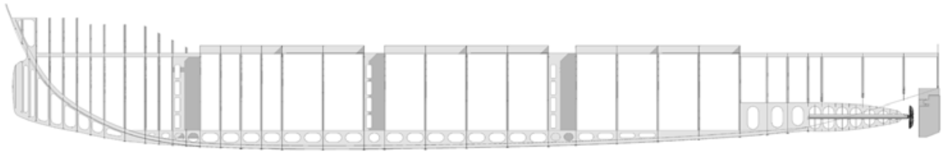
*Table 02. Information on typical Feeder container ships (source: www.containership-info.com)*

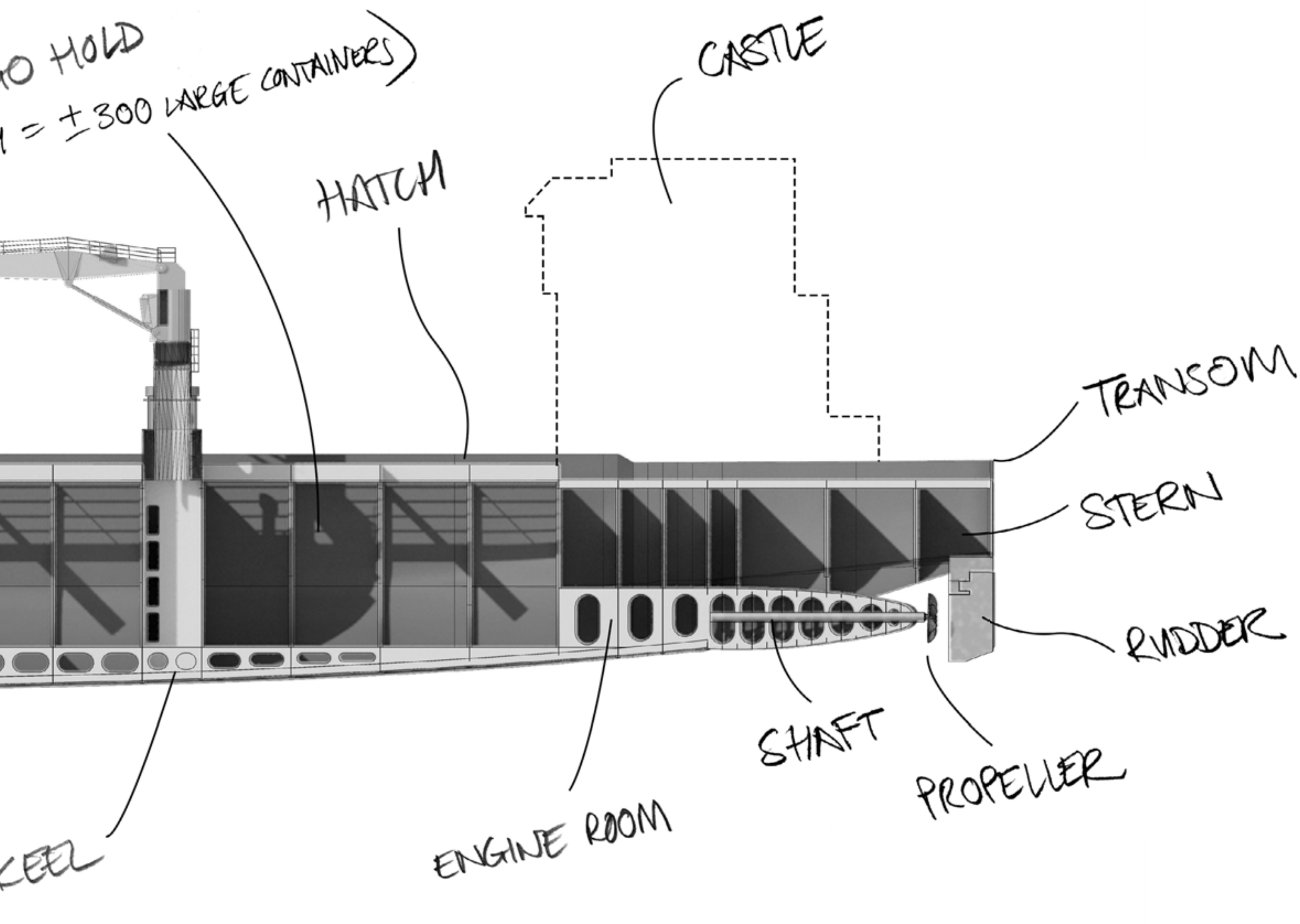
*Fig. 41. (top right) BIM model of the 135m long Rose superstructure.*

*Fig. 42. (below) The Anatomy of a ship.*








HOLD
= ± 300 LARGE CONTAINERS)
CASTLE
HATCH
TRANSOM
STERN
RUDDER
SHAFT
PROPELLER
ENGINE ROOM
KEEL

## SHIP BREAKING

Three ship repair sites have been identified in the Cape Town Harbour area which will be used for ship breaking. Namely the slipway and Robinson Dry Dock in the Alfred Basin, and the Sturrock Dry Dock in Duncan Dock. The operational capacities determine the size of the ships which can be dismantled, establishing a necessary scale of the 'building blocks' by which an architectural end will be realised.

These three ancillary sites were intended to be the spaces where the ship breaking would be conducted, and the extracted components would then be transported by barge to the breakwater site. As the design developed, there came a point where the sheer size of the desired components seemed far too large to be transported in this manner. The eventual program, a maritime museum, demanded large spaces. The solution to this problem was to take on a hybrid system between beaching and the dry dock methods.

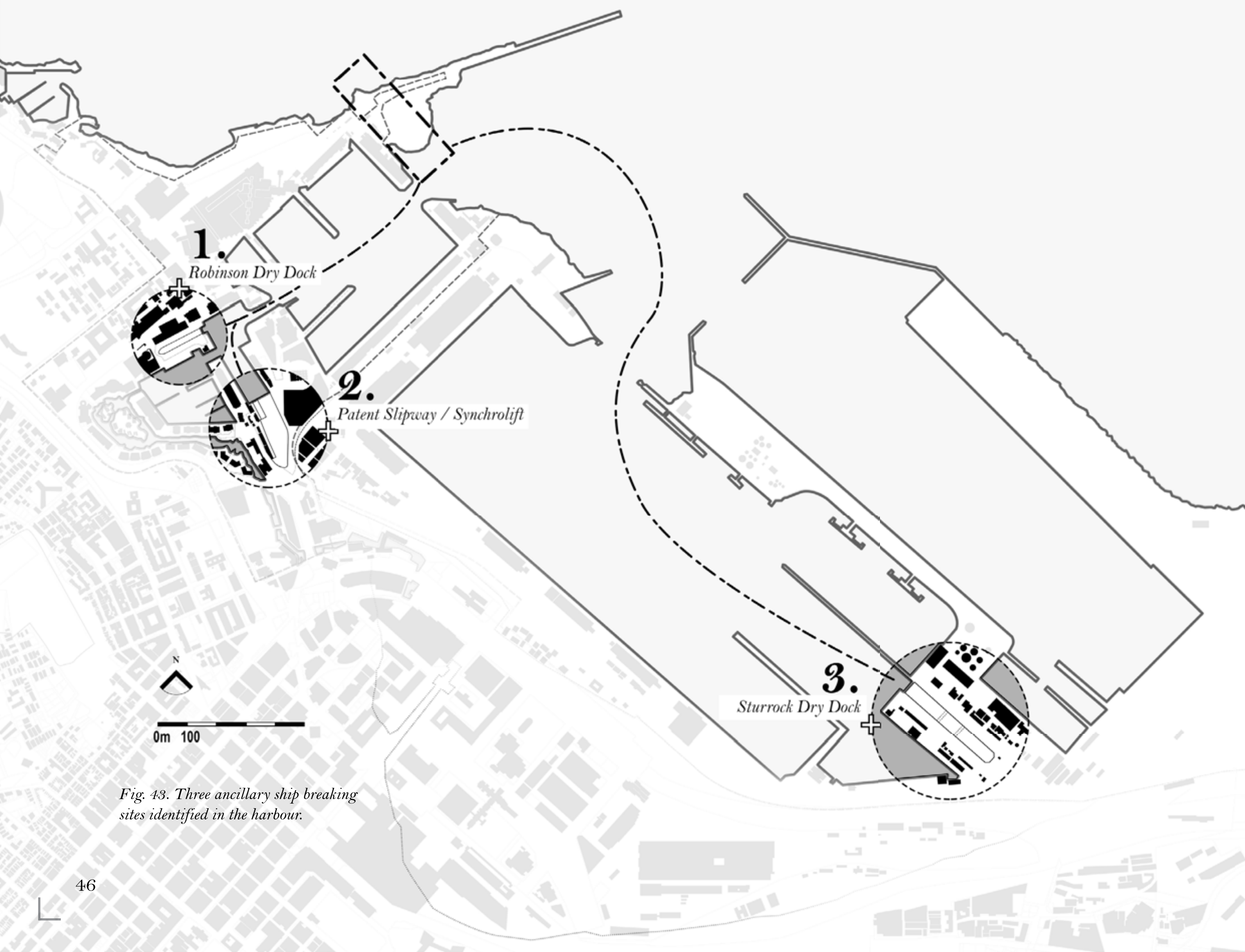



*Fig. 43. Three ancillary ship breaking sites identified in the harbour.*

*Fig. 44. A medium sized fishing ship being repaired in the Robinson Dry Dock, Cape Town.*

*Fig. 45. Quayside breaking taking place in Shanghai, China.*

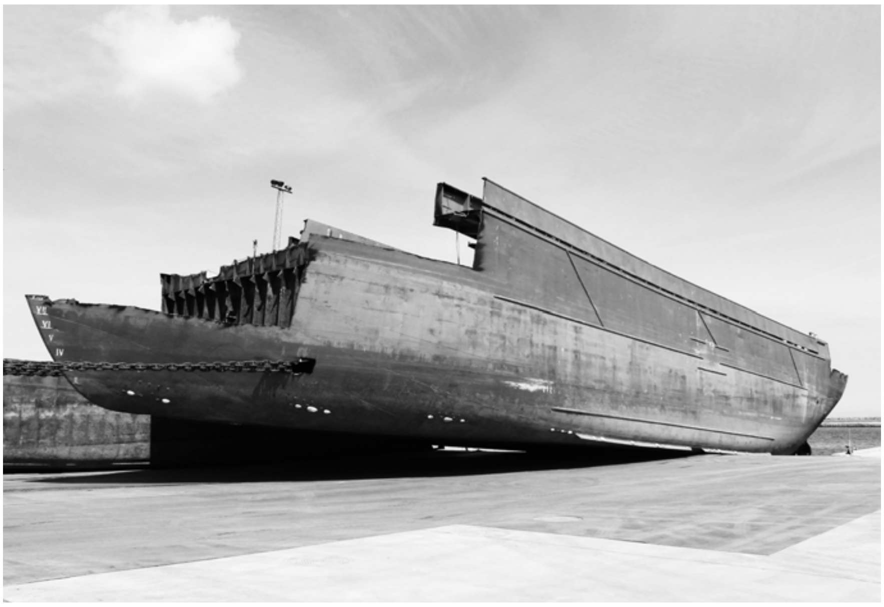


*Fig. 46. A large ship being dragged up a slipway in Fornæs, Denmark.*

*Fig. 47. (diagram) The Life-cycle of a ship and its resources. As this process is already rather complex, the decision was made to limit the scope of the ship breaking procedure to the primary superstructure of the vessel only. All minor structure and fittings are assumed to be easily extracted, recycled and sold. Some fittings will be resued in the museum.*

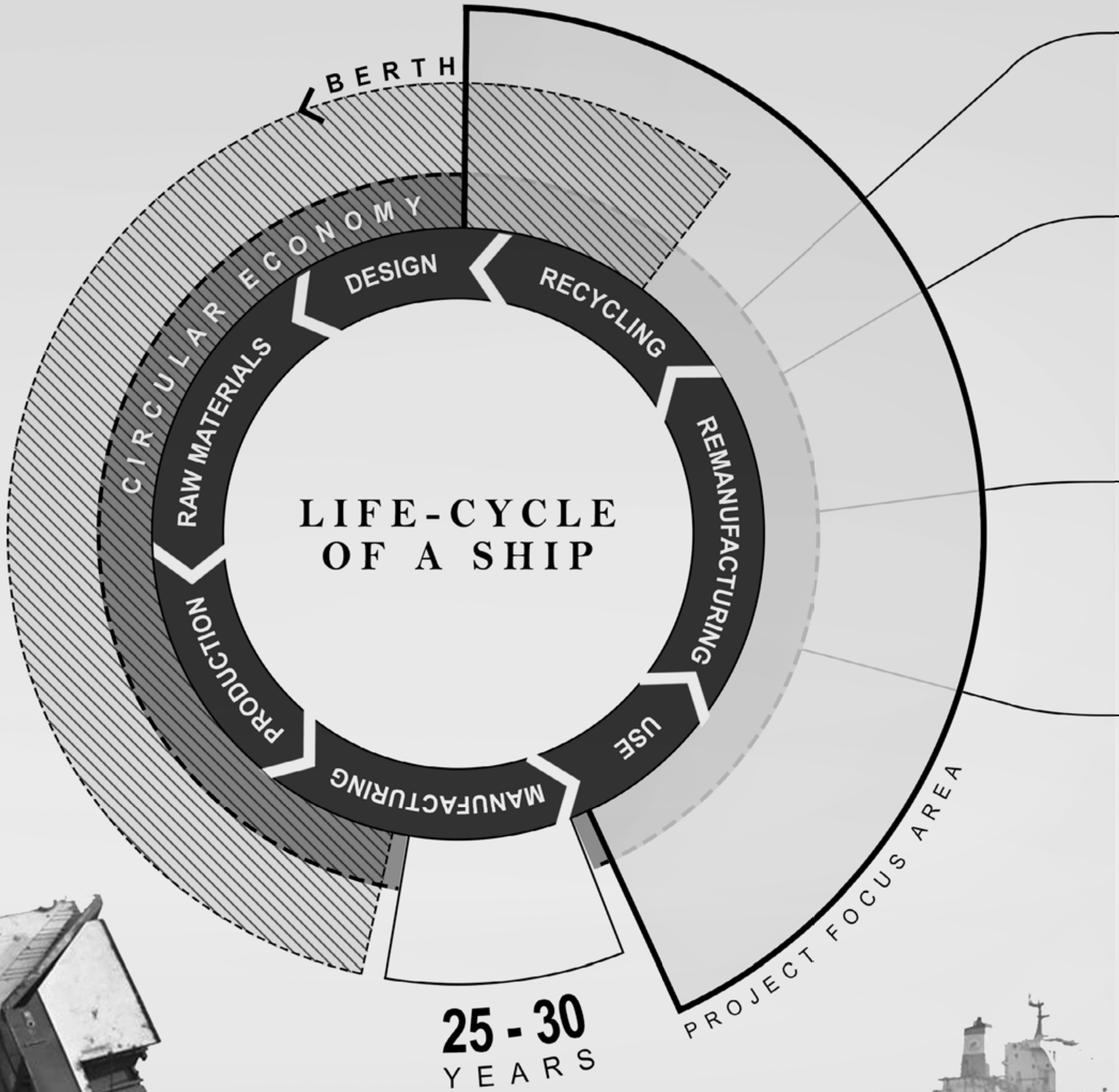



*Fig. 48. (left photo) Left in the mud, Alang, India (Jan Møller Hansen).*

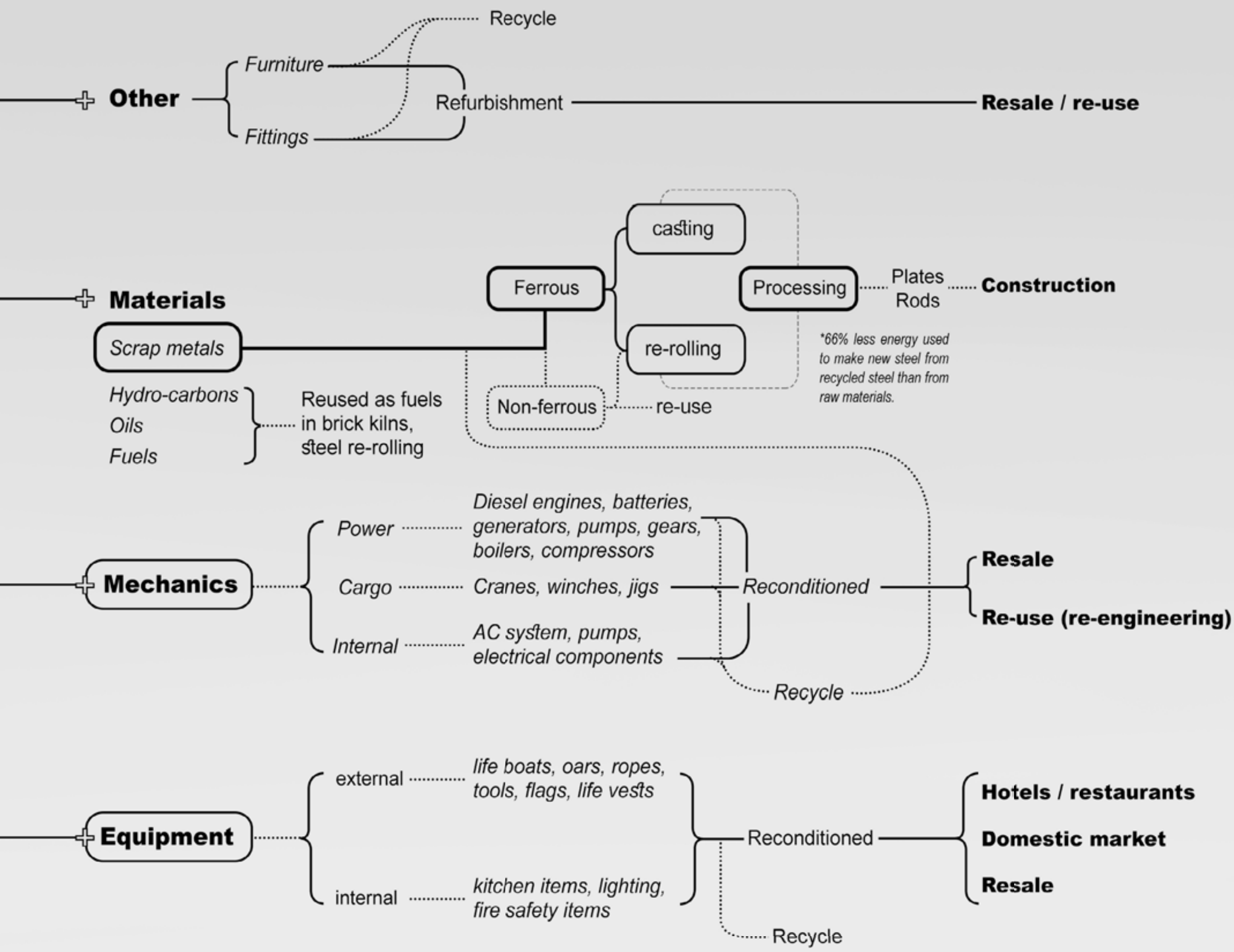



*Fig. 49. (right photo) Ships torn apart, Chittagong, Bangladesh (Edward Burtynsky).*

## SHIP BREAKING STRATEGY

The idea to break apart the ship in satellite sites was not at all feasible and so the design of an on-site hybrid system was developed. The strategy would involved the construction of a dry dock, of sorts, where by a trench with dimensions 150m long x 40m wide x 5m deep would be dug alongside E-pier. This would serve as the basin within which the Rose would be de-constructed (see fig. 50 below). The vessel is cleaned and all toxic waste and ballast liquids are removed in the Robinson Dry Dock, adherring to the environmental guidelines set ou by the IMO. Once approved, the relatively bare superstructure of the ship would be guided to the breakwater site and be beached within the shallow trench. An earth wall will be built behind it to close in the trench.

The construction of the new museum would then begin as the vessel is systematically de-constructed, starting from the bow to the stern. This process of deconstruction would be assisted by both the on-board loading cranes of the Rose as well as a large temporary gantry system. These machines are used to extract the required components and transport them along rails into place. With this basic system in mind, the design then had to be approached with the idea that the museum would be made out of the bow pieces first, and then slowly grow as each new piece was laid and fixed into place. This process of layering complex components drove the design to new and interesting forms.

Once the Rose was completely de-constructed and then reconstructed as the museum, the trench and the gantry tracks would be left to be swallowed up by the landscape. These would essentially be mnemonic devices; subtle clues as to the origins and process of the new building. This is an attempt to extend the building's presence beyond its physical walls and allow its occupants the experience of both mystery and discovery of a building which in rooted in the raw and beautiful landscape.

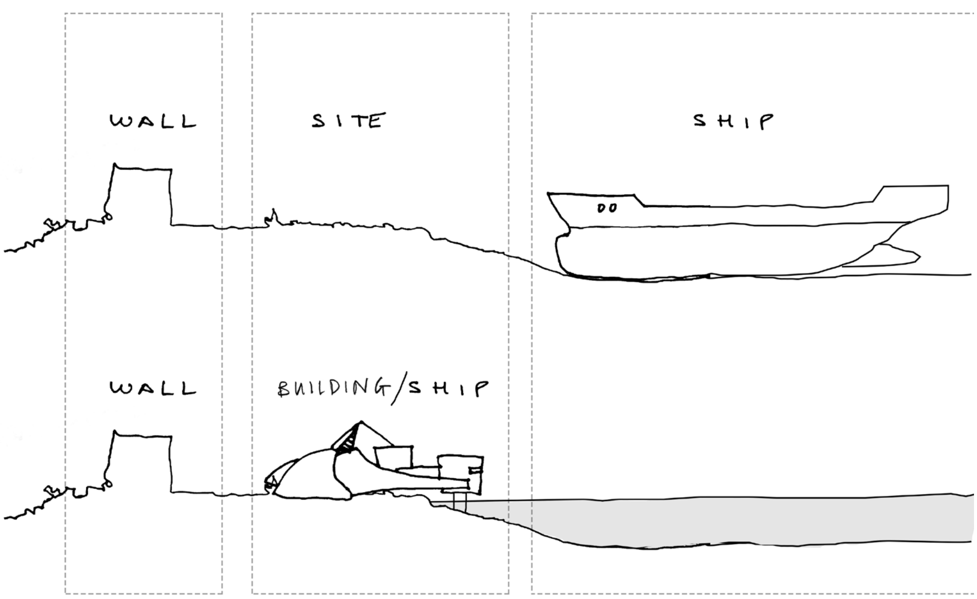
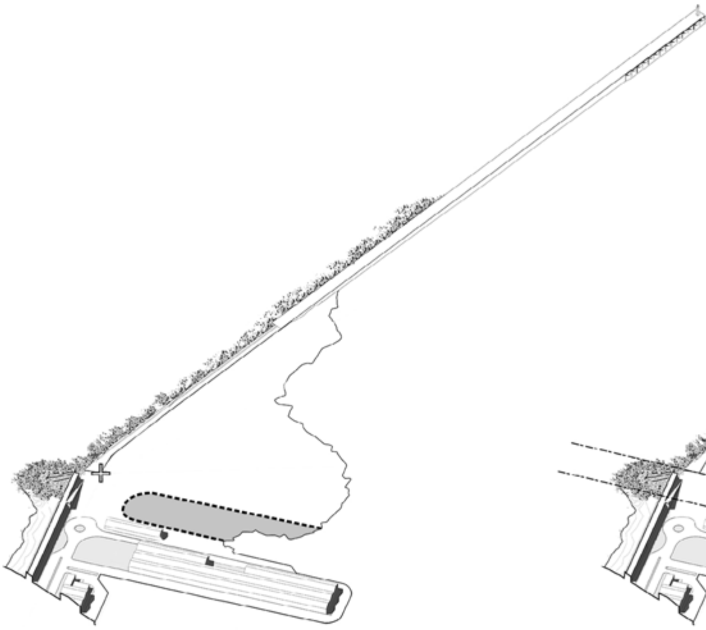
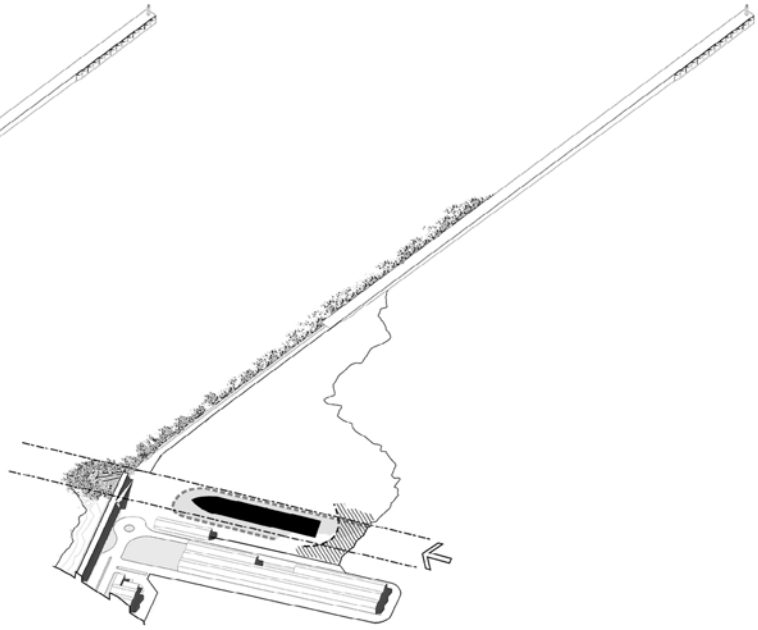


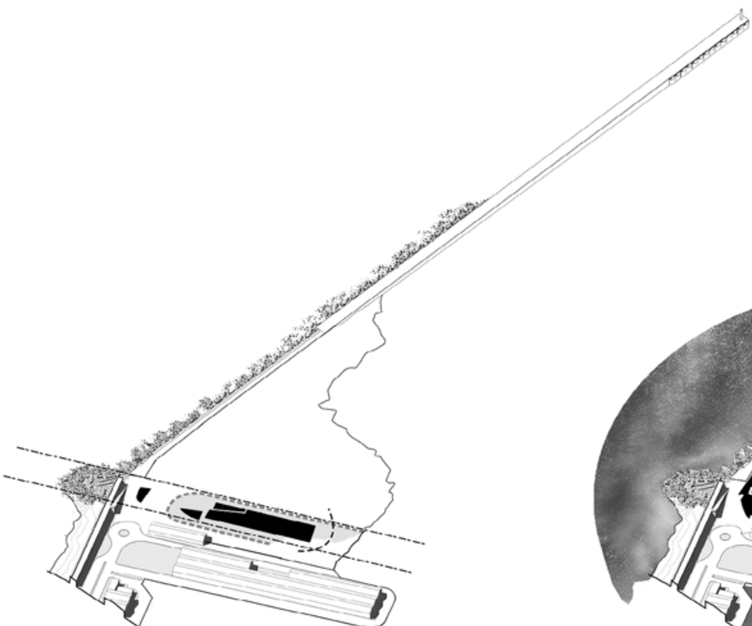

*Fig. 50. Sketch: from ship to museum*



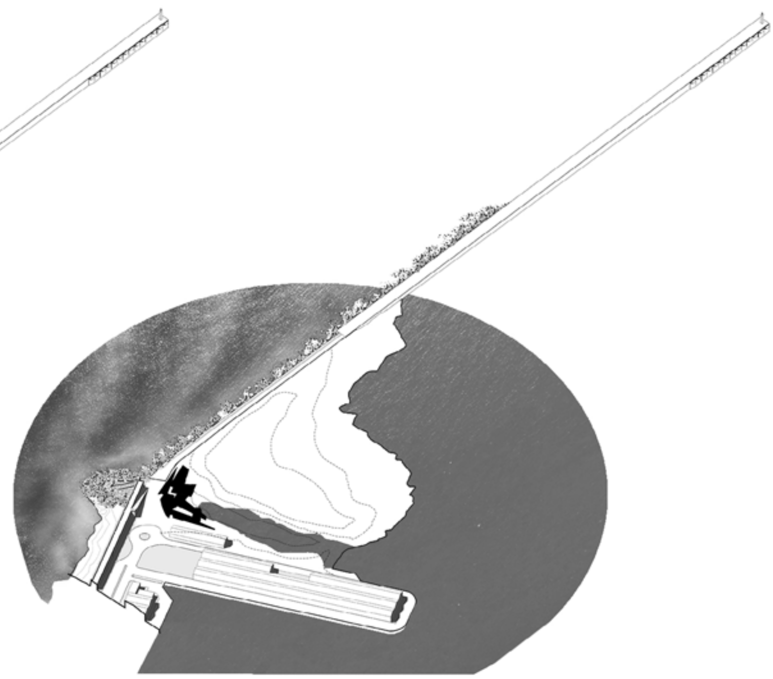
**01** Earth excavated to create 5m deep beaching zone. Temporary gantry system is installed.



**02** The Rose is beached, and a earth wall is built behind it to negate the 1.5m tidal range.



**03** Once enclosed, the Rose is systematically deconstructed and used to build the new maritime museum.



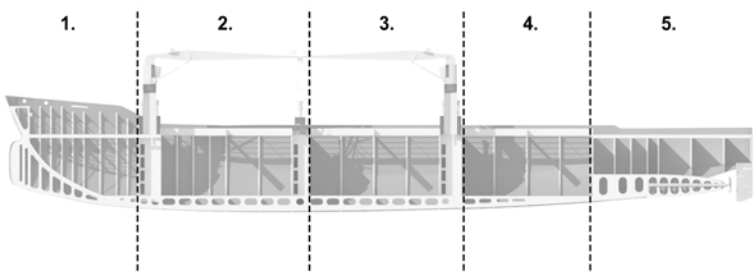
**04** The temporary 'dry dock' is then used as a tidal pool, as cleaner water from the Atlantic is pumped into it, poetically reconnecting the Rose with the sea.

*Fig. 51. Diagrams showing the ship breaking and development strategy.*

## DISAGGREGATION

The issue of de-constructing a super-structure of this scale was tackled by curiosity and the desire to experiment, rather than a pragmatic approach to guarantee absolute structural integrity. That being said, all effort has been made to find a synthesis between technical resolution and a child-like imagination. The first attempt to de-construct the ship was done in the conventional manner found in the ship-breaking capitals of the world, such as Alang in India and Chittagong in Bangladesh, that is to say, the ship was dissected orthogonally along its structural skeleton (see fig. 52 below).

Digitally dissecting the ship with BIM software was a quick approach to generating the building components. The components were abstracted in order to test spatial ideas (following pages).



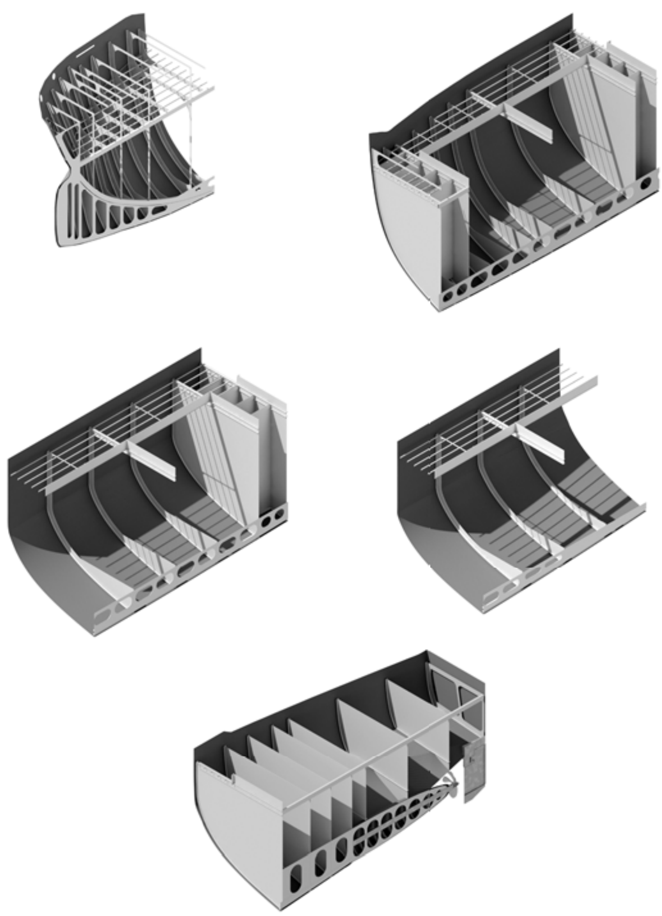
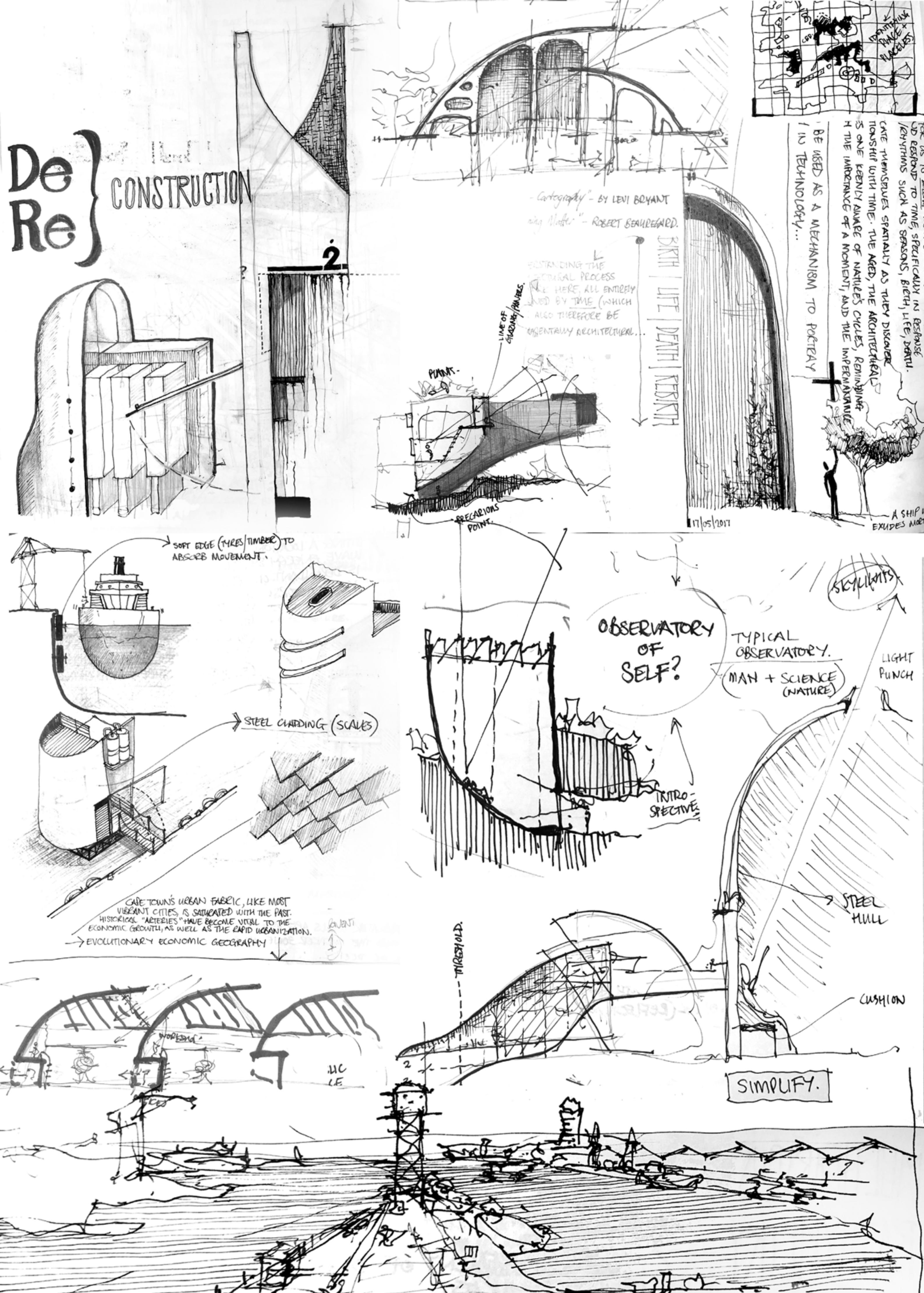



*Fig. 52. (left) The Rose, orthogonally dissected along her structural lines.*

*Fig. 53. (right) Early conceptual sketches of the components with various uses.*



De
Re
CONSTRUCTION
2
"Cartography" - BY LEVI BRYANT
- ROBERT BEAUREGARD.
BIRTH | LIFE | DEATH | REBIRTH
LINE OF GLAZING/PANELS.
PLANT.
PRECARIOUS POINT.
UD RESPOND TO TIME, SPECIFICALLY IN RESPONSE
/RHYTHMS SUCH AS SEASONS, BIRTH, LIFE, DEATH.
CATE THEMSELVES SPATIALLY AS THEY DISCOVER
TIONSHIP WITH TIME. THE AGED, THE ARCHITECTURAL
IS ONE KEENLY AWARE OF NATURE'S CYCLES, REMINDING
H THE IMPORTANCE OF A MOMENT, AND THE IMPERMANANCE
BE USED AS A MECHANISM TO PORTRAY
IN TECHNOLOGY...
17/05/2017
SOFT EDGE (TYRES/TIMBER) TO ABSORB MOVEMENT.
STEEL CLADDING (SCALES)
CAPE TOWN'S URBAN FABRIC, LIKE MOST VIBRANT CITIES, IS SATURATED WITH THE PAST. HISTORICAL "ARTERIES" HAVE BECOME VITAL TO THE ECONOMIC GROWTH, AS WELL AS THE RAPID URBANIZATION.
→ EVOLUTIONARY ECONOMIC GEOGRAPHY
OBSERVATORY OF SELF?
TYPICAL OBSERVATORY.
MAN + SCIENCE (NATURE)
INTRO-SPECTIVE.
SKYLIGHTS
LIGHT PUNCH
STEEL HULL
CUSHION
THRESHOLD.
SIMPLIFY.

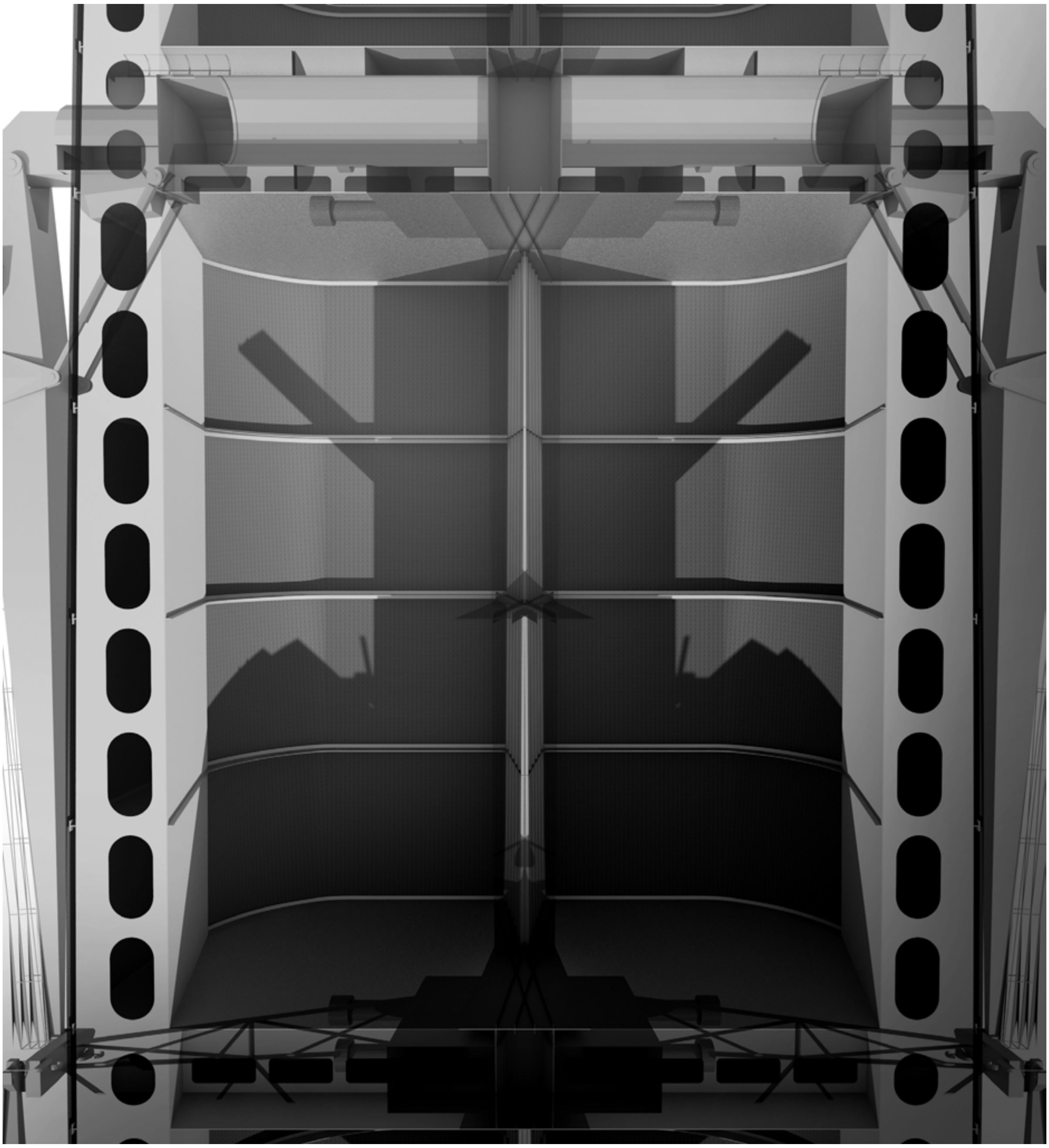


*Fig. 54. Conceptual form study 01.*

*Fig. 55. Conceptual form study 02.*

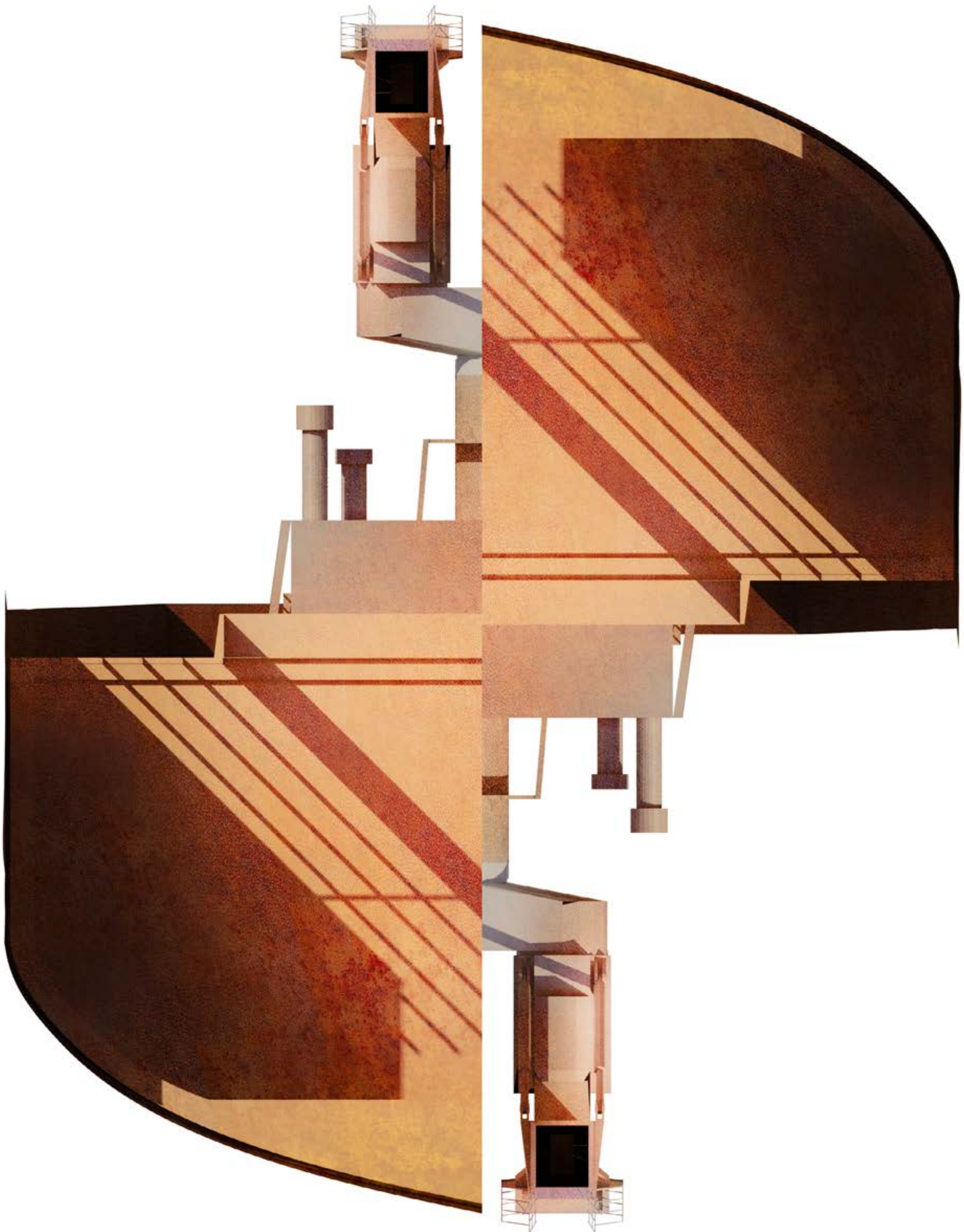


*Fig. 56. Conceptual form study 03.*

*Fig. 57. Conceptual form study 04.*

Abstracting the forms in this way echoes the ideas of Baroque sculptor Gian Lorenzo Bernini, as he said,

> There are two devices which can help the sculptor to judge his work: one is not to see it for a while. The other... is to look at his work through spectacles which will change its colour and magnify or diminish it, so as to disguise it somehow to his eye, and make it look as though it were the work of another.[1]

Abstraction here is used as a lens though which these forms take on a whole new identity spatially and programatically. Through this fluid process of experimentation, several interesting relationships and spaces were discovered. The cross-section of the ship seemed incredibly repetitive, however, and some of the experiments appeared ordinary, expected and, at times, rather boring. The concept of taking apart a massive ship only to re-arrange orthogonal pieces in an obvious way seemed to be an injustice to the overall idea. The adage 'Go big, or go home!' seemed to ring true in this scenario.

The work of artist and sculptor, Richard Serra, has played a huge role in my architectural journey thus far. Much of his work is aimed at exploring the relationship between materials and their relationship with viewer and site. Most profound to me, and pertinent to this design journey, are his studies of large steel plates which are curved in provocative forms. These single sheets explore concavity and convexity, and represent Serra's yearning to better understanding the power of simple geometric form as they entice the viewer to explore such unique forms.[2] Serra's work celebrates form through the isolation of a single material.

Similarly, this design journey steers towards continually asking the question, "What if...?" What if the method of taking apart a ship could be done differently in order to generate exciting forms, stretching the final building's identity further away from a recognizable ship and more towards the celebration of the extracted, peculiar forms. What if the team of arc welders and engineers could extrude a variety of forms from the Rose, and interesting spaces can be imagined within them?

Much like Serra's work, the form of the hull (essentially a monocoque[3]) is manipulated to form a landscape of sorts, settling the weathered, steel museum into the breakwater site. The singular material as a semi-structural skin accentuates the overall form.

---

1 Levin, Irving (1980). *'Bernini and the Unity of the Visual Arts.'* New York: Oxford University Press.

2 Interview between Richard Serra and Adrian Searle, Frieze.com, 'Metal Works.' 2008.

3 Essentially this is where the outer skin is integral with the structure of the body. It is a term derived from French: mono meaning 'single' & coque meaning 'shell'.

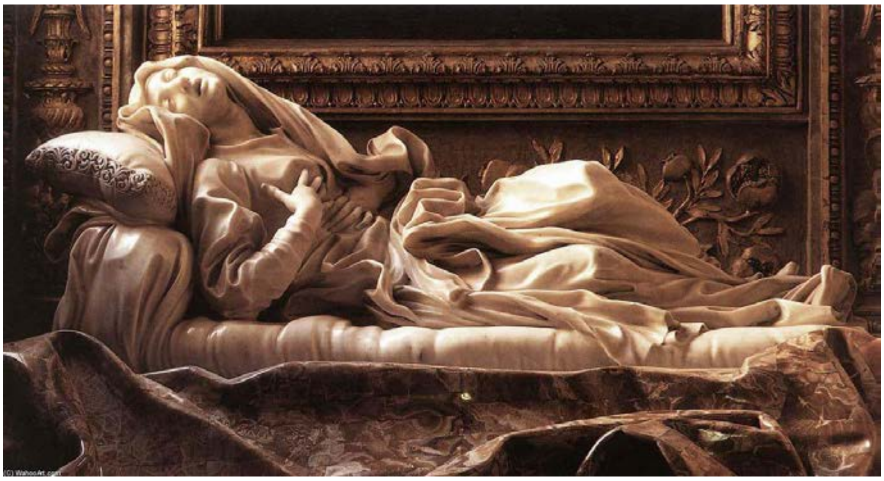


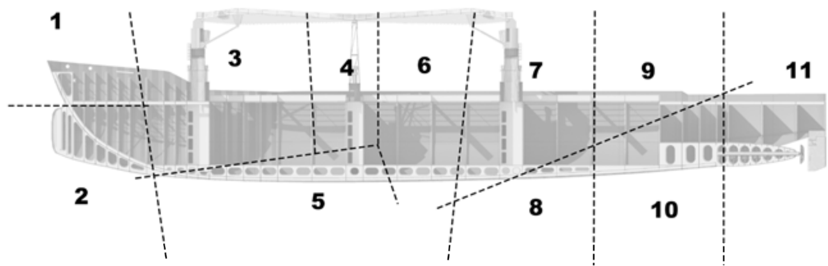
*Fig. 59. 'Beata Ludovica Albertoni', Marble by Gian Lorenzo Bernini (1598-1680, Italy)*

*Fig. 60. 'Torqued Spiral' by Richard Serra, 2004.*

*Fig. 61. 'Snake' by Richard Serra, 1997.*

Again, the Rose was put into a virtual laboratory where it was dissected along less orthogonal lines. The resultant pieces were analysed firstly in abstraction and then through an iterative process whereby many different combinations of components were documented both in isolation and placed onto the breakwater site.

The following diagrams (pages 62 to 67) are conceptual and aimed at testing ideas of how these pieces could come together to create intersting spaces. This method of experimentation was conducted without contraint of program or function, and was rather focused on finding a synthesis of form and potential issues with the construction process. Each component of the Rose was placed on site in the systematic order of the proposed disassembly method (from bow to stern).



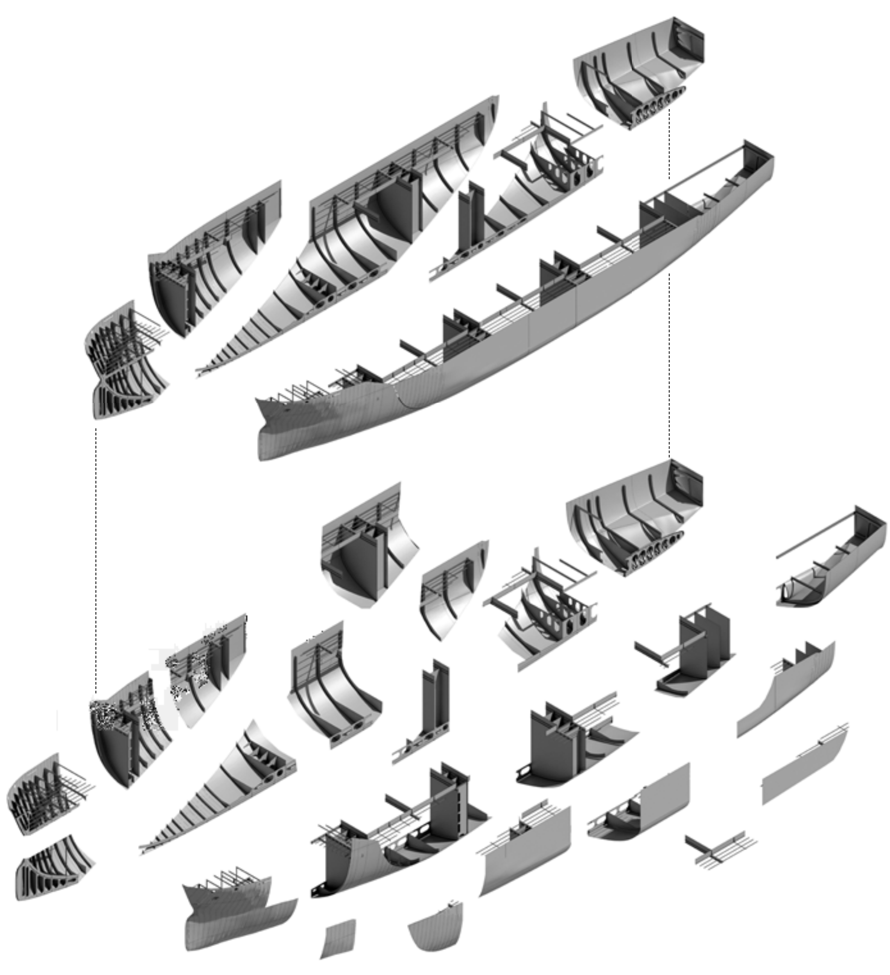
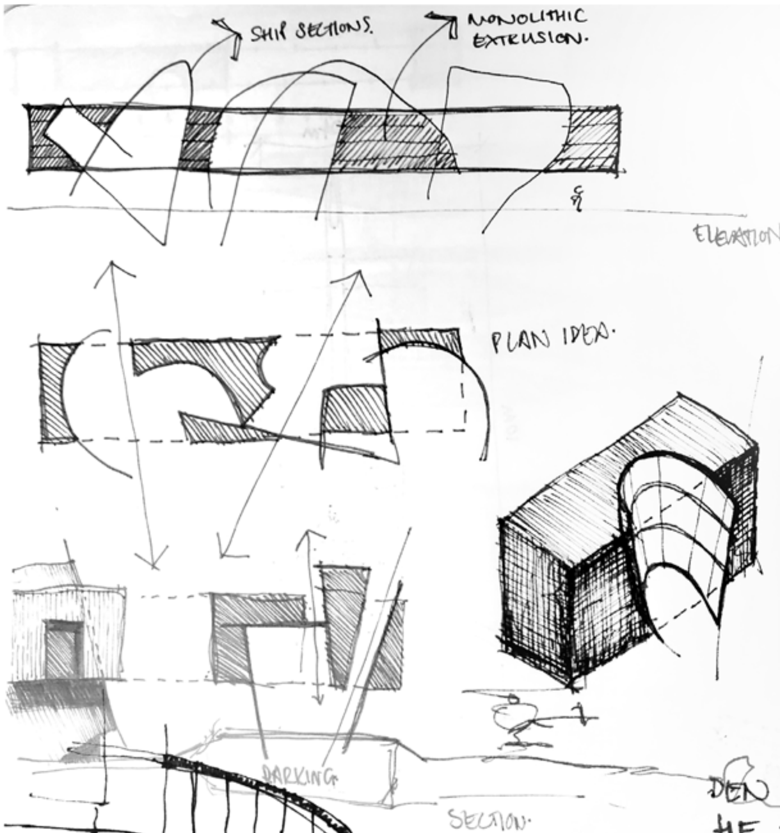
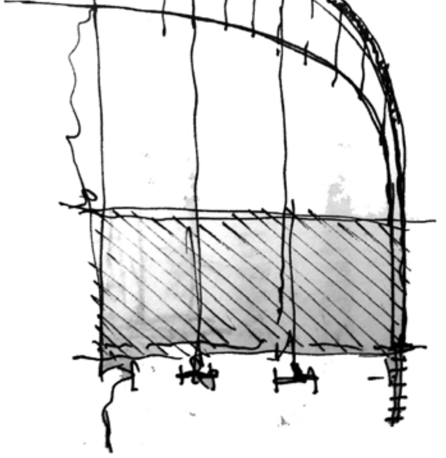
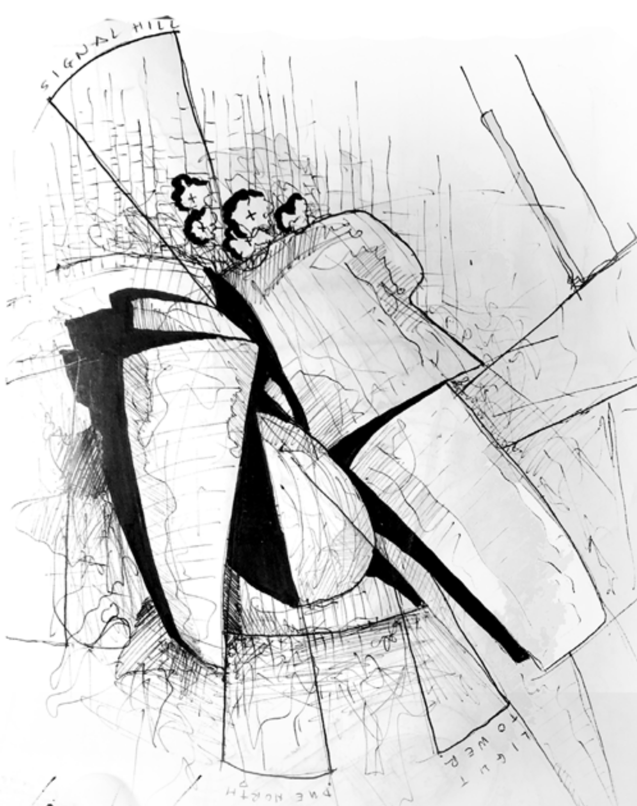



*Fig. 62. (left) Fig. XX. The more imaginative dissection drawings of the Rose.*

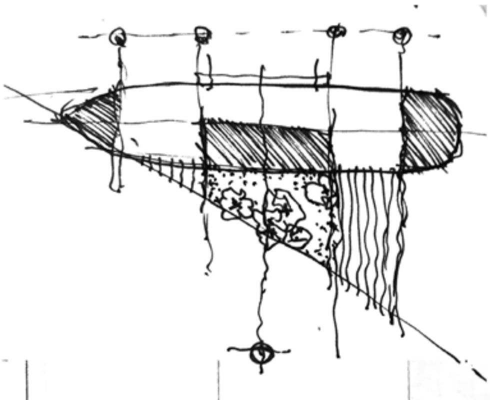
*Fig. 63. (right) Early conceptual sketches of the more dynamic components.*

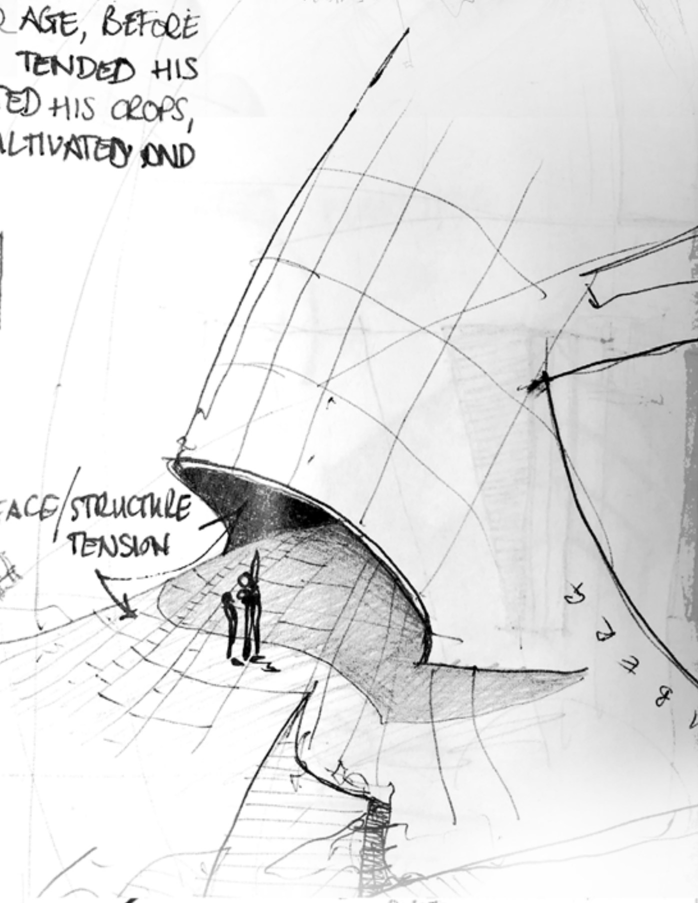


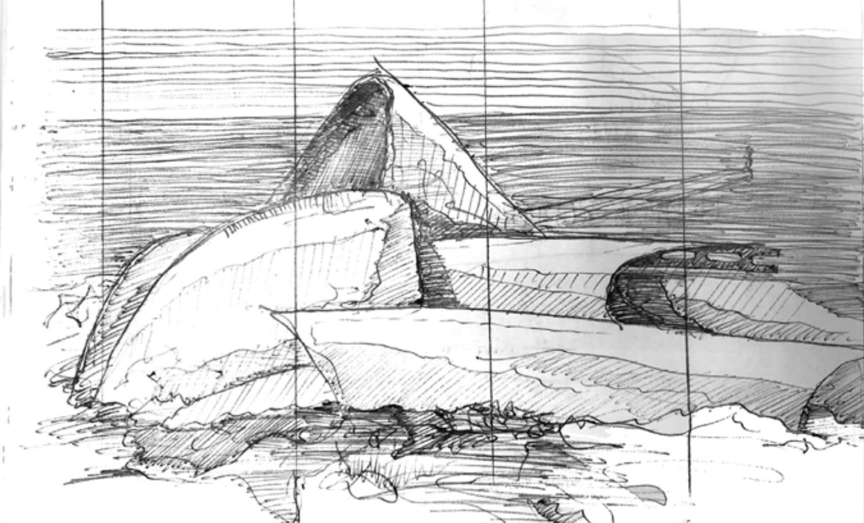



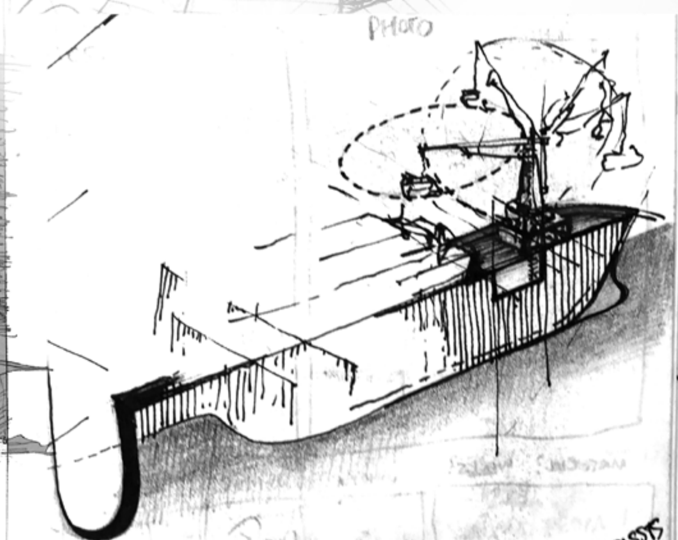


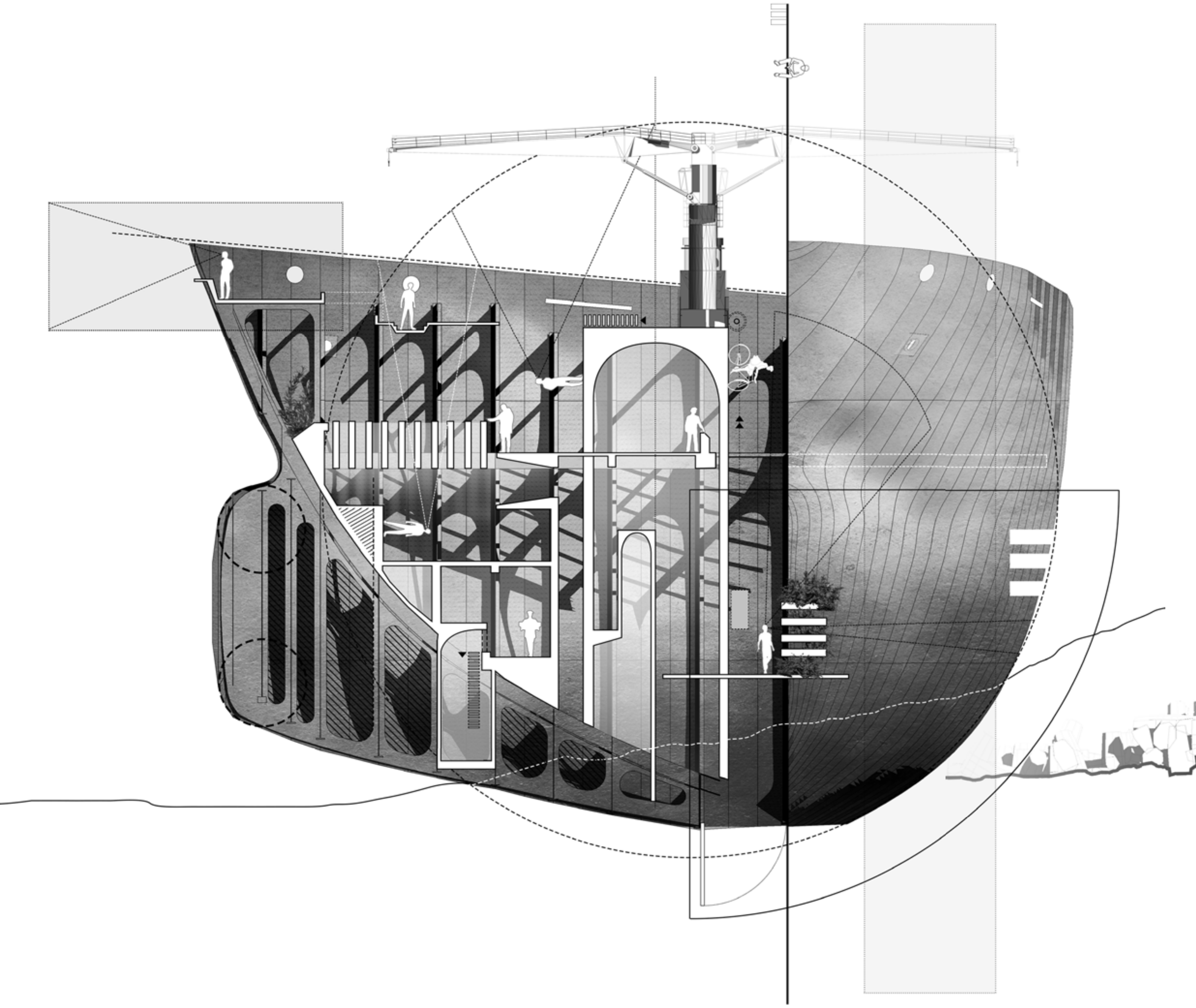

DEN AGE, BEFORE
HE TENDED HIS
WATED HIS CROPS,
CULTIVATED AND









## COMPONENT 01 / BOW SECTION


*Fig. 64. Conceptual form study: Bow.*

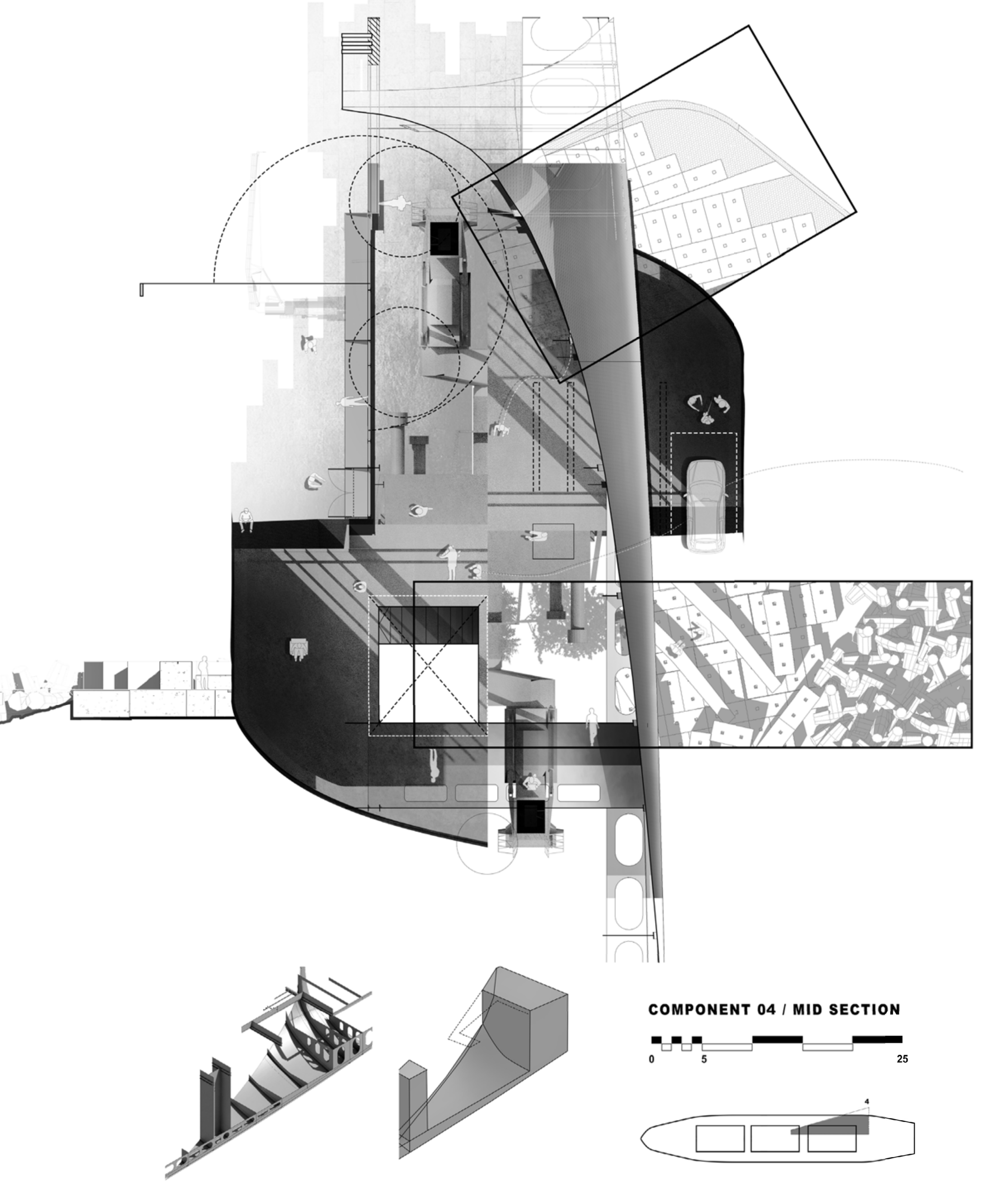
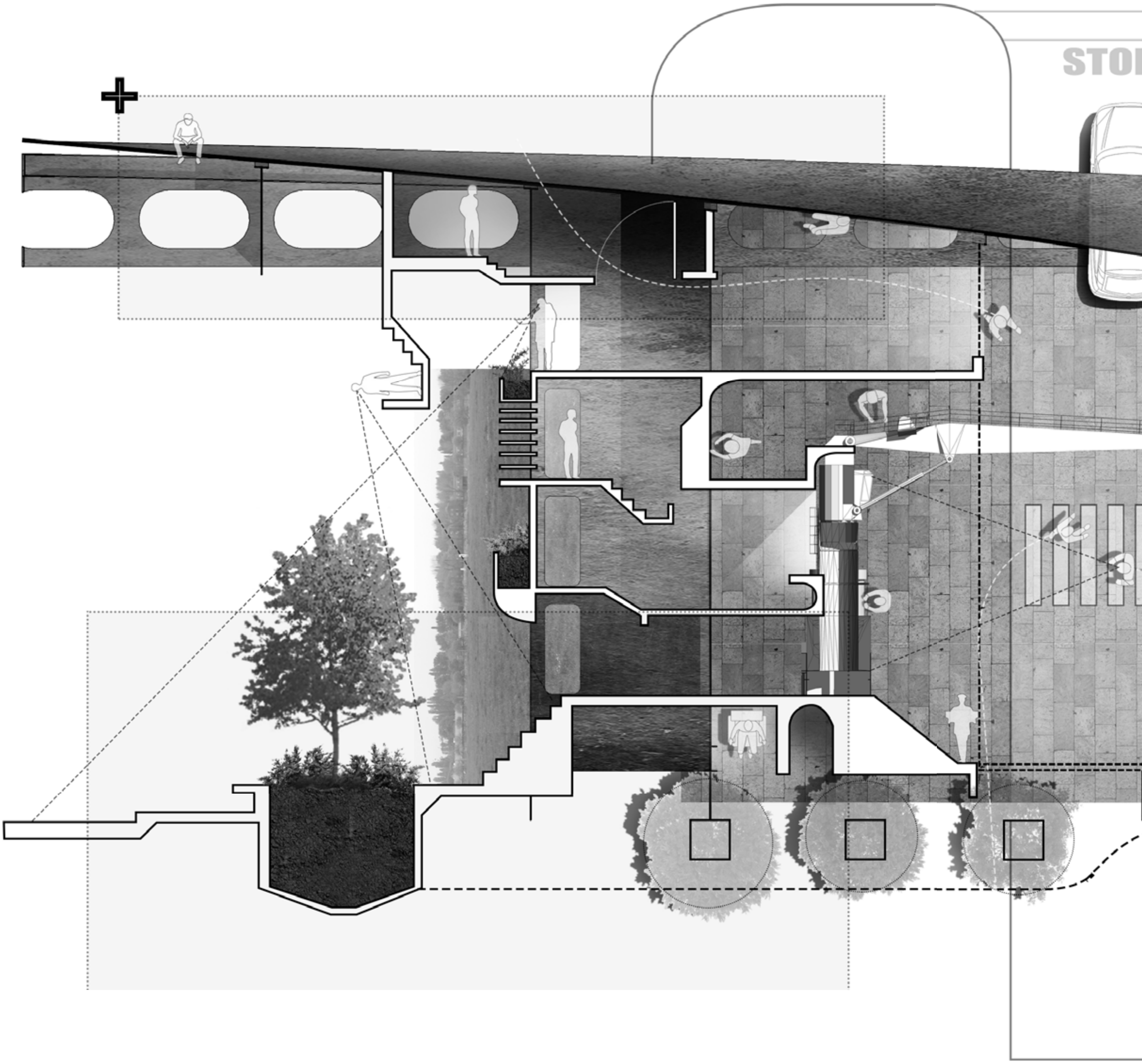
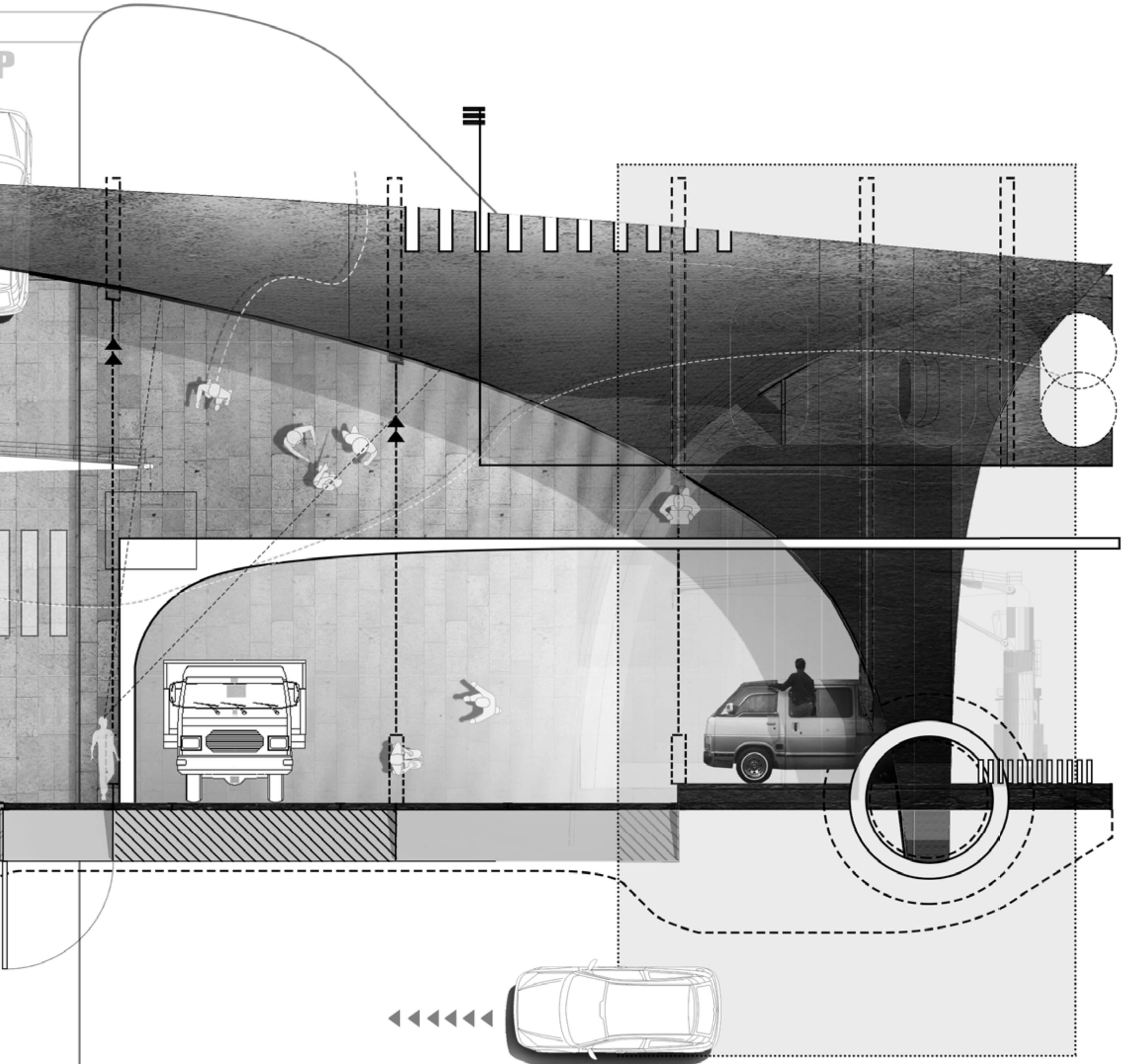


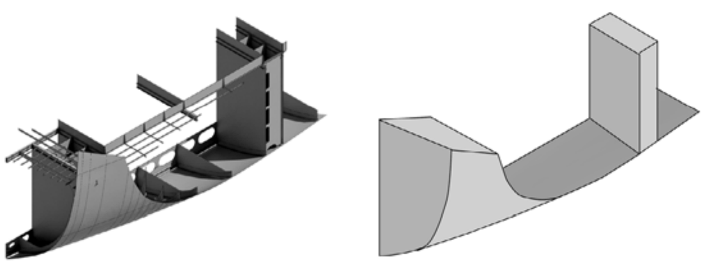

*Fig. 65. Conceptual form study: Mid-section.*




This exericise was intended to be playful, to let the mind wonder and imagine what spaces could develop over time. The only constant in all of the compositions is the presence of human figures which solidify the scale of the overall space and form. Elevation, fixtures, materials, lighting were all manipulated or exaggerated in order to express some of the early design ideas.

This was an important constant as it is very easy to loose sight of how large some of these components actually when operating this process digitally.





## COMPONENT 07 / MID SECTION

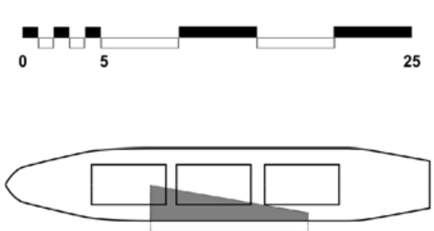



*Fig. 66. Conceptual form study: Mid-section.*

01

*Fig. 67. Form Iteration Study: No. 05 (isometric)*

02

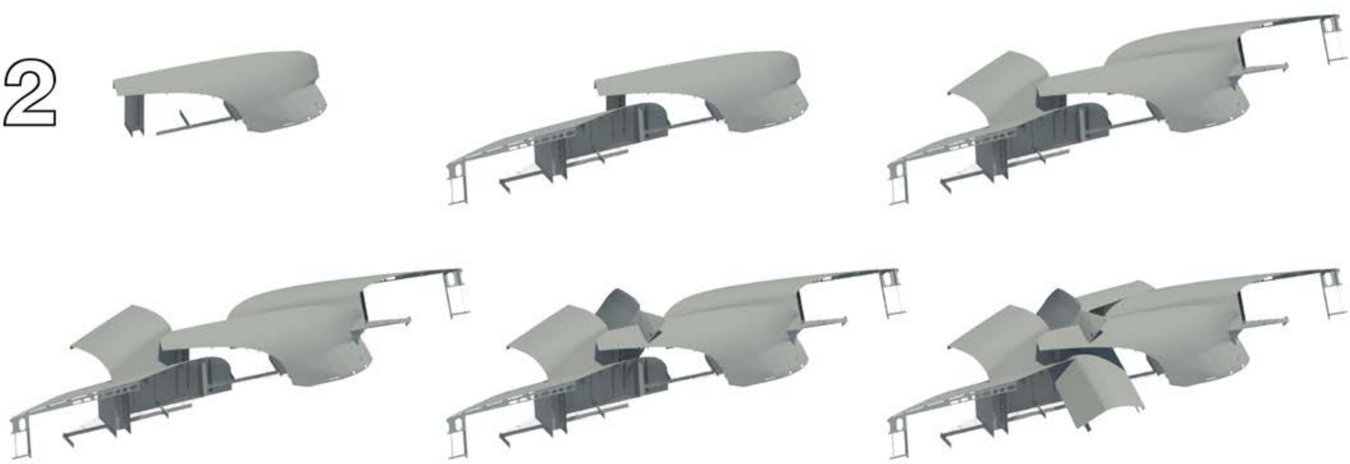


*Fig. 68. Form Iteration Study: No. 24 (isometric)*

The next stage of abstraction and experimentation was to model many different iterations of the components of the Rose together as a building. Each new model was documented in plan, isometric view elevation, and 3D renders to provide a thorough analysis of the relationships between the different forms. 30 different iterations were constructed over two months. Through a process of elimination, certain key spatial relationships were found, as well as several intriguing geometric occurrences which are further developed in the sketch design.

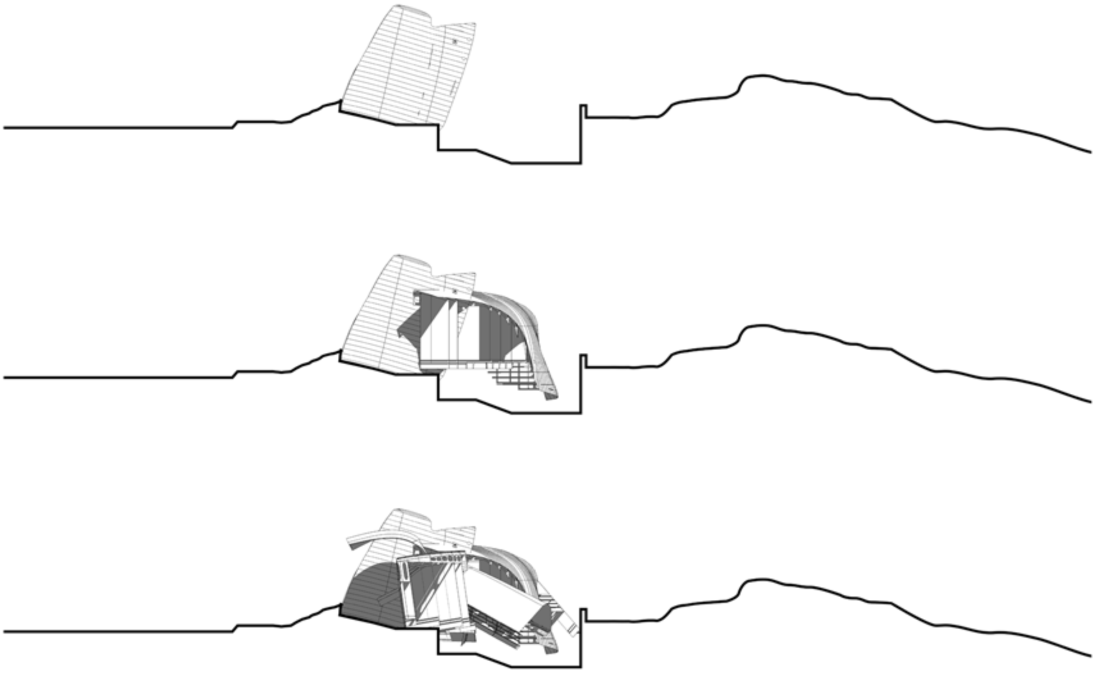


*Fig. 69. Form Iteration Study: No. 02 (elevation)*

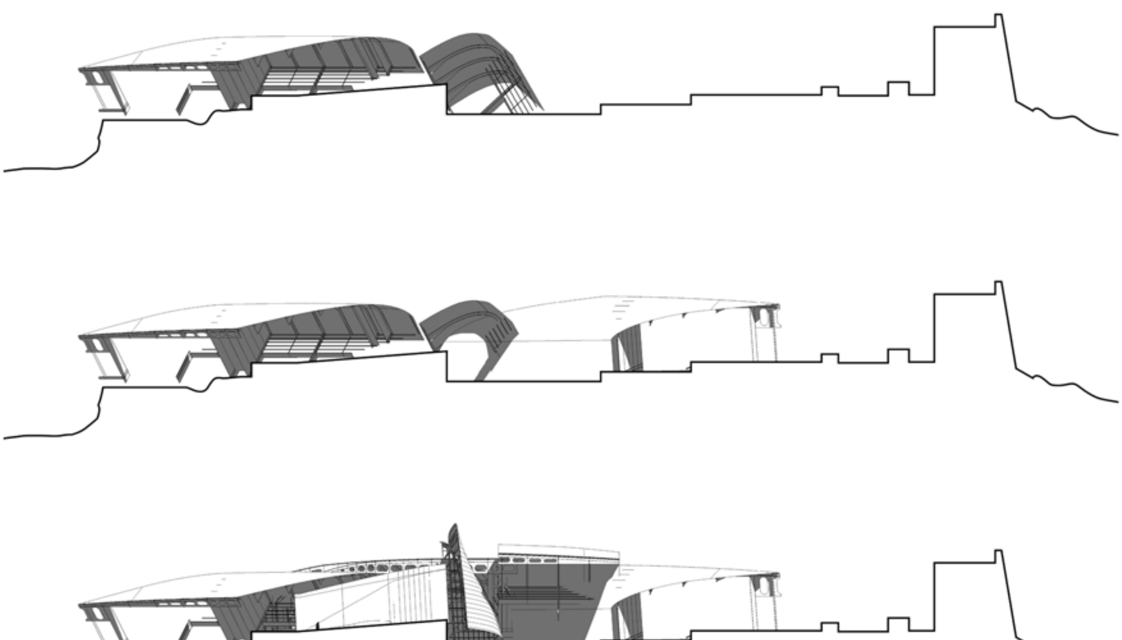


*Fig. 70. Form Iteration Study: No. 24 (elevation)*

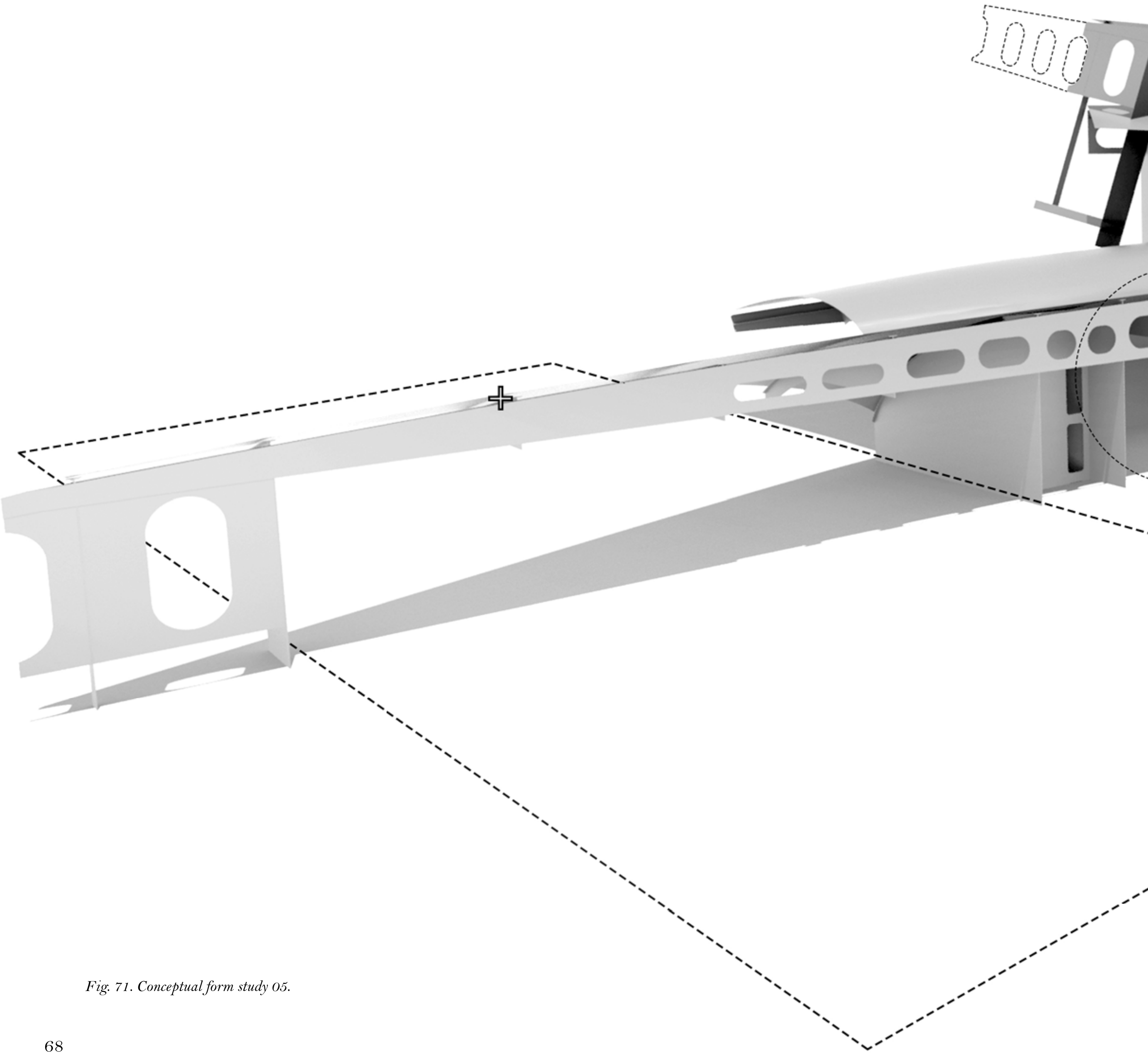
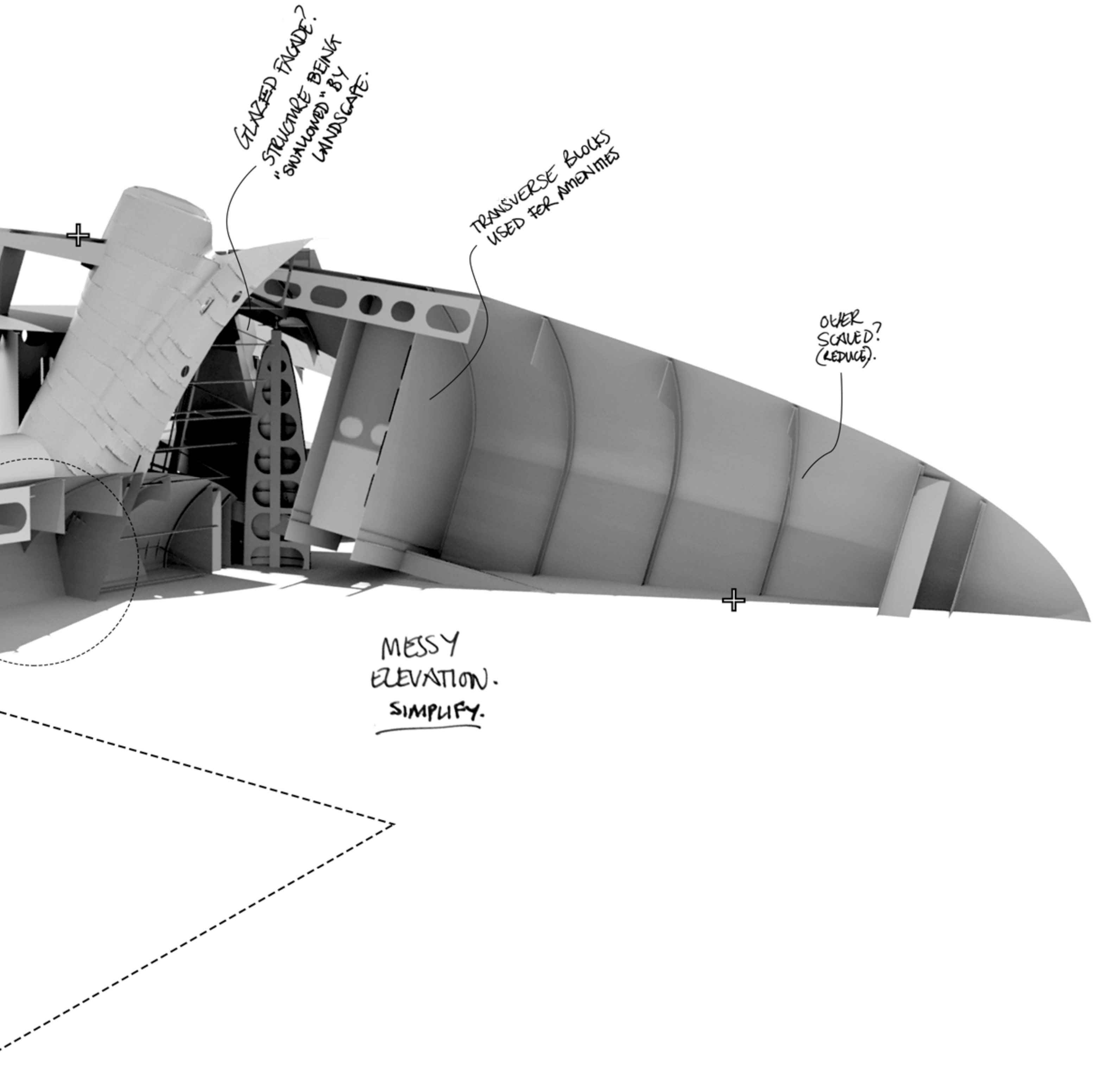


*Fig. 71. Conceptual form study 05.*


GLAZED FAÇADE?
STRUCTURE BEING "SWALLOWED" BY LANDSCAPE.
TRANSVERSE BLOCKS USED FOR AMENITIES
OVER SCALED? (REDUCE).
MESSY ELEVATION. SIMPLIFY.

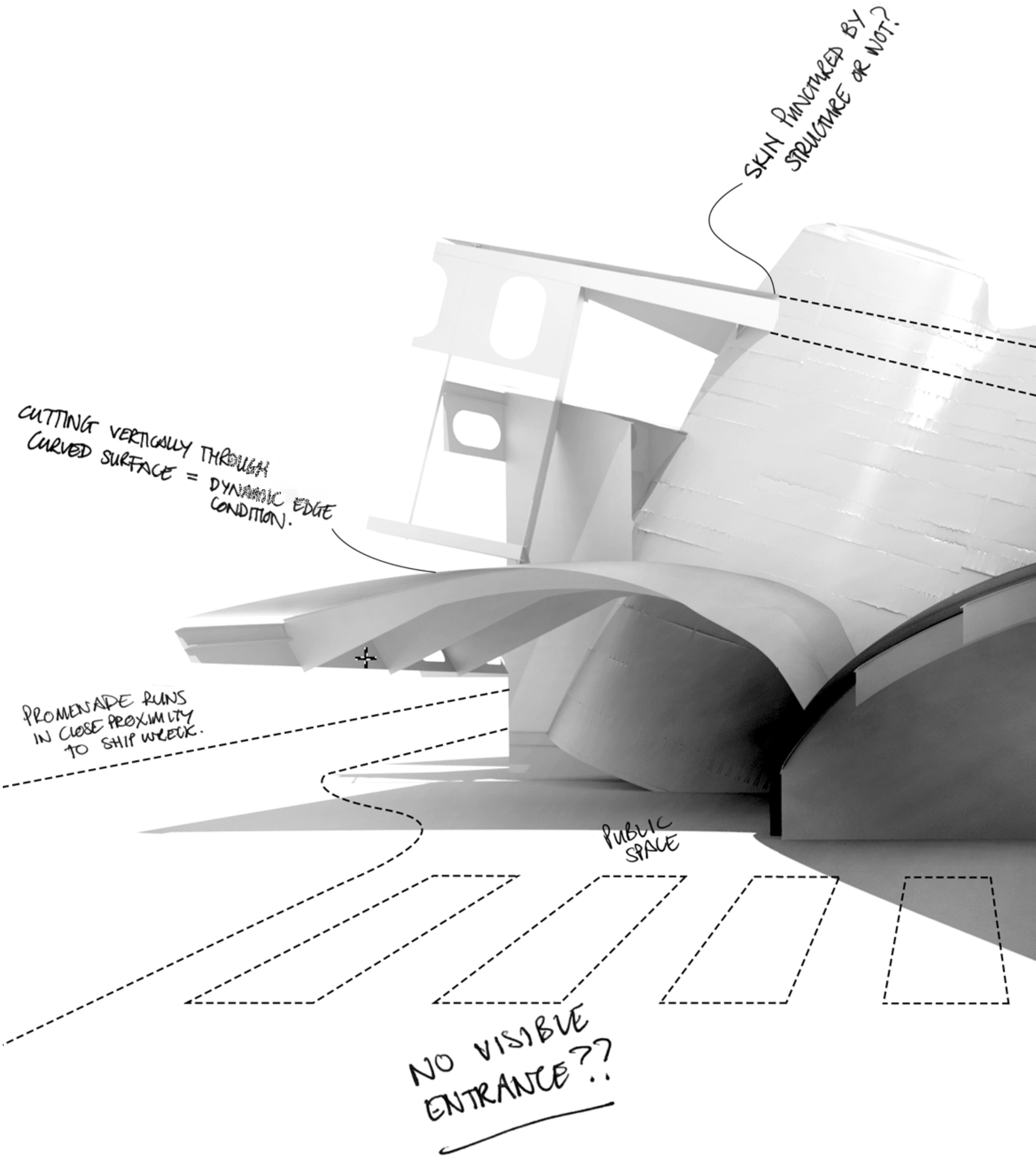
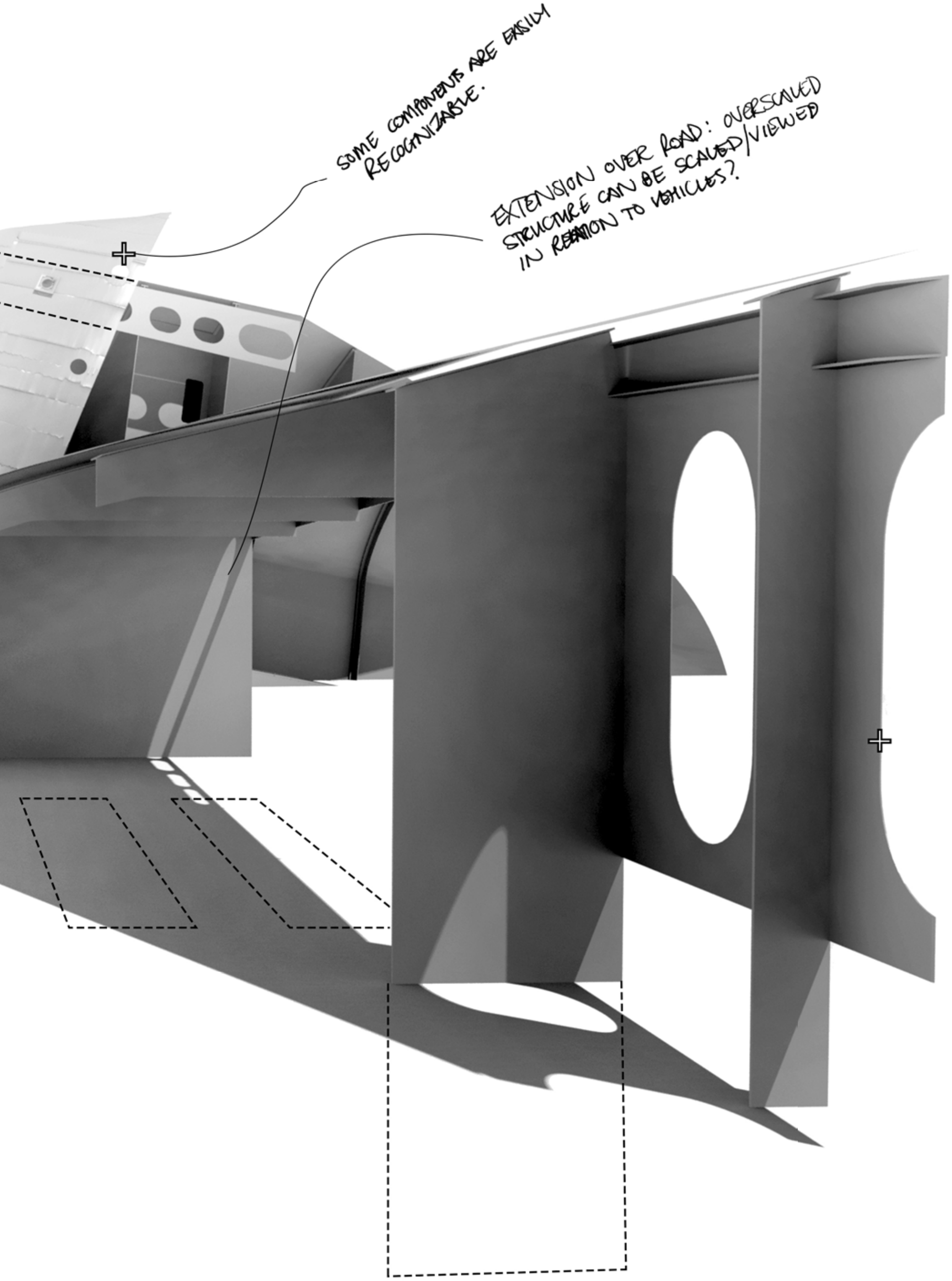



*Fig. 72. Conceptual form study 06.*


SOME COMPONENTS ARE EASILY RECOGNIZABLE.
EXTENSION OVER ROAD: OVERSCALED STRUCTURE CAN BE SCALED/VIEWED IN RELATION TO VEHICLES?

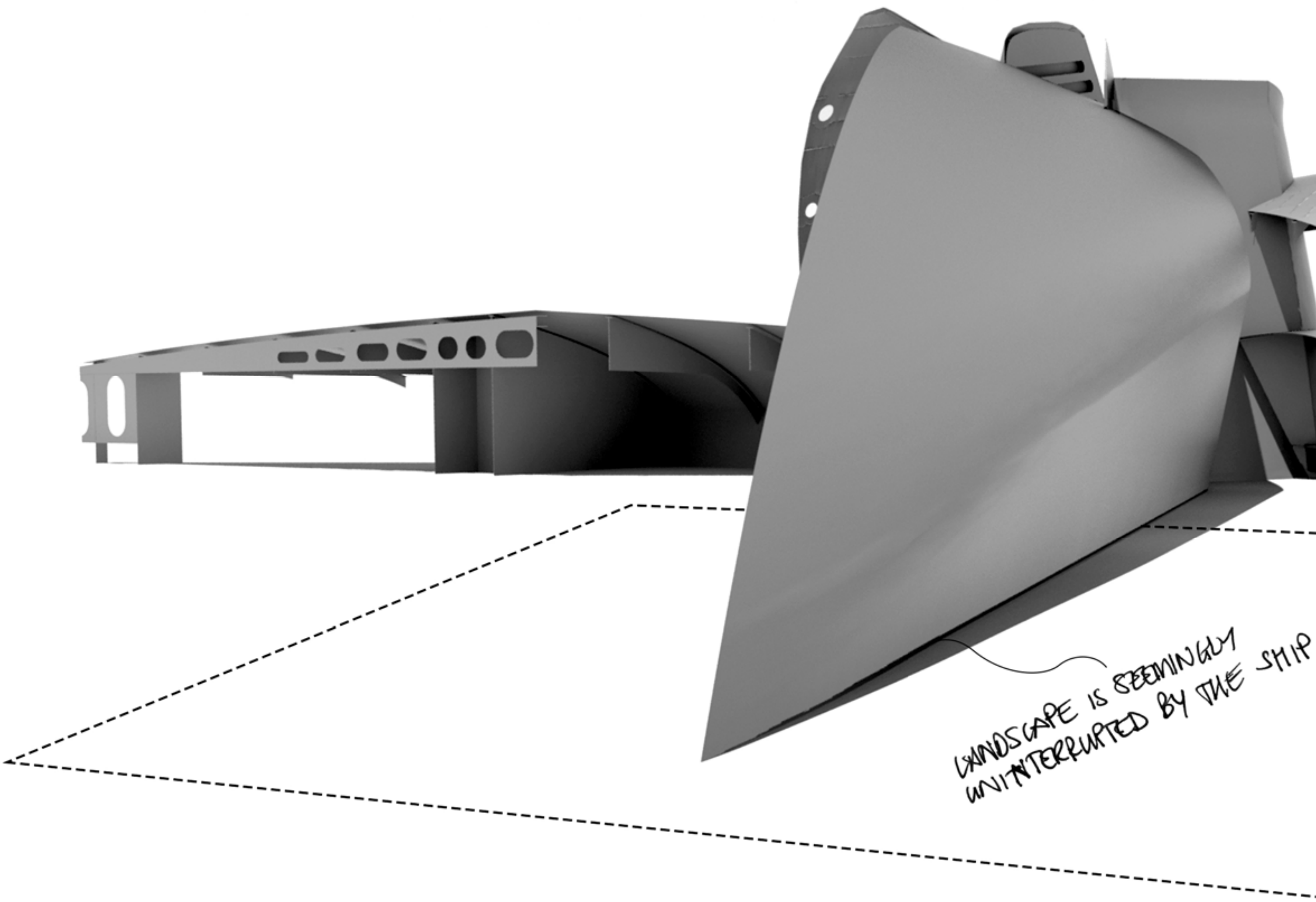
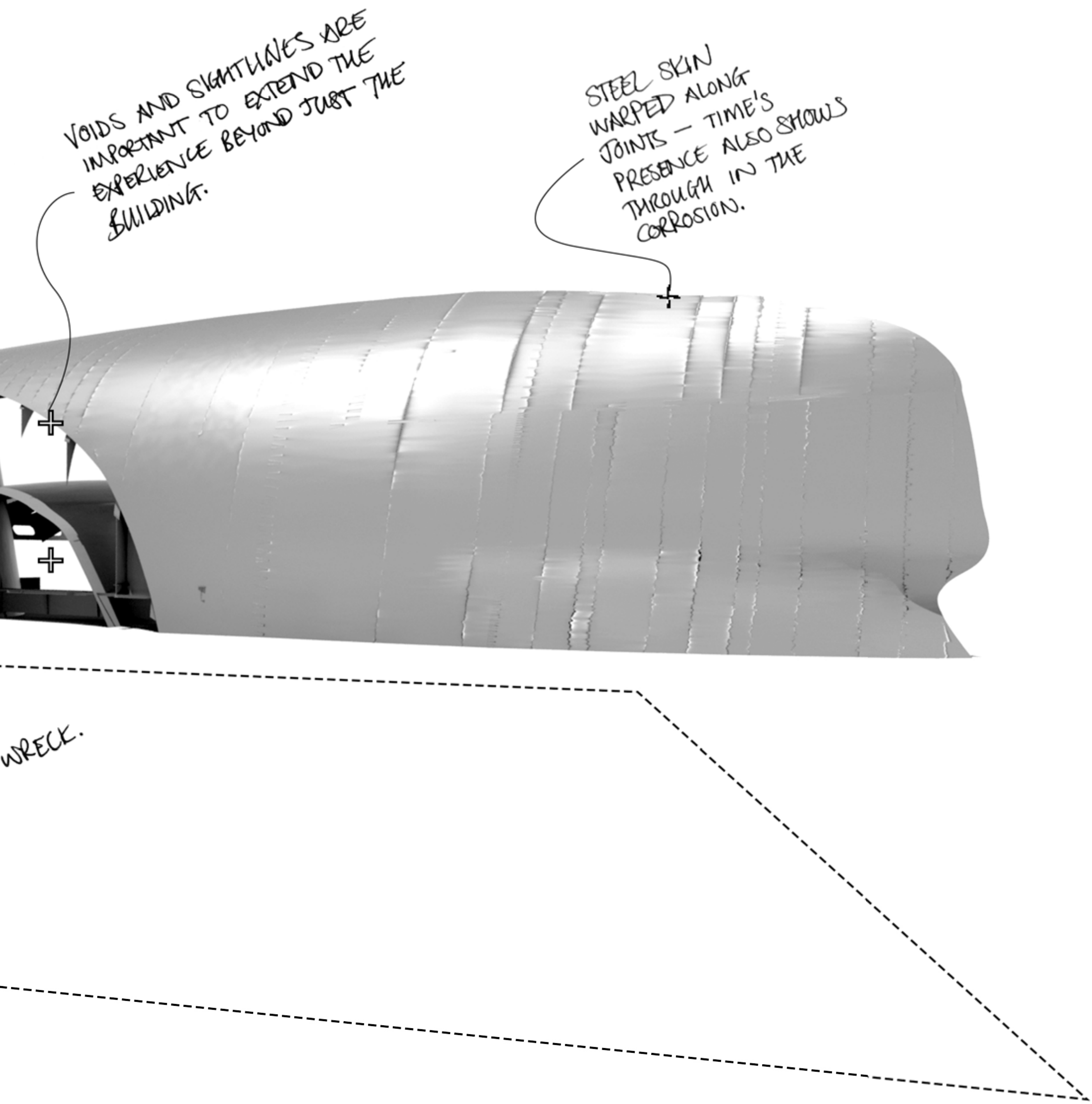


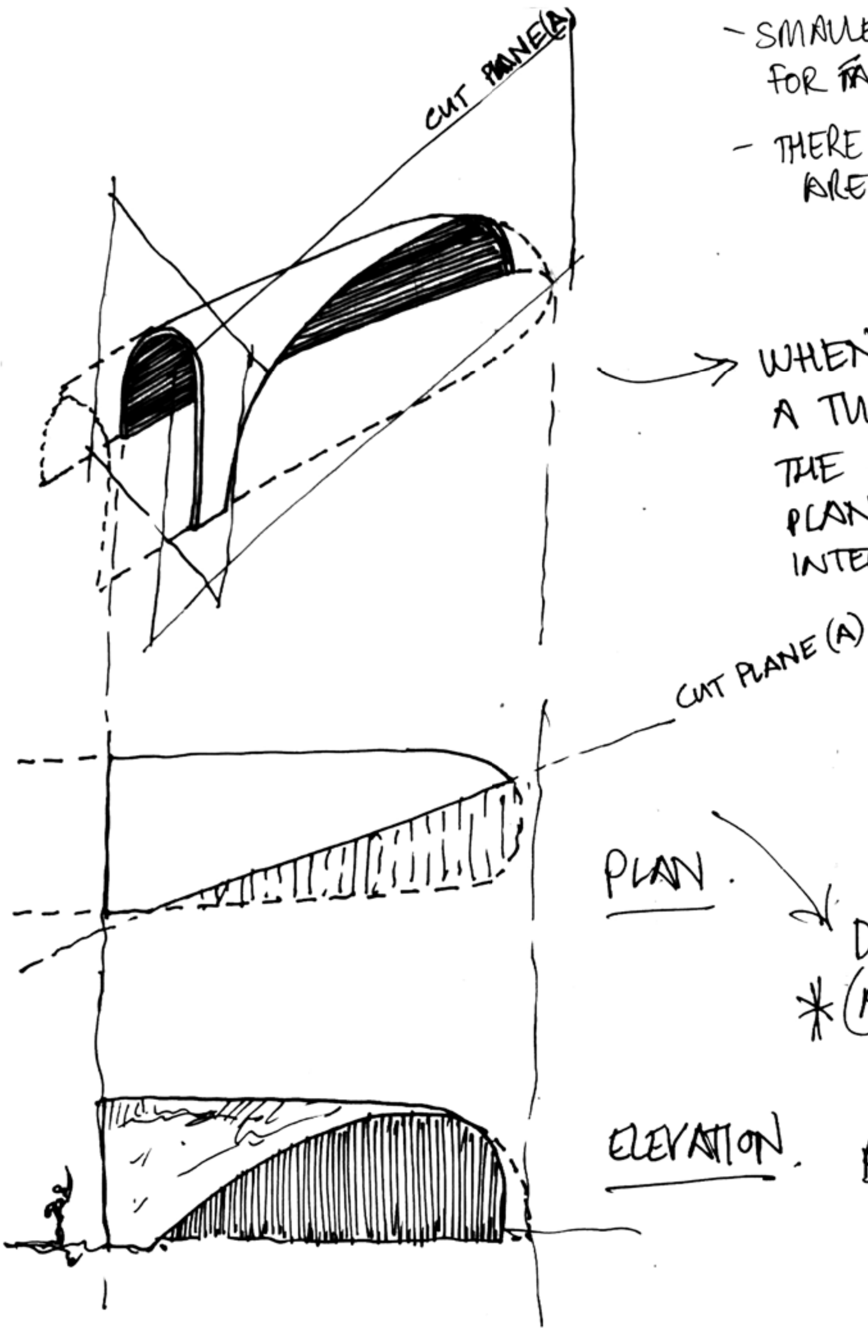

*Fig. 73. Conceptual form study 06.*


VOIDS AND SIGHTLINES ARE IMPORTANT TO EXTEND THE EXPERIENCE BEYOND JUST THE BUILDING.
STEEL SKIN WARPED ALONG JOINTS — TIME'S PRESENCE ALSO SHOWS THROUGH IN THE CORROSION.
WRECK.

# DEDUCTIONS FROM CONCEPTUAL STAGES.

BUILDING CAN EXTEND OUTWARDS DUE TO THE LONG STRUCTURE.

- SMALLER PIECES MAKE FOR FAR TOO COMPLEX SPACES
- THERE ARE COMPONENTS WHICH ARE TOO BIG (#002, #007, #014)




WHEN CUTTING ACROSS A TUBULAR SHAPE, THE STRAIGHT CUT IN PLAN LEAVES A VERY INTERESTING CURVE IN ELEVATION.

DELICATE EDGES...
* (ADDITIONAL STEEL NEEDED TO BRACE COMPONENTS BEFORE TRANSPORT).

*Fig. 74. Sketching of ideas after the initial stage of analysis.*

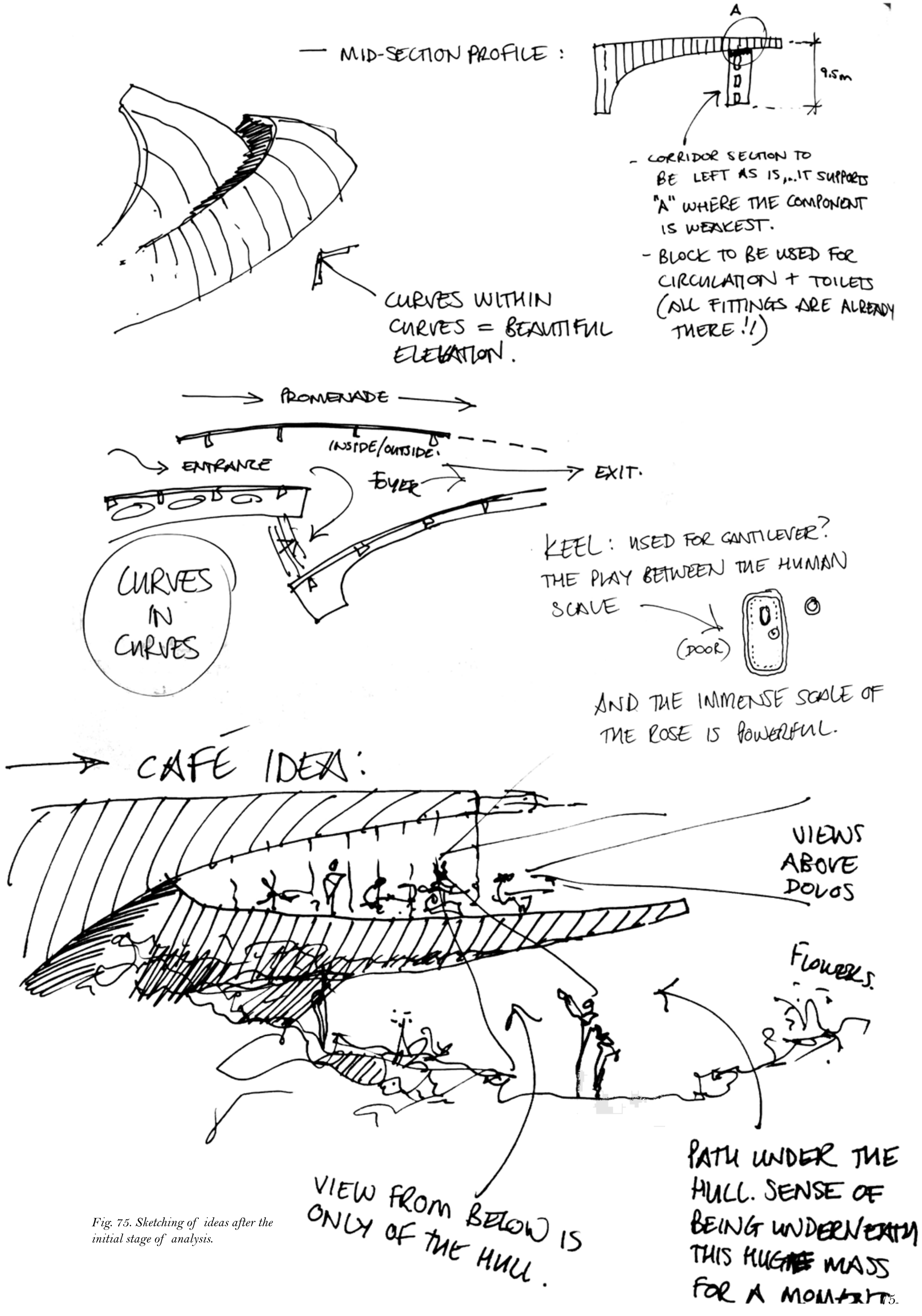



*Fig. 75. Sketching of ideas after the initial stage of analysis.*

## TECHNICAL ANALYSIS

The land along the breakwater is largely made up of stone from the near by Signal Hill quarries as well as the soil and rocks extracted from the construction of the Prince Alfred Basin (1860), Victoria Basin (1920) and Duncan Dock (1945).[1] One of the key design decisions from the early conceptual stage of the project was for the museum to consist of a strong concrete base with the elegant steel forms from the Rose resting upon it, much like a ship which has been wrecked upon the rocks. Construction of such a building at the breakwater site was investigated, and two primary concerns were highlighted:

1. Foundations: The soil conditions on site would demand a deep foundational system to reduce potential movement in the structure over time, as well as to found the building on the bedrock rather than the loose reclaimed land.

2. Steel Structure: The forces acting on the various large components of the Rose would need to be evenly distributed into the ground. Due to their individual complexity, a feasible structural system would have to be applied to accommodate the steel structure.

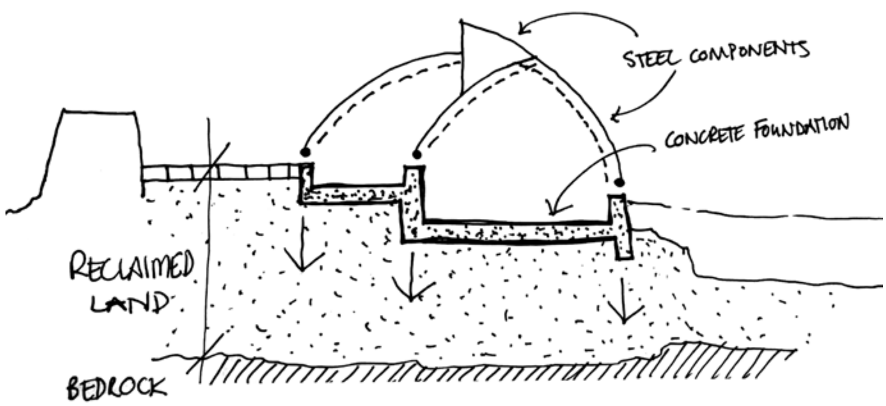



*Fig. 76. Early sketch of the basic idea behind the foundation of the museum. The foundations and floor slabs are mimicking the surfaces around the old wall, and the large 4m x 2m x 1.5m concrete blocks are also used throughout the lower levels as the same language of the exterior terrain is drawn in through the building.*

## 1. FOUNDATIONS

The first issue, that of the foundatons of the museum, was resolved through the use of a pile foundation system. A pile is basically a long cylinder of a strong material, usually reinforced concrete, which is installed deep into the ground to transfer the weight of a building directly into more stable soil or the bedrock.[2]

Piles distribute forces into the ground in two manners. Firstly, a pile can disribute a load acting upon it through friction. Secondly, end

1 Worden, N. 1992: 7.

2 Cornick, H. 1968: 306.

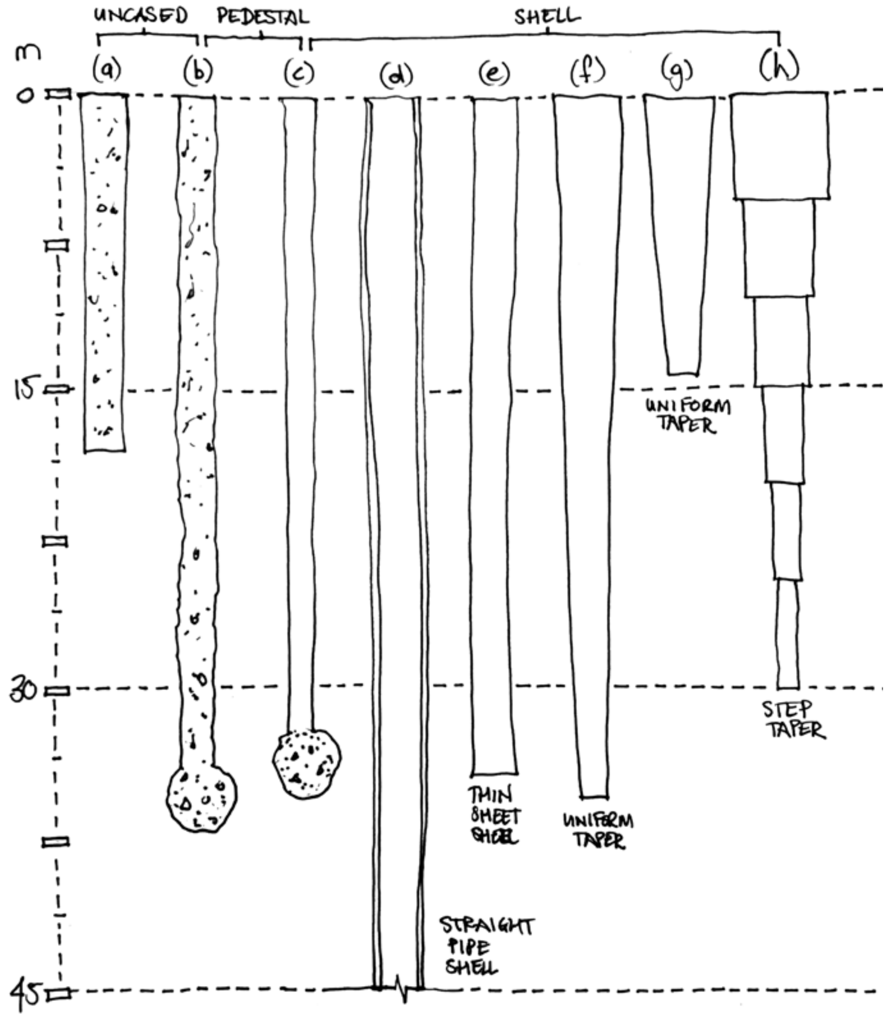



*Fig. 77. Sketch of the many different kinds of piles: (a) uncased pile; (b) Franki uncased-pedestal pile; (c) Franki cased-pedestal pile; (d) seamless pipe pile; (e) cased thin sheet shell pile; (f) monotube pile; (g) uniform tapered pile; (h) step-tapered pile. This sketch is based on the work in 'Foundation Analysis and Design' by Joseph E. Bowles, 1997.*

bearing piles act like submerged columns in a way as they transfer the laod straight down into a surface with a good load bearing capacity, bypassing weak soil.[1] There are several different kinds of piles, each used in different conditions (see fig. 77 above). The new maritime museum will need to be founded on the deeper bedrock, therefore, a foundational system using uncased 'Franki' piles will be used.

Uncased 'Franki' piles work both as friction piles (the uncased concrete grips the surrounding soil), as well as end bearing piles. They have a reasonable tensile load capacity as the base toe also acts as an anchor to the building, preventing any lifting of the structure. Another consideration would be their environemntal impact. Construction along the waters edge in Table Bay needs to firstly be approved by the Department of Environmental Affairs due to the high impact such activities could have on the surrounding marine life. As Franki piles have relatively low noise and ground vibration levels in comparision to other types of piles they are the most logical choice for the foundation of the museum.[2]

1 Cornick, H. 1968: 306.
2 Ibid.

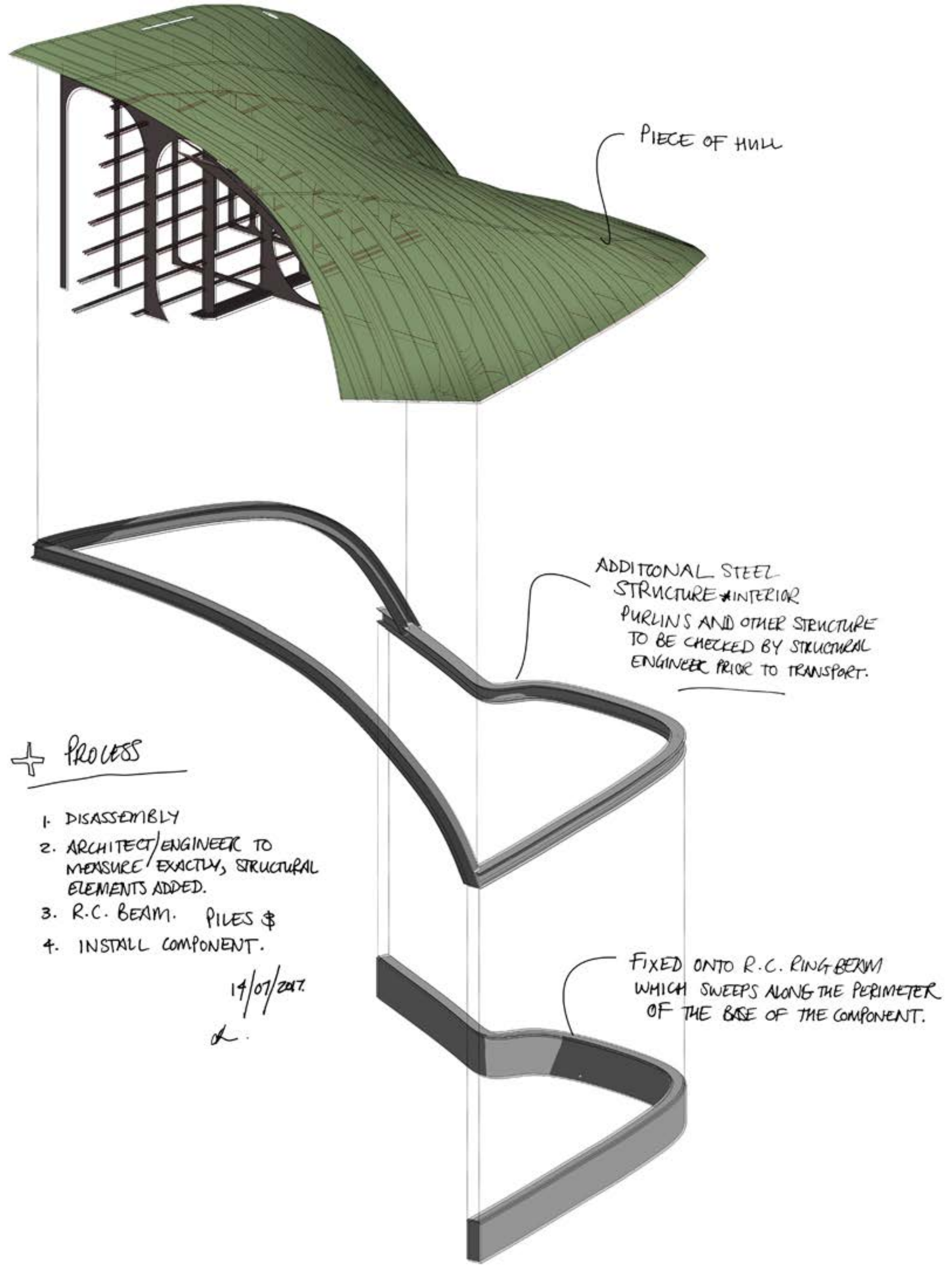



*Fig. 78. Sketch showing how the pieces extracted from the Rose are reinforced with additional steel (also obtained from the ship). The alternative method of disassembly would be to completely break apart every piece of the ship and then rebuild the components again as design on site. This would be far more complicated than the current proposal. With the help of the massive gantry system these pieces will be carefully removed, reinforced and then moved into place on site.*

## 2. STEEL STRUCTURE

This second concern has been included in this geo-technical analysis as the structural resolution of such large components is dealt with using the primary concrete foundation, despite the steel structure being above ground.

The steel structure needs to address three main issues: (a) maintaining structural integrity of each component as it is extracted from the Rose, (b) distribution of structural loads onto concrete foundation, and (c) protecting the steel to avoid corrosion.

*(a) Maintaining Structural Integrity:*

The monocoque structure of the Rose is compromised when the ship is disassembled in the manner which this dissertation suggests. In order to maintain the overall structural integrity of each component as it is removed from the main vessel, additional steel structure will be required. One of the main reasons why the Rose is to be broken apart on site rather than in off site dry docks is the fact that deformation of the disassembled components is drastically reduced by not having to transport these large awkward shapes of steel over a large distance.

As the process of disassembly is largely achieved by engineers manually cutting out the desired form using oxyacetylene torches, human error would have to be factored in. This, among other issues such as potential deformation of the hull prior to disassembly, has been considered in the design process.

Despite the hypothetical nature of this project, a fair amount of room for error is intended in the process of disassembly and construction of the museum. Each component is to be cut out of the Rose as per the architectural drawings, however, there is an allowance for a deviation of form. The process of disassembling the Rose systematically from its bow to stern is not only common practice in the ship breaking industry, but it also has an interesting influence on the construction process.

Each piece is carefully laid in place, and the following piece is then adjusted to fit around it. This is an incremental design whereby human error or deviation from the initial architectural drawings would have to be carefully and individually resolved as each component is placed on site. This is not outside the role of the architect today, as one is typically required to ensure that a building is built as per the construction drawings, however, circumstances occur whereby compromise or alterations to the initial design are made.

With regards to the new maritime museum, the poetic process of using pieces of a ship to build a building is less about a feasible and expedient project, and more about the slow crafting of a structure through a careful and complex process.

*(b) Distribution of loads onto concrete foundation:*

The mediator between the steel monocoque and the pile foundations will be a reinforced concrete ring-beam. The beam will follow the base outline of each of the large steel components. All of the forces will then be evenly distributed downwards onto the pile foundations. This simple method will also be used to keep the main steel structure at least 500mm above the ground level in order to prevent any contact with ground surface water, reducing the chance of corrosion.

*(c) Protection of steel to avoid corrosion:*

The corrosion of steel is the process which occurs when it is simultaneously exposed to oxygen and moisture. The iron content of the steel is oxidised and can expand to about 6 times its original size. This electrochemical process produces hydrated ferric oxide (rust) on the steel and, over time, can significantly reduce structural integrity.[1] In regions where there is a high moisture content, such as that found in Cape Town near the breakwater, steel must be protected by various means if it is to perform structurally. The various atmospheric corrosivity categories and examples of typical environments are shown in Table 2 (top right).

The breakwater site falls into the C5-M category which means that the average steel thickness loss over 5 years could be at least 1mm. Marine steel thickness ranges from 4.5mm to 30mm, with the most economical strength to thickness ratio for hull plating being around 6mm.[2] This average of 6mm will be taken as the given thickness of the hull plates of the Rose, and the structural frame is based on the naval construction drawings on which the BIM model was based.

Certain high strength low alloy steels corrode in such a way that the rust forms a protective layer against further corrosion. Where the rust on normal steel would fall off after some time, starting the corrosive process again, these atmospheric corrosion resistant steels maintain their initial rust layer. Structures built from these steels can have up to a 120 year design life with minimal maintenance due to the extremely low corrosion rate.[3] This is an extremely interesting notion for this development of this design project as the breakwater site is subject to extreme atmospheric conditions, calling for an architectural intervention which needs to be highly resilient as well as have a reduced maintenance requirement.

Although this weathering steel, commonly known as 'Cor-Ten' steel, is marginally more expensive than traditional steel, construction and maintenance costs are significantly reduced as there is no need to paint the steel with protective coatings. It requires very little maintenance throughout the lifespan of the building, reducing

1 Macsteel, 2017.
2 Ibid.
3 World Steel Association, 2017.

*Table 3. Corrosivity Categories and Environments (Based on the information obtained from World Steel Association, 2017.)*

| Corrosivity category and risk | Low-carbon steel Thickness loss (µm)* | Examples of typical environments in a temperate climate (informative only) | |
|---|---|---|---|
| | | Exterior | Interior |
| C1 (very low) | ≤ 1.3 | - | Heated buildings with clean atmospheres, e.g. offices, shops, schools, hotels |
| C2 (low) | > 1.3 to 25 | Atmospheres with low level of pollution (mostly rural areas) | Unheated buildings where condensation may occur, e.g. depots, sports halls |
| C3 (medium) | > 25 to 50 | Urban and industrial atmospheres, moderate sulphur dioxide pollution, coastal area with low salinity | Production rooms with high humidity and some air pollution e.g. food-processing plants, laundries, breweries, dairies |
| C4 (high) | > 50 to 80 | Industrial areas and coastal areas with moderate salinity | Chemical plants, swimming pools, coastal, ship and boatyards |
| C5 I (very high - industrial) | > 80 to 200 | Industrial areas with high humidity and aggressive atmosphere | Buildings or areas with almost permanent condensation and high pollution |
| C5 M (very high - marine) | > 80 to 200 | Coastal and offshore areas with high salinity | Buildings or areas with almost permanent condensation and high pollution |

1µm (1 micron) = 0.001mm

*The thickness loss values are after the first year of exposure. Losses may reduce over subsequent years.

In coastal areas in hot, humid zones, the mass or thickness losses can exceed the limits stated above. Special precautions must therefore be taken when selecting protective paint systems for structures in such areas.

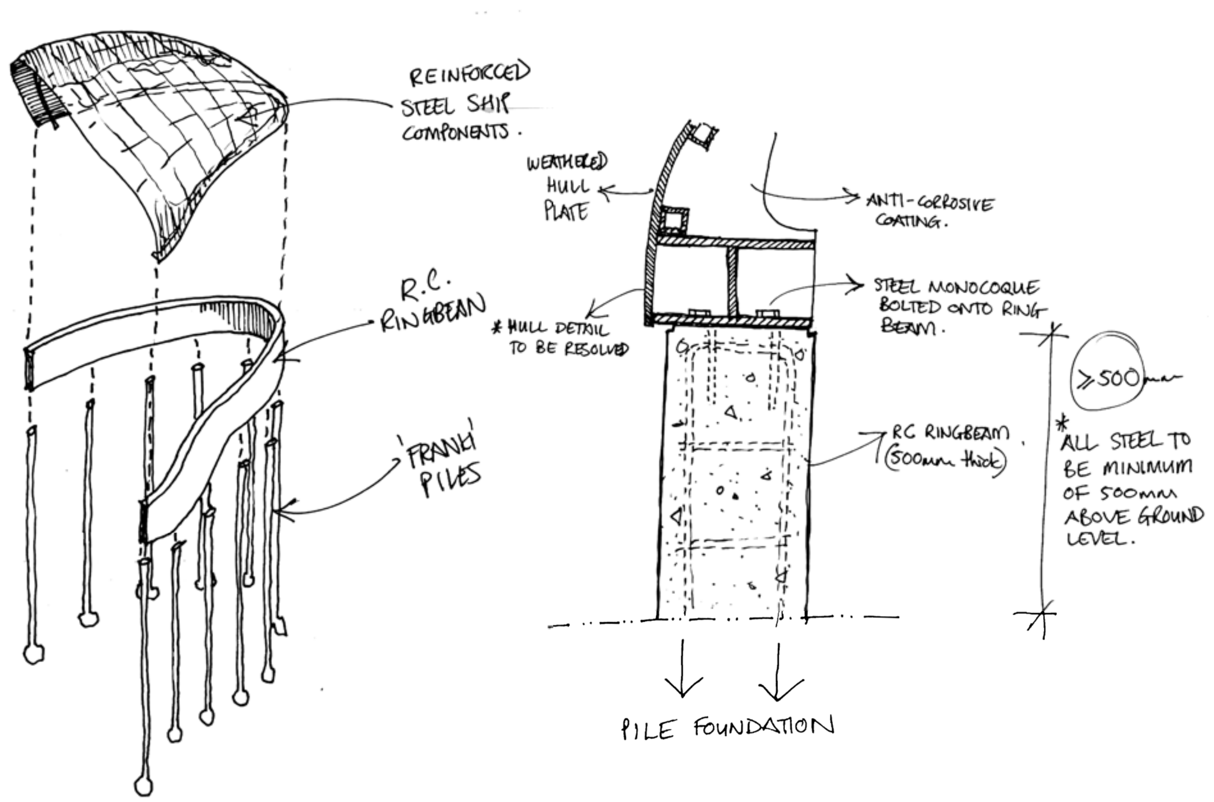



*Fig. 78. Sketch design of the basic structure (piles & ring-beam) and an early detail section of the joint between the steel monocoque and the reinforced concrete ring-beam.*

overall costs.[1] The proximity to the Atlantic Ocean means that there is a constant presence of water and a high salt content. It would be suggested that structural engineers check the major structural elements annually.

Weathered steel has been used in many different ways as it can be rather powerful if used creatively. Instead of trying to completely prevent all of the steel on site from corroding, the design along the breakwater is deliberately designed with corrosion as a material which marks the effects of time on the building, even on the site. As the weathered steel plates near the point of structural instability, additional steel plates from recycled ships could be obtained. This falls in line with the theoretical undertaking whereby this project is not only a single instance by which a ship becomes a building, but it is a building which is maintained by the steady income of recycled steel from ships.

Over time, the museum may grow with the addition of a second vessel, as the architectural design continues turning matter out of place into something which matters.

1 *World Steel Association, 2017.*

*Fig. 79. A collage of materials for the exterior of the museum: it is a search for a synthesis between the materials of both ship and site.*

*Fig. 80. Dovecote Studio by Haworth Tompkins with a Cor-Ten addition. Weathered steel may seem so evocative as it is a direct counter to how steel is typically treated, where it is polished, stainless and serious. In this way, the museum takes on the very same rustic qualities found on site and it developes a character with age.*

*Fig. 81. The exposed steel loops used to lift the large concrete blocks rust away, staining the water and the surrounding concrete. Similarly, the rusting of the outer skin of the monocoque of the museum will effect the base on which it sits.*

## CASE STUDY: GUGGENHEIM BILBAO

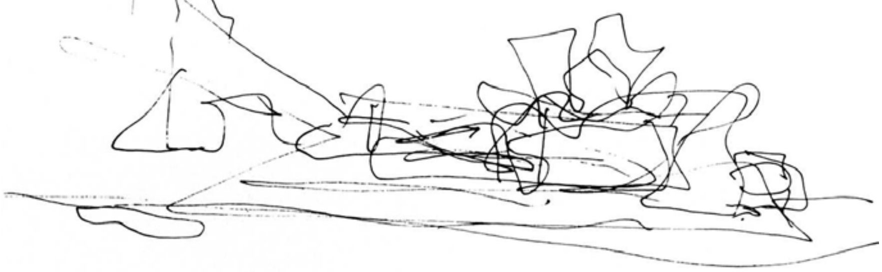
Built in 1997, the Guggenheim Museum in Bilbao was part of a large-scale rejuvenation and development project to address the dilapidated condition of the industrial city, a condition for which industrialisation and murky politics were largely to blame.[1] The museum was designed by Frank O. Gehry and completed in 1997. It sits on the cusp between architecture and art as the architecture warps and folds into its context to make not only one of the world's most famous museums for contemporary art, its positive impact on the surrounding city of Bilbao has become commonly know as the "Bilbao effect".

Where this short case study intersects with this dissertation is not, however, the ambitious assumption that the new maritime museum would have a similar impact on Cape Town, but rather in the exploration of complex and unconventional form, as well as the relationship between form and materiality.

*Form Finding:*

Bilbao's history is embedded in the shipbuilding industry due to its location along the Nervión River. Towards the end of the twentieth century, the diminished shipbuilding industry left many cities across Europe with industrial wastelands close to urban centres. The site which the museum was eventually built on sits amongst freight yards, main highways and the Nervión.[2]

The form of the building was first designed using rolled up pieces of paper and tape. This 'liquid' process of design is typical of Gehry as his expressive work is the manifestation of his desire to search for new forms.[3] Often times, these forms are far beyond the capabilities of conventional BIM programs, and so Gehry adopted the use of a software program called CATIA (Computer Aided Three dimensional Interactive Application) which was first developed for the aviation and vehicular industry.[4] CATIA allowed Gehry to digitise his conceptual models, as well as develop the design within the bounds of those early models.



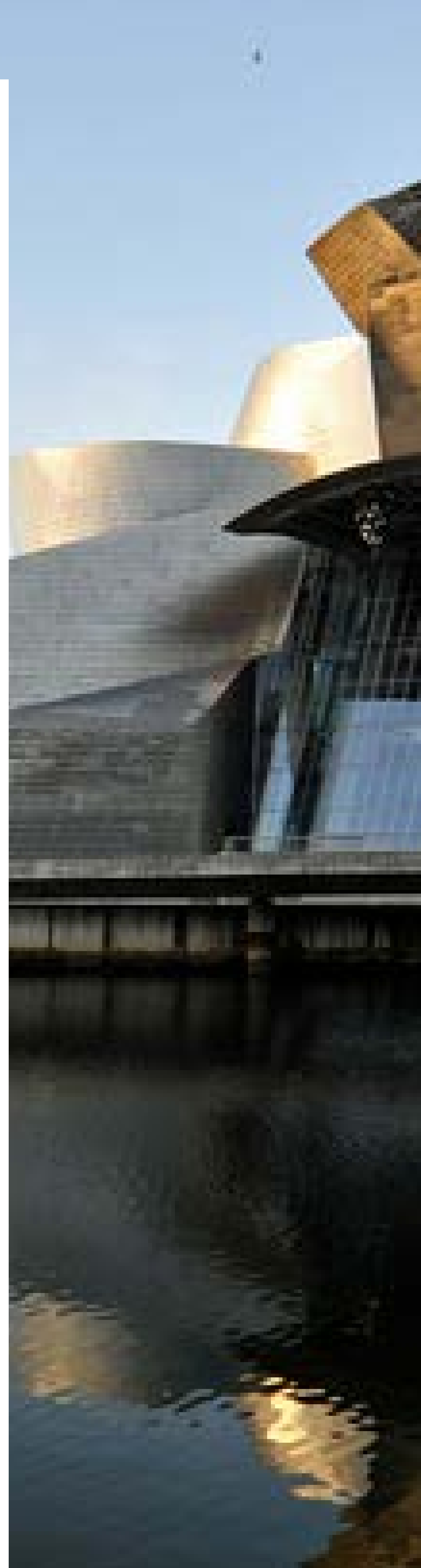


*Fig. 82. (left) Sketch of the Guggenheim Museum by Frank Gehry.*

*Fig. 83. (right) The Guggenheim Museum from across the Nervión River in Bilbao, Spain.*

1 Slessor, C. (1997).
2 Lapunzina, A. (1960), p86.
3 Slessor, C. (1997).
4 Ibid.

One of the struggles in this dissertation was the complex task of breaking apart a ship to build a building which not only meets the functional aspects of its brief but also explores new methods of construction and design. The issues arise with the limitations of conventional BIM software, or, more accurately, the limitations of the user. In this cases, the software tends to limit the design, becoming the architect and the user becomes merely a tool.

In the light of this issue, a significant portion of the time taken to develop this design was spent painfully manipulating the components extracted from the Rose to meet the original sketches and abstractions which were done early on in the project. This anchoring of intent to maintain the fluidity of a sketch was critical to the development of the design as it preserved the fundamental idea of breaking a ship upon a site to make a building - a task which includes a fair amount of chaos and disorder, which are beyond the capabilities of the software at hand.

Similar the Gehry, the struggle and eventual manipulation of software can create architecture which is incredibly unique as well as relatively economical. In the disassembly of the Rose and construction of the maritime museum, the digital model of the rose is accurately based on naval architectural drawings and this would allow for not only an accurate architectural design model but it could also be used by engineers and other professionals to expedite the project.

*Form and Materiality:*

So much of architecture today is like another American investigative drama series. On the surface, each episode seems to employ an elaborate plot, but by the end of episode the conclusion is so predictable that one tends to regret spending the last 30 minutes of their life watching a shallow copied-and-pasted balderdash.

Gehry's method of design alludes to an inherent spirit of discovery whereby program and function are relatively indistinguishable from the outside of the structure. It is only upon entering into the building whereby one discovers a program (see fig. 84). The Guggenheim Bilbao is reminiscent of the historical industrial past of the city, and the design identifies with context through its materiality and form.

The expressive form is an abstraction of the large ships which once were constructed along the banks of the river and cladded with 0.38mm thick titanium scales, indented slightly by fixings, giving them a ripple effect.[1] These plates reflect warped vies of the Nervión River and surrounding spaces. The skin is pulled right down to ground level at times, making the building interactive both from near (touch) and far away (view of the city around the museum reflected by the titanium cladding). A fortuitous drop in the price of titanium around the time of construction allowed for such a typically high-valued material to be used to such a great extent.[2]

1 Slessor, C. (1997).
2 Ibid.

*Fig. 84. Interior view of one of the galleries of the Guggenheim Bilbao. The titanium scales are pulled into the interior spaces as the structure of the building wraps around the galleries. Typical characterstics of a building such as windows, doors, roofs and walls are not visible from the exterior of the museum. This deliberate design method developes idea that the museum houses contemporary art, and is also an art piece itself and not strictly a building.*

*Fig. 85. The exterior of the building is cladding with thin titanium scales.*

The design of the maritime museum in the breakwater takes these ideas explored by Gehry in the Guggenheim Bilbao and explores them further. Gehry's museum is a piece of art which houses art. The maritime museum will be a ship which houses ships (simply speaking). The sculpted forms of both buildings share a desire to engage with a broader audience than just those upon the sight, drawing upon key sight-lines and an omni-presence.

The following section expands on these statements with the introduction of the sketch design of the maritime museum.

*Waves and the Wall*

The Southern African climate is largely dictated by the pressure systems created to the south towards the Antarctic. Cape Town experiences the majority of its annual wind and subsequent weather from the south-east (fig. 86).

The wave patterns are also heavily dictated by the wind from these pressure systems, resulting in the typical wave patterns which we see today in Table Bay (see fig 87). Here the vital wave deflection function of the breakwater wall can be seen, as it not only protects the V&A basins but creates a considerably large 'shadow zone' protecting the southern part of Table Bay from the direct waves.

The projected climatic models for Cape Town point to the strong possibility of radical climatic change impacting the city and the activity within the harbour.[1] Rises in wind speeds and rainfall are expected to happen, and an increase in extreme weather conditions. Policies have been put in place in recent years to adhere to these climate warnings as the realization that these shifts in weather patterns could have a devastating effect on what is the largest city in the Western Cape.

One of the most pressing potential threats for the harbour is the rising water levels due to the increase in temperatures across the world. The sea levels are estimated to rise between 450 - 820mm by 2100.[2] This could result in a significant amount of force acting upon the breakwater wall, and, therefore, this project begins to speculate into the future of the monitoring, maintenance and eventual upgrade of this important structure.

As shown in figures 88, 89 and 90, the breakwater is subject to immense waves at times, which crash over the wall. The maritime museum is, therefore, located partially behind the old wall and the artificial concrete hip for protection.

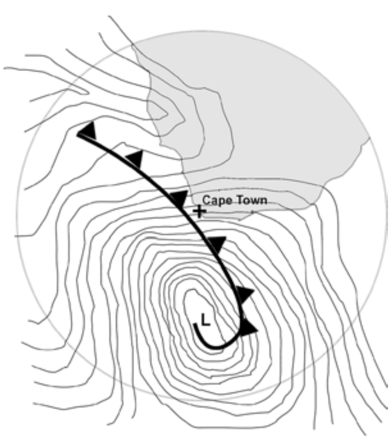



*Fig. 86. Low pressure system, Cape of Good Hope.*


*Fig. 87. Incoming wave patterns in Table Bay.*

1 Hewitson, B.C. (2005), in Western Cape Report: *A Status Quo, Vulnerability and Adaptation Assessment of the Physical and Socio-Economic Effects of Climate.*

2 Gregory, Jonathan. (2016) *'Projections of Sea Level Rise'*, IPCC Report.

In extreme conditions, the waves can crash over the breakwater, making it extremely dangerous. Some original construction drawings included balustrades along the top of the wall, however, these would provide very little protection.

| | 100 years (without climate change) | 100 years (with climate change projected to 2060) |
|---|---|---|
| MHWS | 0.92 | 0.92 |
| Storm Surge | 0.74 | 0.74 |
| Sea Level Rise (2060) | 0 | 0.48 |
| Increase in Storm Surge | 0 | 0.08 |
| **Design Water Levels** | **1.66m** | **2.22m** |

*Table 4. Design Water Levels (based on the information obtained from the City of Cape Town Report: Coastal Dynamics Assessment (2014).*

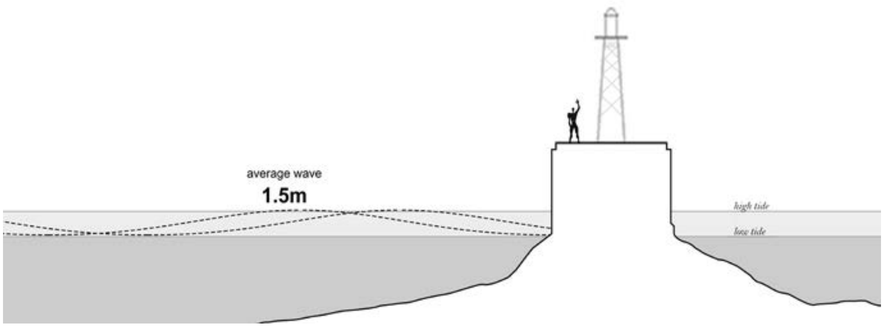



*Fig. 88. Average wave height at the Breakwater.*

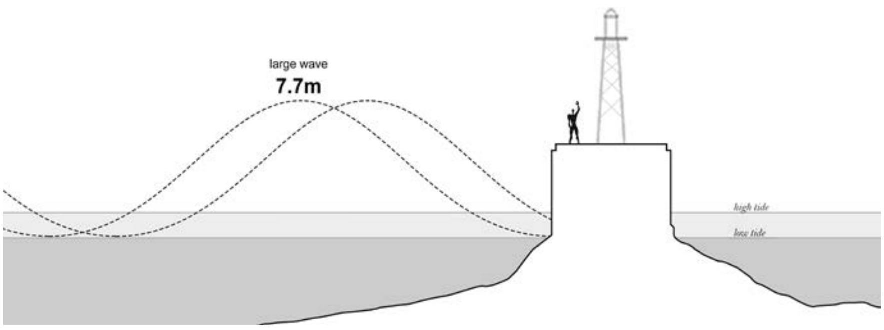



*Fig. 89. Large wave height at the Breakwater.*

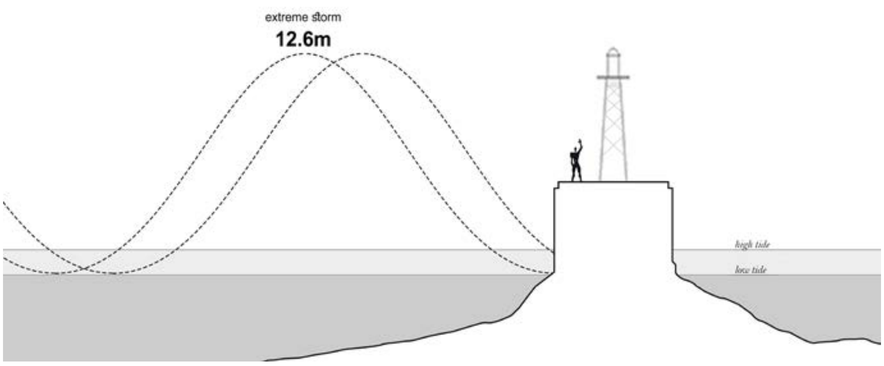



*Fig. 90. Extreme storm wave height at the Breakwater.*

## Dealing with Waves: Structure

The boundary condition between the land and the ocean in which a harbour exists can challenge conventional construction methods due to the proximity to water. The tidal range (average low to high tide) in Table Bay is around 1.5 - 2.0m[1] which means that the construction of a building along the coast must be safe from the effects of high tides and constructed above the Design Water Level as put forward in the earlier section on wave motion.[2] Observationally there are several methods to deal with structure and the proximity to the ocean.

An investigation into the boundary conditions where the built environment meets the ocean was conducted. An important device which is used along the quayside is the floating platform which serves as detachable extension of a pier or a walkway. These structures basically comprise of a deck upon a sturdy steel frame which is fixed to floatation devices such as large drums. The structure is kept in place by being tethered to the quayside with ropes.

More permanent structures, such as that found near the Nelson Mandela Gateway to Robben Island building at the V&A Waterfront, are supported by tall mooring columns which are sunk into the rock beneath the water. A wheel guide system is used to allow the platform to rise and fall with the changing water levels (vertical movement) while the columns hold it in place (horizontal fixing).

Aside from reclaiming more land along the harbour side of the breakwater wall, as has been done in the past, this technique of using sturdy floating structures is intriguing as it extends architecture over a terrain beyond the bounds of solid ground. These structures are easily installed and are detachable, therefore, also have little impact on the environment.

*Fig. 91. (top right sketch) old tyres create a soft edge.*

*Fig. 92. (top right photo) Tyres used to protect the passing ships.*

*As the car tyre is a familiar everyday object, it is a sublte scaling device when viewed beside a less familiar object. For example, the tyres in this photo allow the viewing to understand the thickness of the timber structure below.*

*This is important due to the fact that harbours are made up of machines and objects which are scaled according to purpose (the shipping industry) and necessarily the human scale. These sublte moments allow an otherwise otherworldy environment to be relatable. The opposite experience whereby one's idea of scale and reference is completely lost could be equally as moving.*

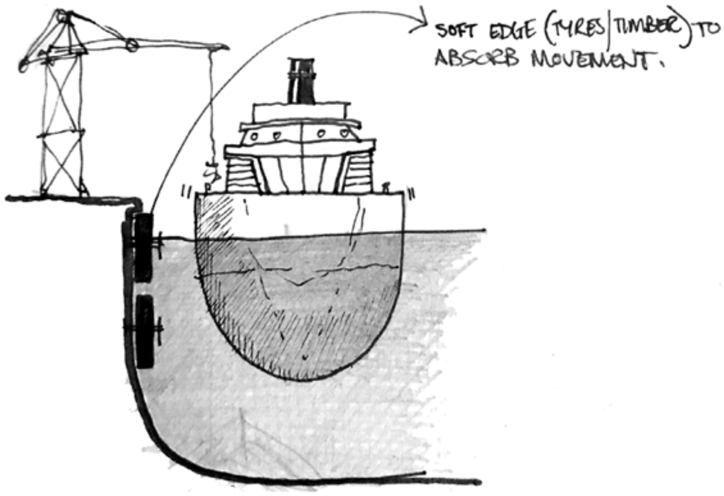
*Fig. 93. (middle right sketch) Extending the museum into the water lends itself to the idea of a poetic reintroduction of the ship and the ocean. The structure is also mimicking the rocking of a ship in the waves, making the viewer's experience of discovering the rose physically experiential as well as appealing to the softer narrativs of the poetic.*

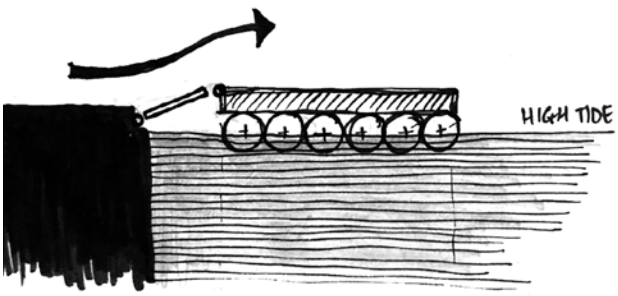
*Fig. 94. (middle right photo) Publicly accessible floating timber platform at the V & A Waterfront.*

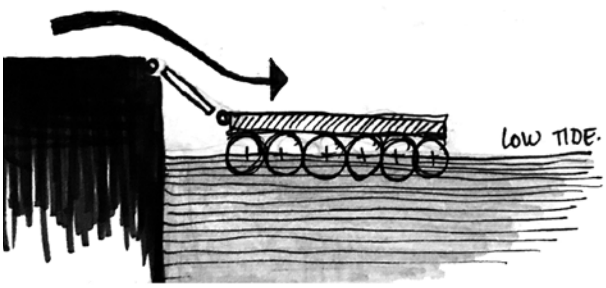
*Fig. 95. (bottom right sketch) rough sketch of the visual connection to the breakwater and the Atlantic beyond, looking through the V & A basins.*

*Fig. 96. (lower right photo) A telescope along one of the popular walkways, V & A Waterfront.*

1 Joubert, James (2013).
2 Design water levels for Cape Town are between 1.6m and 2.2m above sea-level (City of Cape Town Report: Coastal Dynamics Assessment (2014).


SOFT EDGE (TYRES|TIMBER) TO ABSORB MOVEMENT.


HIGH TIDE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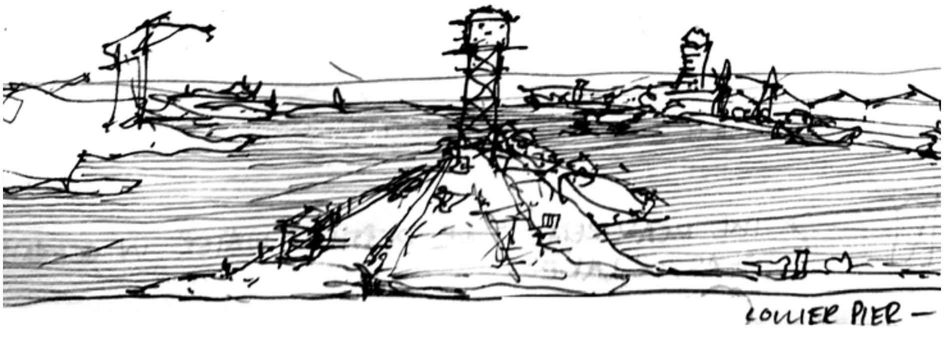
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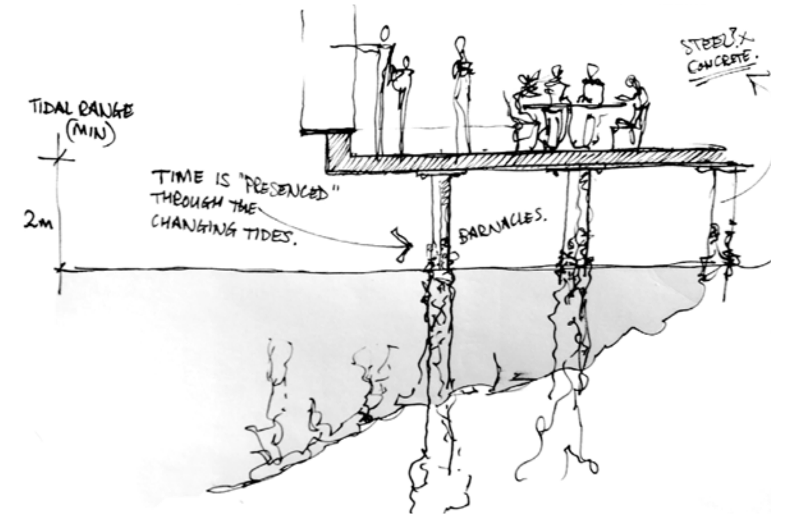
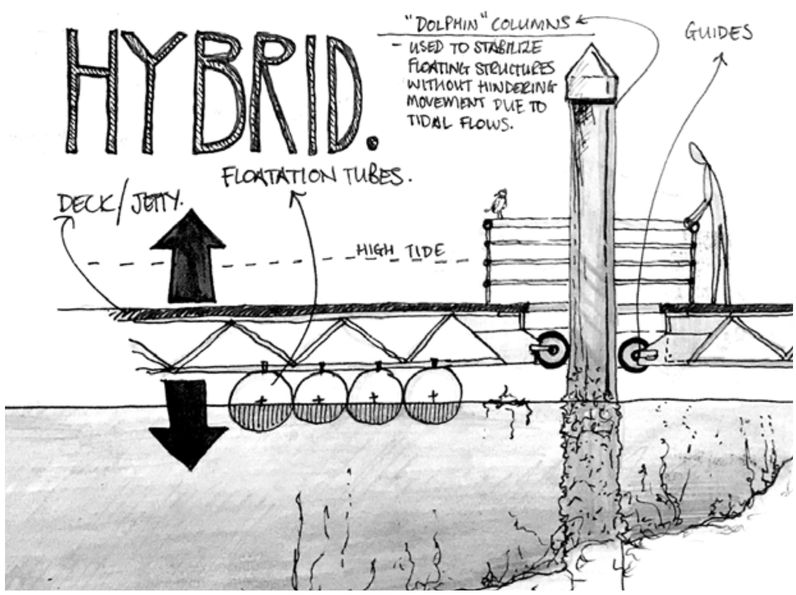


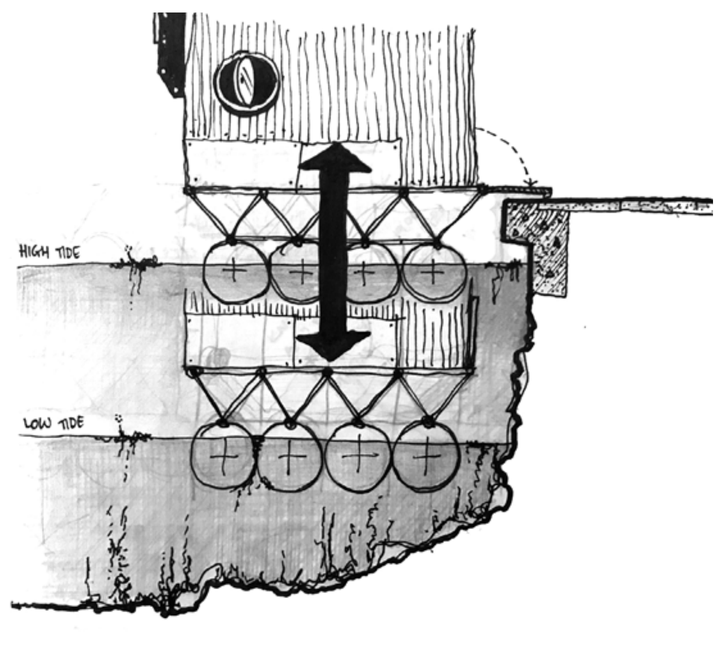




*Fig. 97. (top photo) Precast concrete piles used to extend the building. Over time the piles are covered with barnacles and become an 'extrusion' of the ocean.*

*Fig. 98. (top sketch) The water lines mark the tidal range on the piles.*

*Fig. 99. (middle photo) The guides acting on the mooring column, V & A Waterfront.*

*Fig. 100. (middle sketch) the platform gently creaks as its components adjust to the waves.*

*Fig. 101. (bottom sketch) part of the maritime museum can adopt this technology. The connection of the museum to the ocean again is important, and the mechanics of a floating platform as such goes beyond what an ordinary museum has to offer. Access could also be dependent on the tide, or even the building could communicate the tidal shift to the public/ships through the movement of the floating platform.*

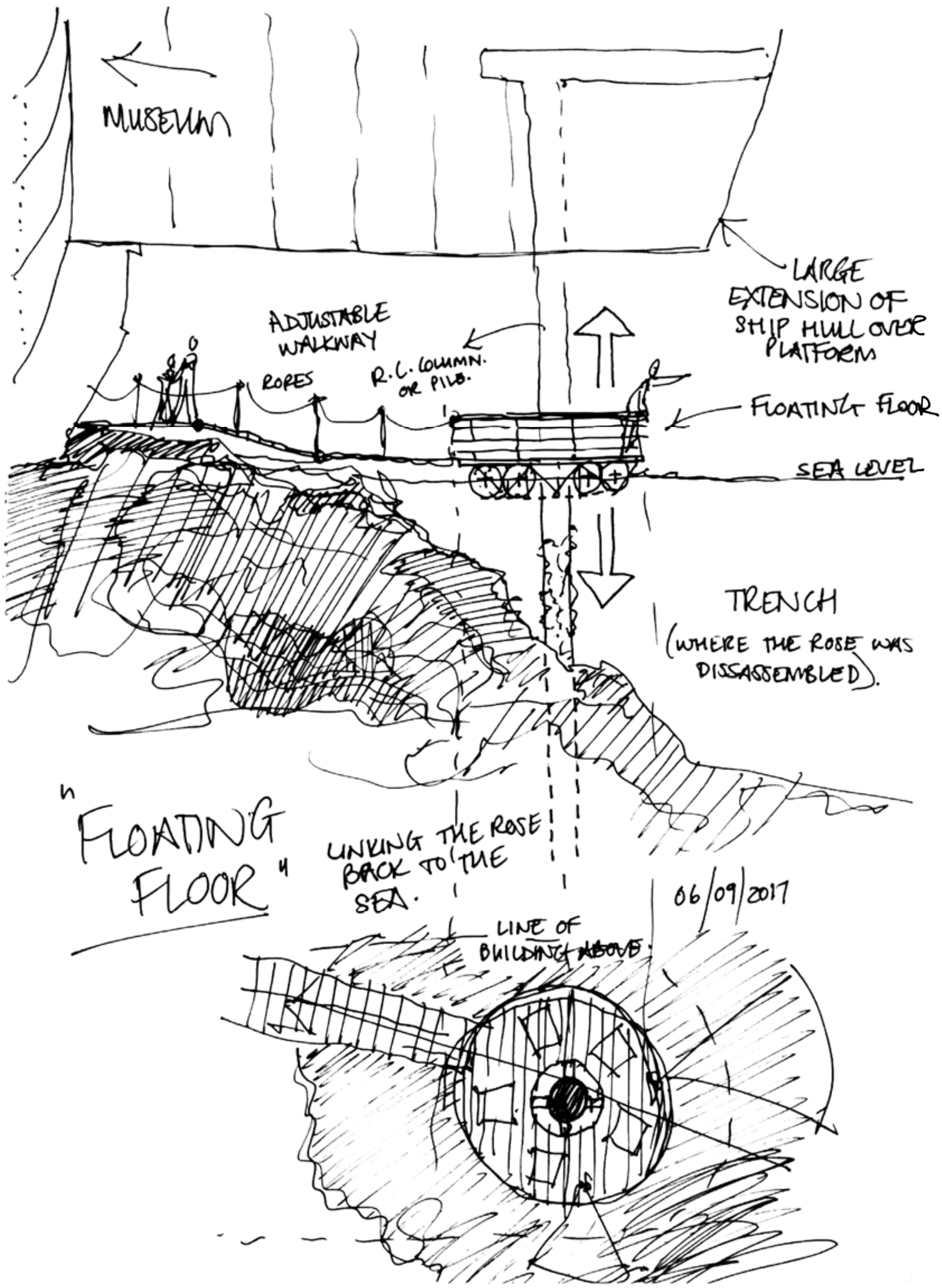



*Fig. 102. Early sketch designs of the 'floating floor' which is the device used to reconnect the building with the ocean.*

# DESIGN

## OUTLINE

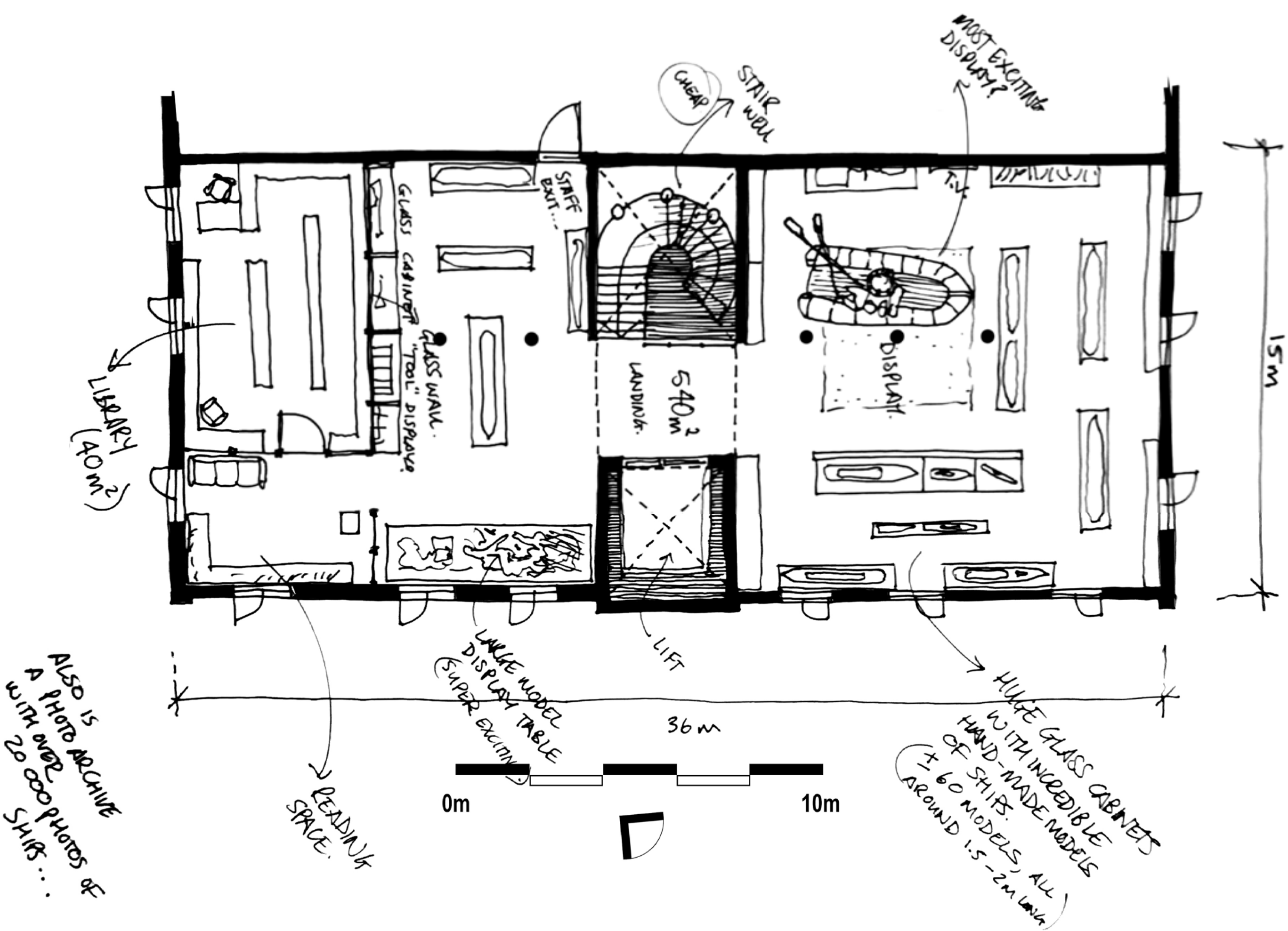
*1. Client*

The client identified in this dissertation is the Iziko Museums of South Africa, an organization which falls under the Department of Arts and Culture. The current Iziko Maritime Museum is in a dismal state for a number of reasons and the brief for the architectural outcome of this dissertation aims to address these issues.

*Fig. 103. The interior of the museum is rather bland and clinical.*

*Fig. 104. (top right) A rough plan of the current Iziko Maritime Museum. The plan was drawn on a visit to the museum.*

*Fig. 105. Photo of one of the incredible hand-made models on display.*




*Information on the current Iziko Maritime Museum:*
*(based on data obtained from the Iziko Museums of South Africa)*

## DETAILS

Location: 1st Floor,Union-Castle House, Dock Road, V&A Waterfront.

Capacity: 4 staff

Hours: 10h00 to 17h00

Tickets: Adults / R20
6-18 years / R10
Students / R10

## FACILITIES

**Total floor space: 540m²**

Lobby, security desk, storage, elevator, toilets, museum floor space (380m²), library and photo archives (40m²), reading room (8m²).

Notes:

+/- 50 large hand-made models of ships and the CT Harbour.

interesting equipment displays, as well as the models.

## ISSUES

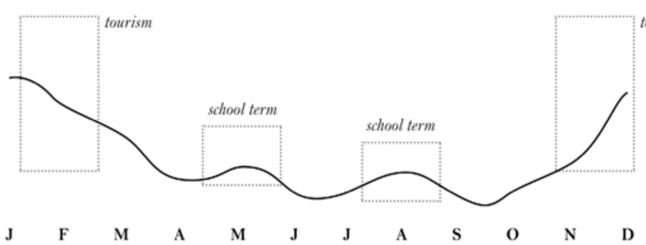
1. Very hidden away from the busy V & A Waterfront. Little or no signage.

2. Understaffed.

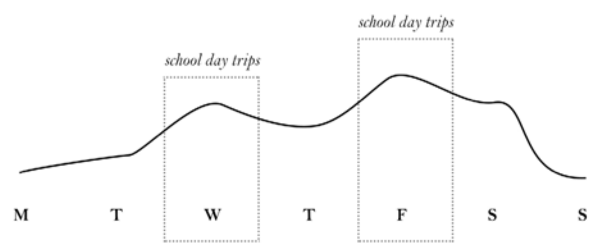
3. Generic displays. It is a building full of models, very little else about CT's maritime history.

4. Cramped spaces (library is too small for the amount of information which is stored in it).

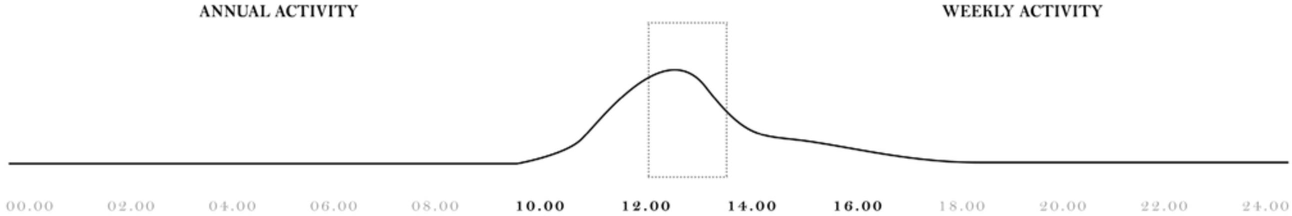
5. Stagnant experience. Graveyard for fantastic, hand-made models.




ANNUAL ACTIVITY




WEEKLY ACTIVITY




DAILY ACTIVITY

*2. Brief*

After analysing the current state of the Iziko Maritime Museum and indentifying the issues at hand, a design brief was established. The brief is as follows:

| | |
|---|---|
| *Location*: | End of E-Pier Road,<br>V & A Waterfront<br>-33.900537, 18.425429 |
| *Staff Capacity:* | 10 - 12 staff |
| *Operational Hours:* | 08h00 to 19h00 (museum) |
| *Facilities:* | Total floor space: 2100m2 |

Lobby, security office and front desk, storage (small, general), storage (large, models/furniture), elevator, toilets, gallery space (m2), library (m2), reading room (m2), digital photo archive & VR room, lecture theatre, museum offices, cafe, mooring station for small engineering maintenance boat.

*Solutions:*

1. Proximity to the new promenade will encourage visitors, as well as the experince not only of seeing the hostorical artifacts, but also that of being sourrounded by a deconstructed ship.

2. The oveall capacity of the museum will be increased.

3. photo archives are digitised and an interactive Augmented and Virtual Reality experience provided.

4. Library capacity increased.

5. Building is a ship which houses ships.

*3. Creating the Museum*

Creating a building out of the complex pieces from the Rose began with an iterative process whereby the different components weremanipulated, moved, rotated and then analysed for their spatial potential. This was approached with the same playfulness permitted in the previous abstraction exercises. An example of this process is shown in figure XX (right), where the first three pieces from the bow of the Rose were manipulated and adjusted on site.

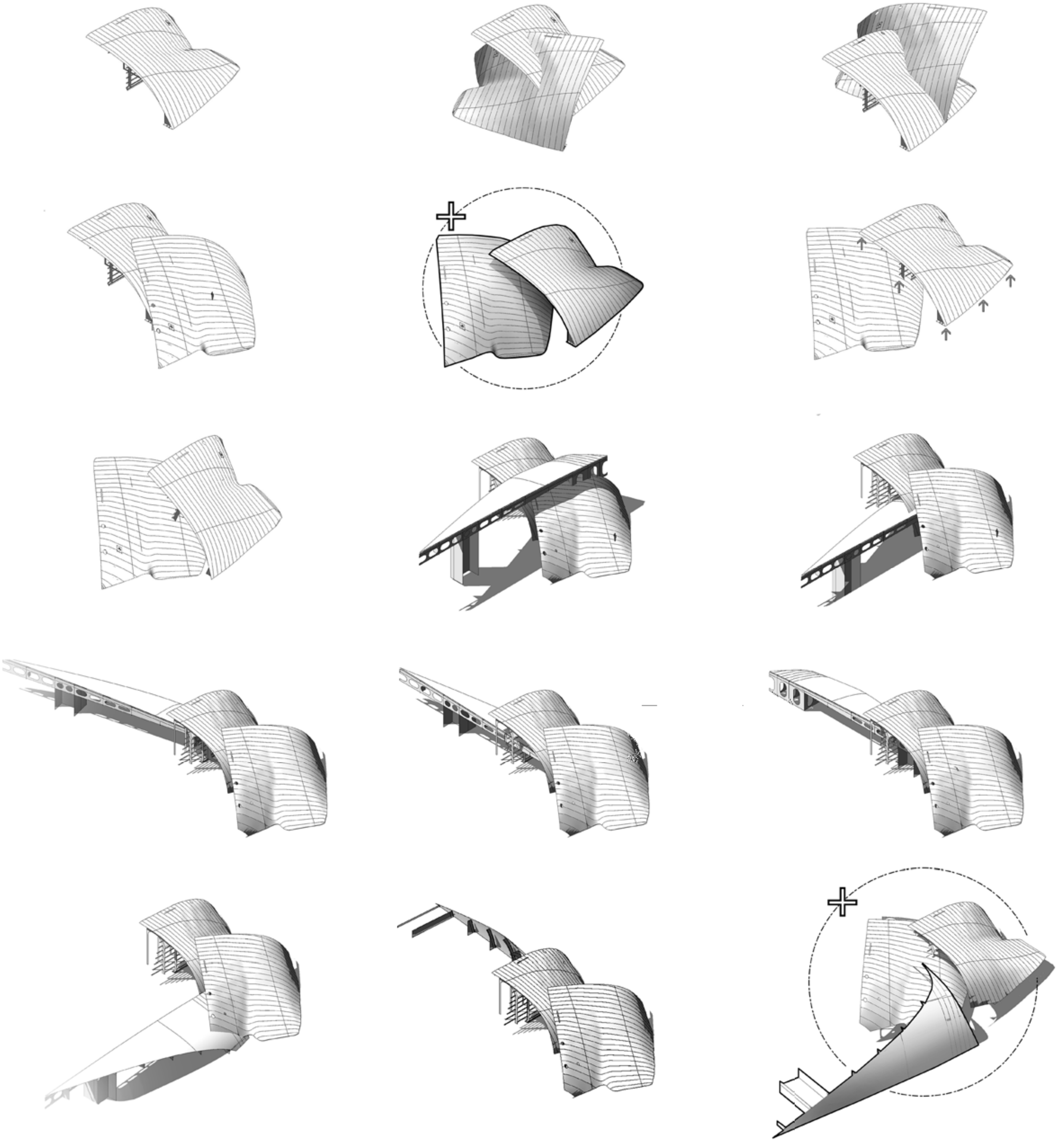


*Fig. 106. A series of investigations of form and composition.*

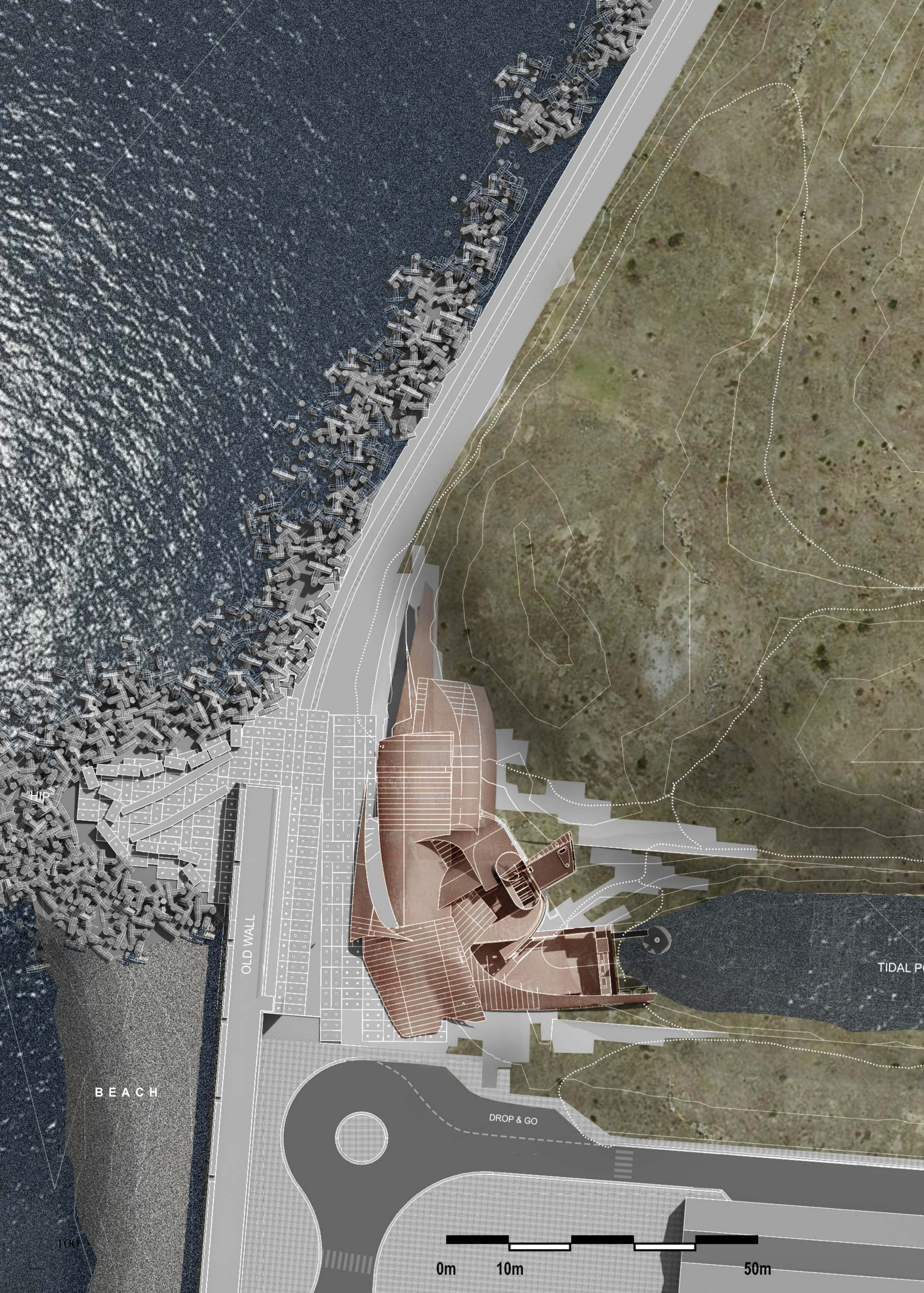

"HIP"
OLD WALL
TIDAL PO
BEACH
DROP & GO
0m
10m
50m

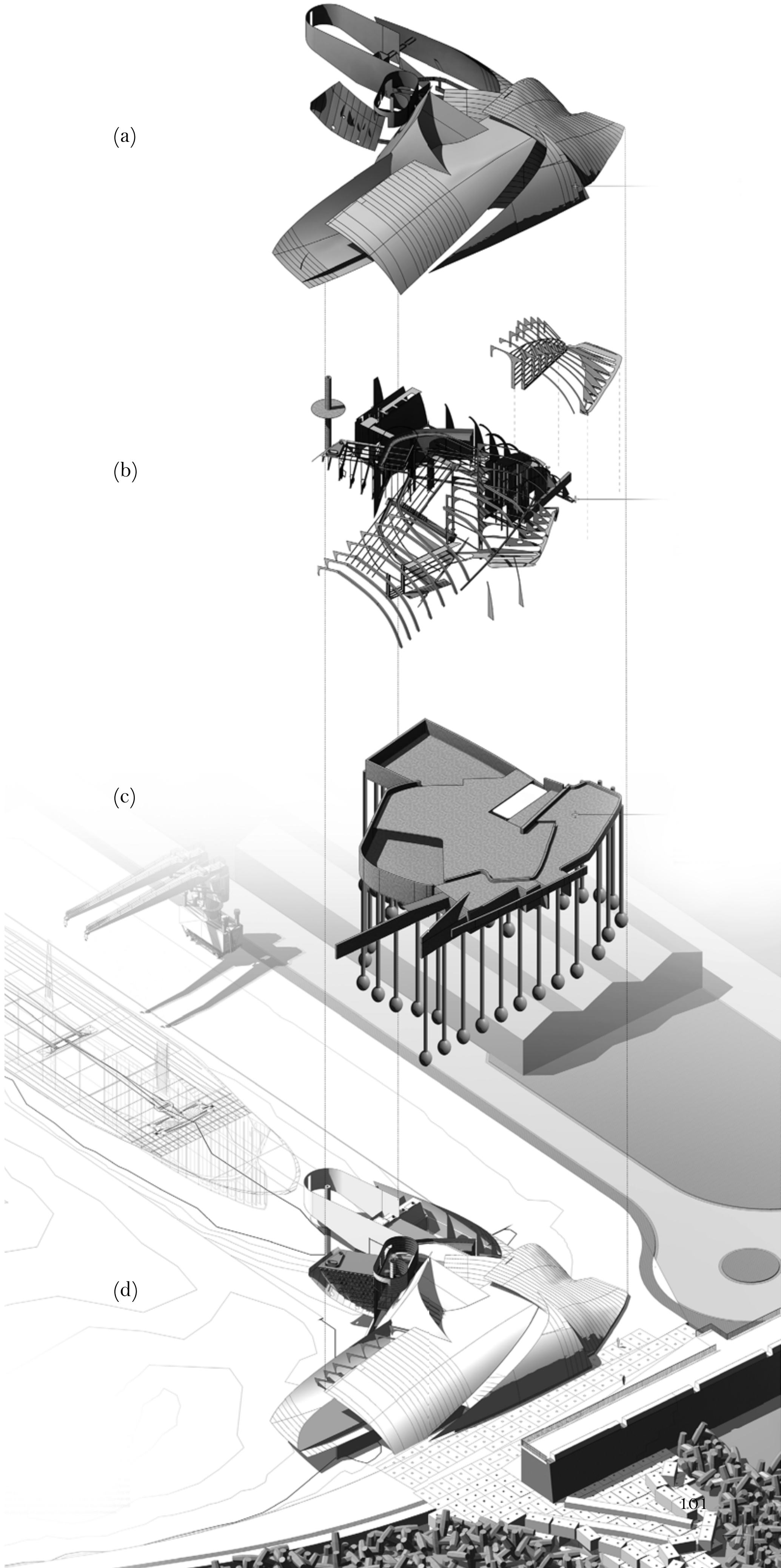

*Fig. 108. (left) site plan showing the surface materials of the building and its surroundings. The large concrete units are pulled right through the building as a main floor surface. Some of these blocks are also used as retaining walls.*

*Fig. 109. (right) An exploded isometric view of the new museum.*

*(a) & (b) the monocoque structure, made up of the different components from The Rose.*

*(c) the sturdy concrete foundations and ringbeams which sit into the site.*

*(d) building, as of the current sketch design plans*



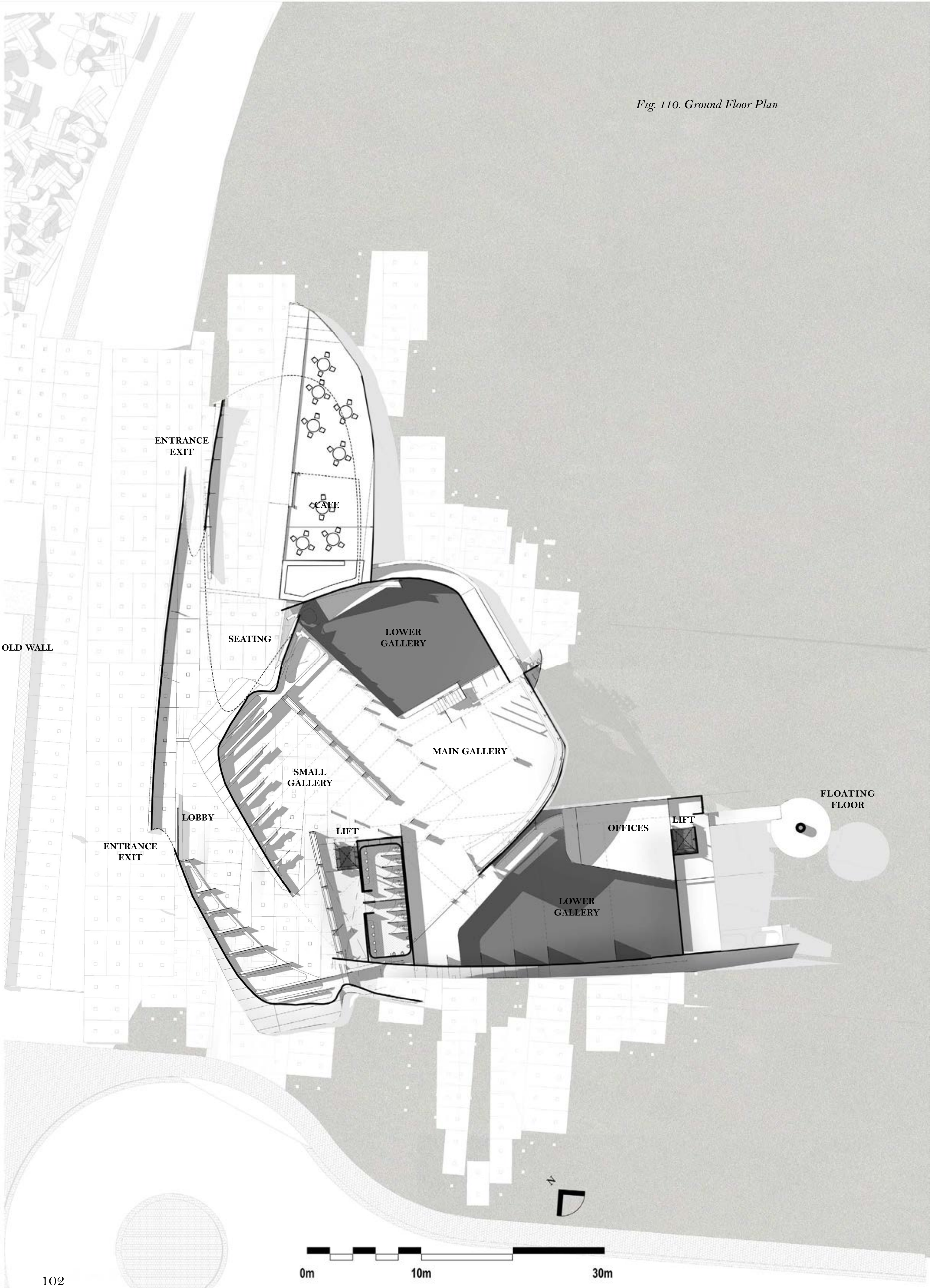
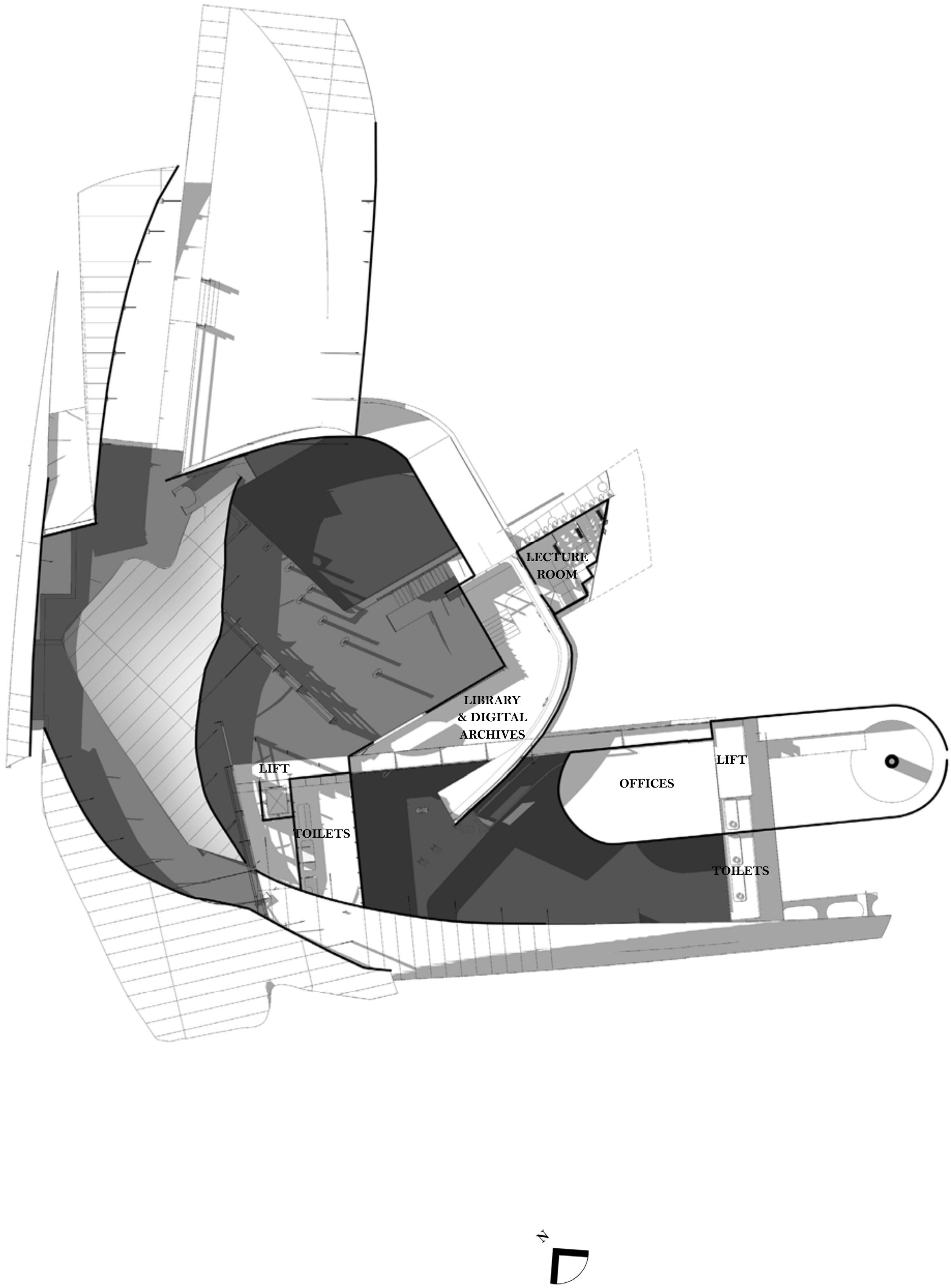



*Fig. 110. Ground Floor Plan*

*Fig. 111. First Floor Plan*



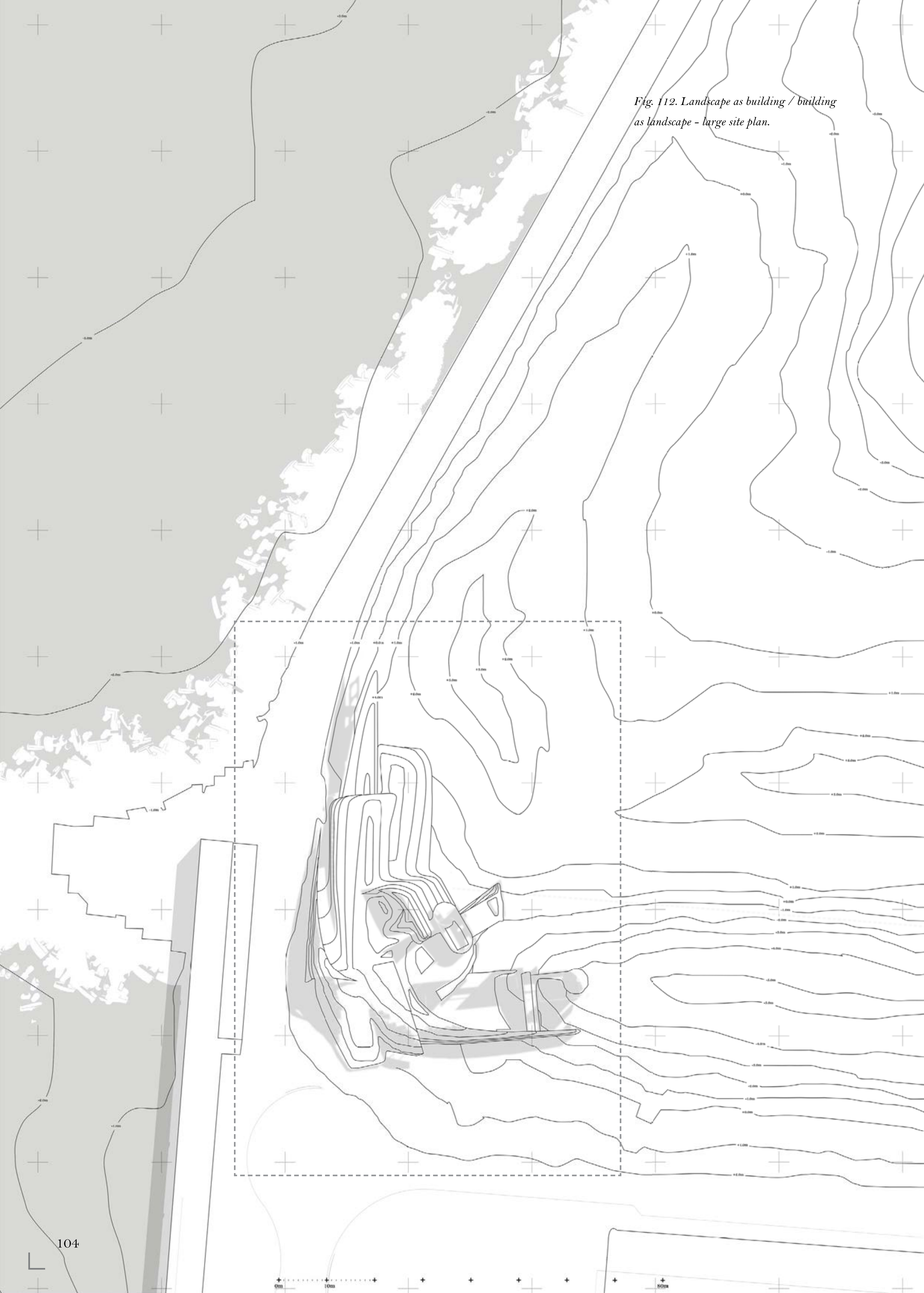



*Fig. 112. Landscape as building / building as landscape - large site plan.*

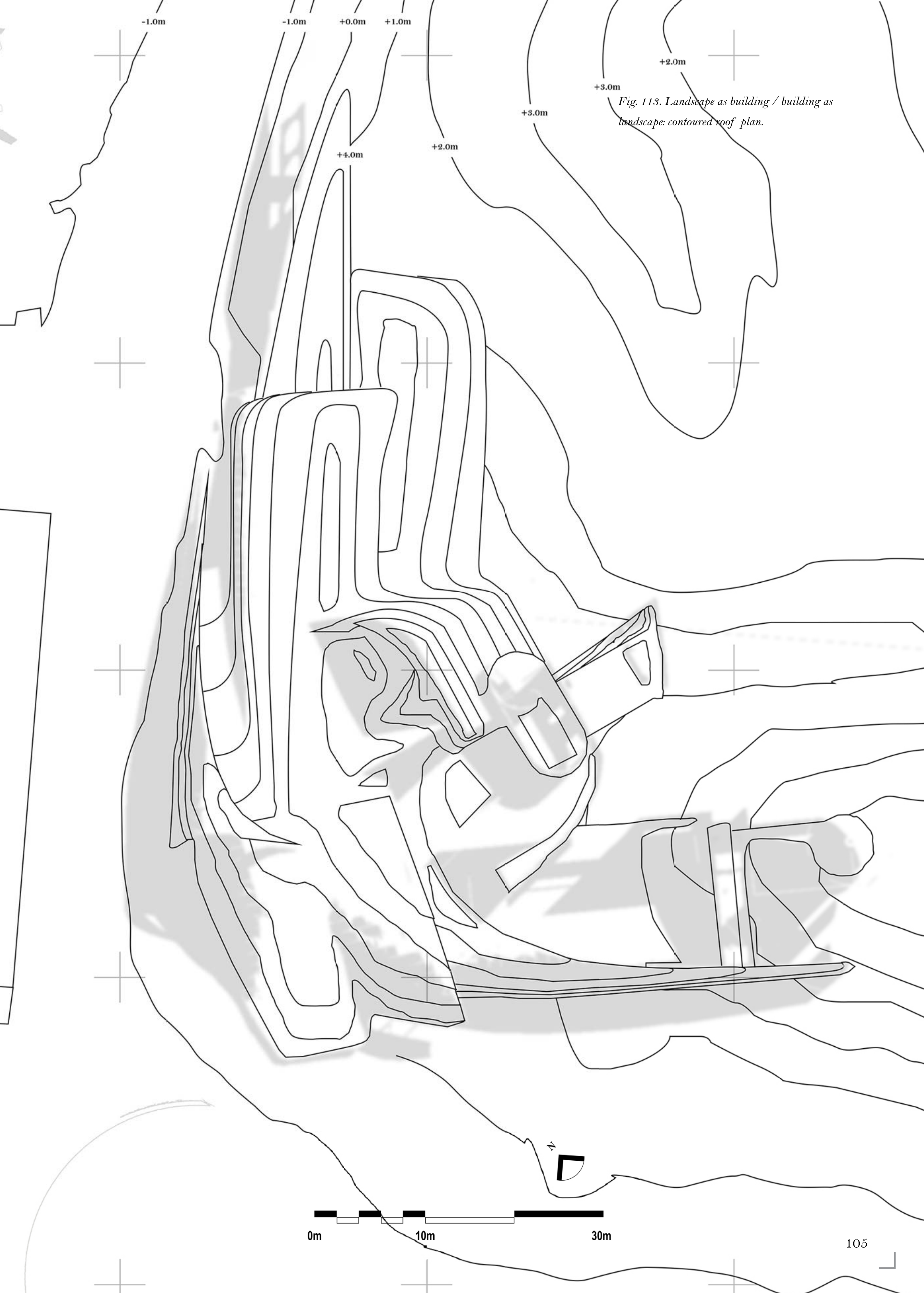



*Fig. 113. Landscape as building / building as landscape: contoured roof plan.*

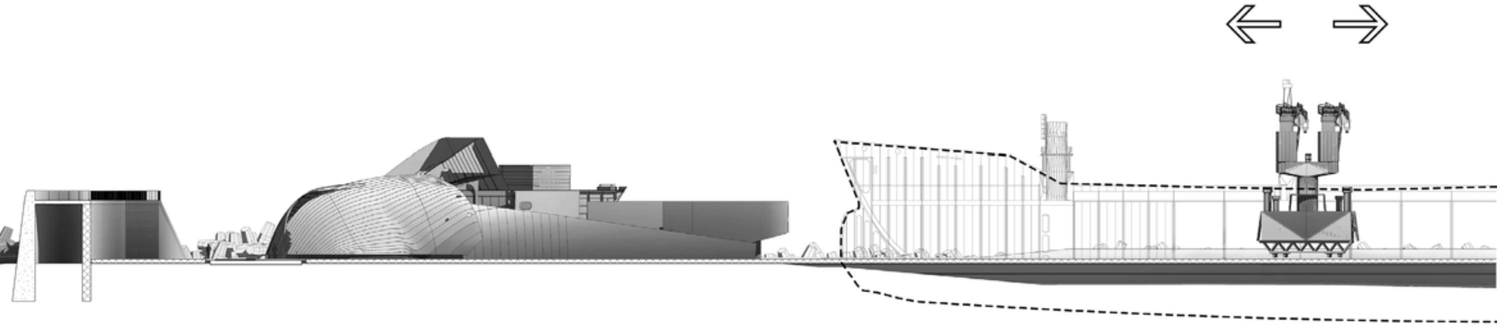


*Fig. 114. South elevation*

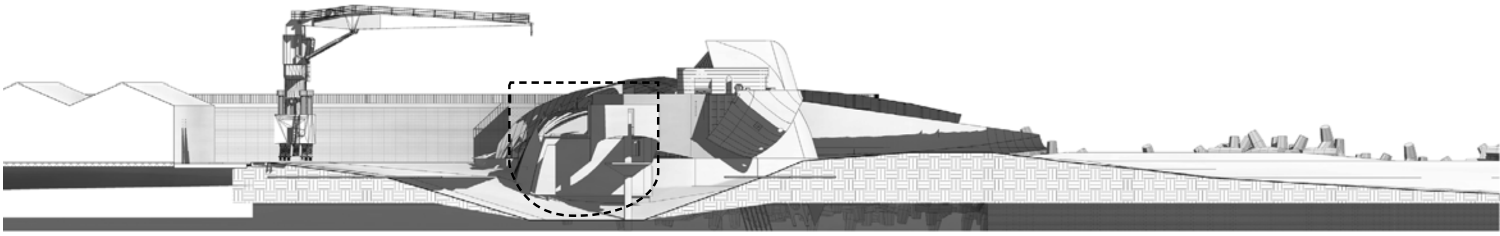
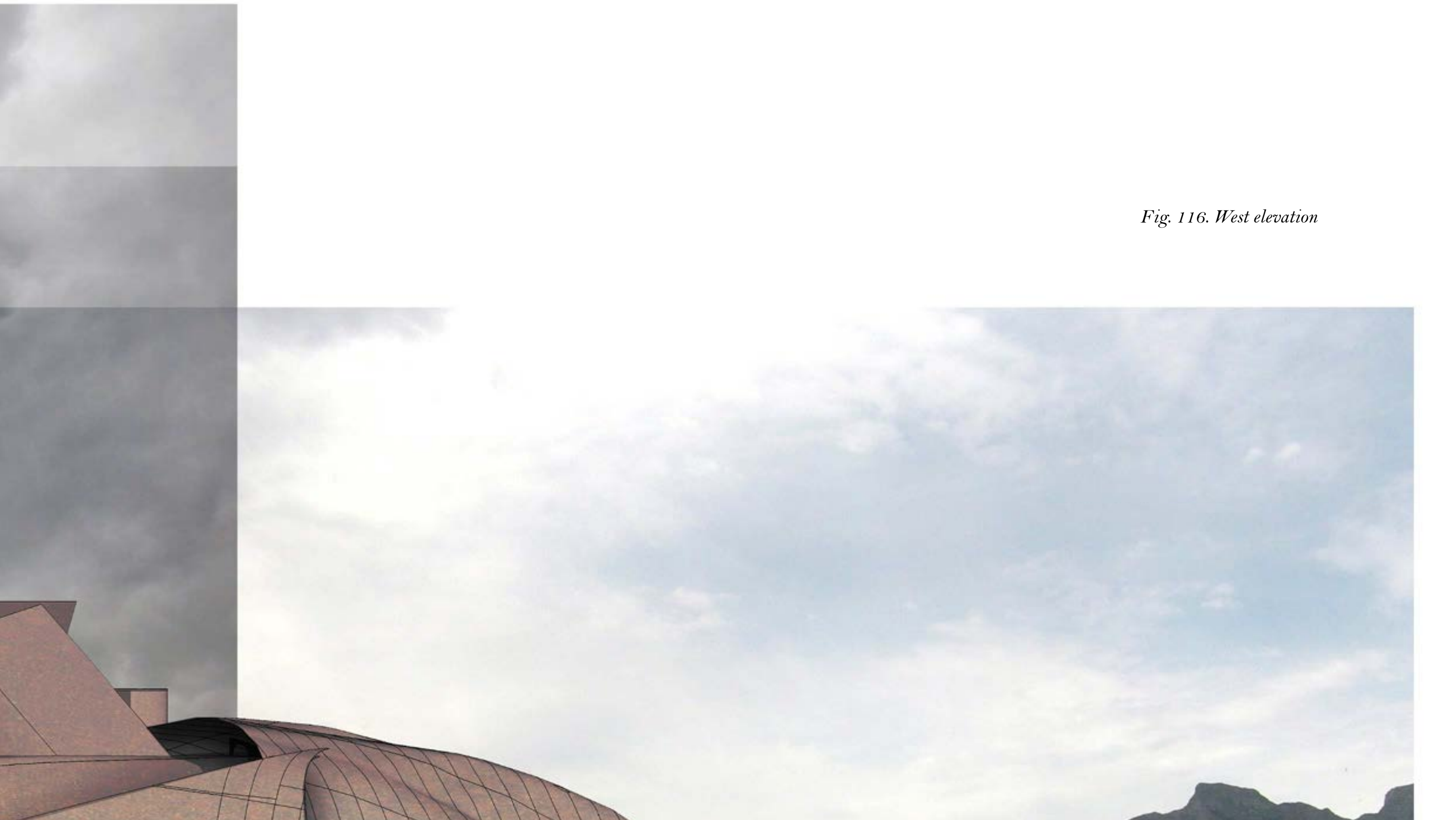


*Fig. 115. East elevation*

*Fig. 116. West elevation*



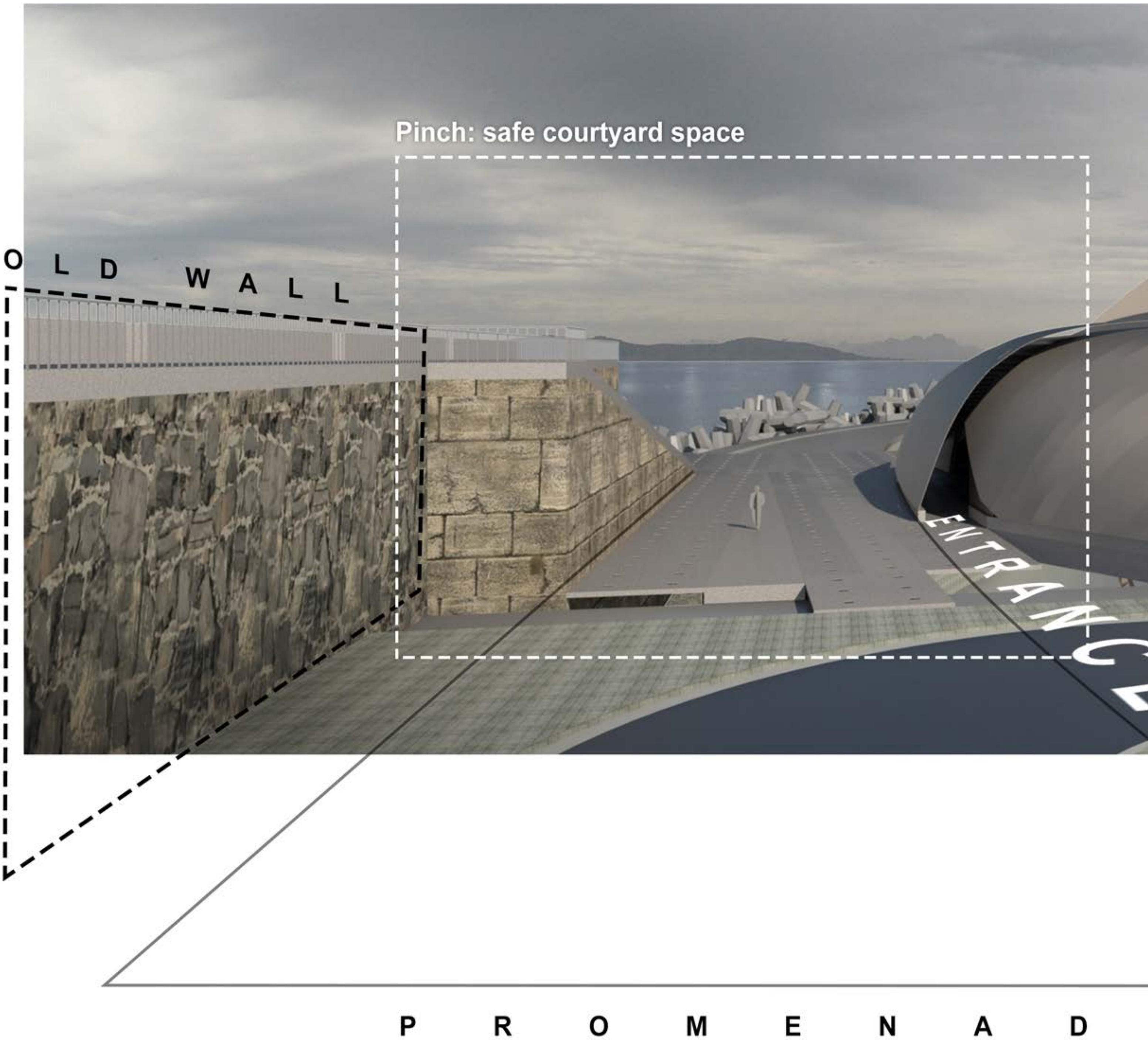
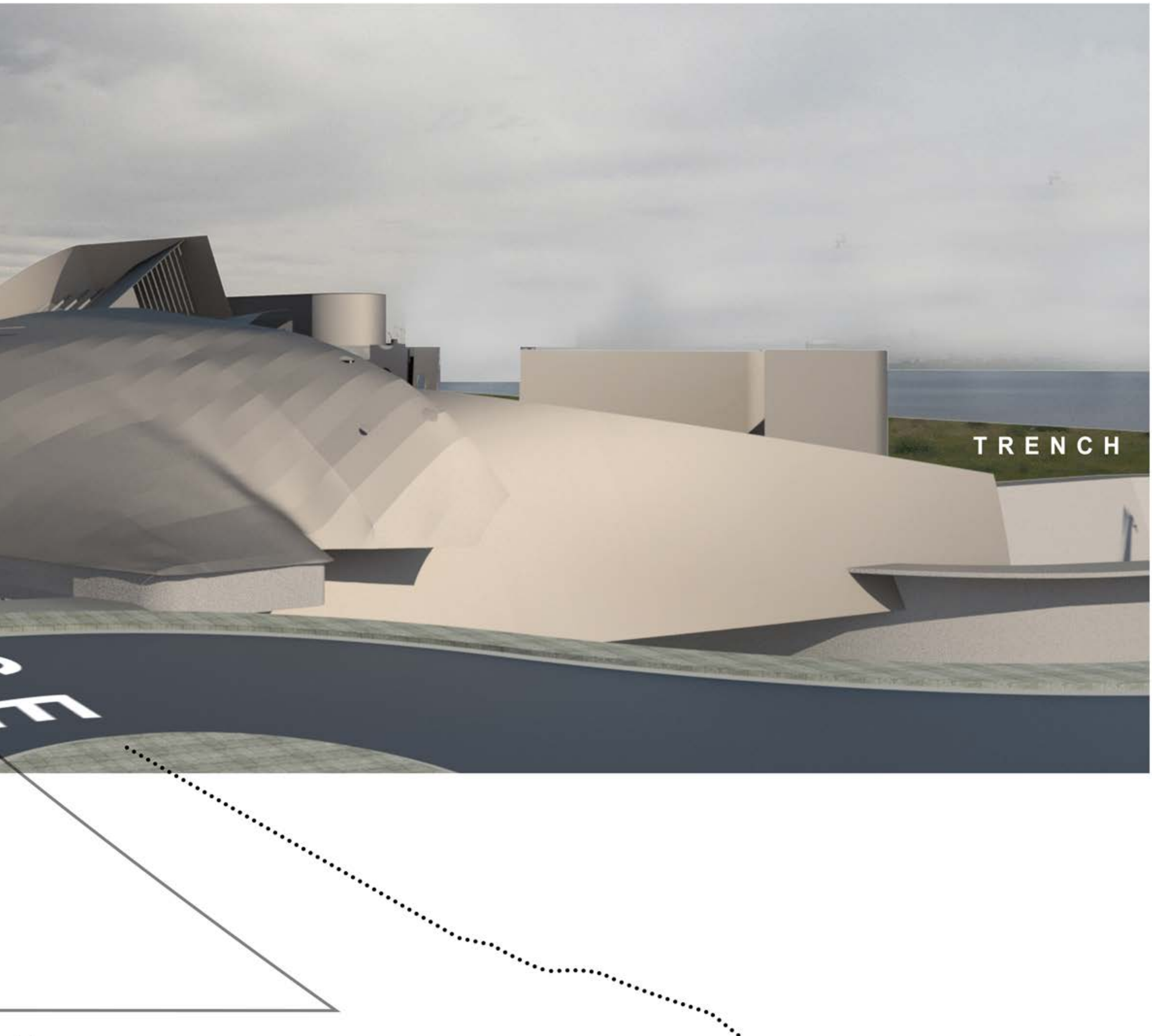

Pinch: safe courtyard space
O L D W A L L
ENTRANC
P R O M E N A D

*Fig. 117. view approaching the museum from E-Pier Road.*



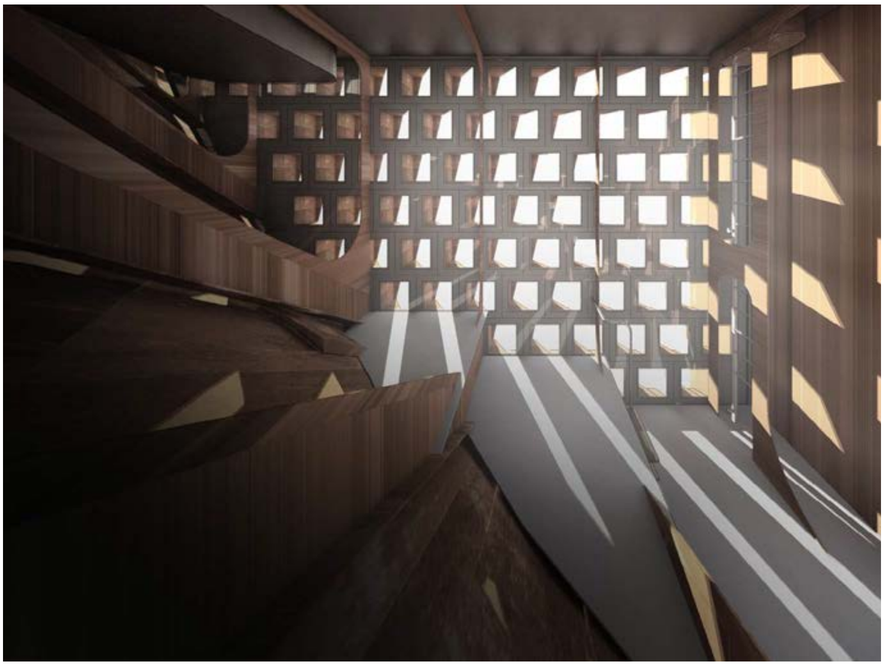


*Fig. 119. Early interior render showing the morning light in the reading room next to the library.*

*Fig. 120. Render of one of the large skylights above the gallery spaces. The light plays off the curved surfaces on its way into the triple volume space*

*Fig. 118. (right) Render looking up towards the library. The museum's concrete base and surfaces dissolve into the landscape.*

*Fig. 121. Interior Study 01.*

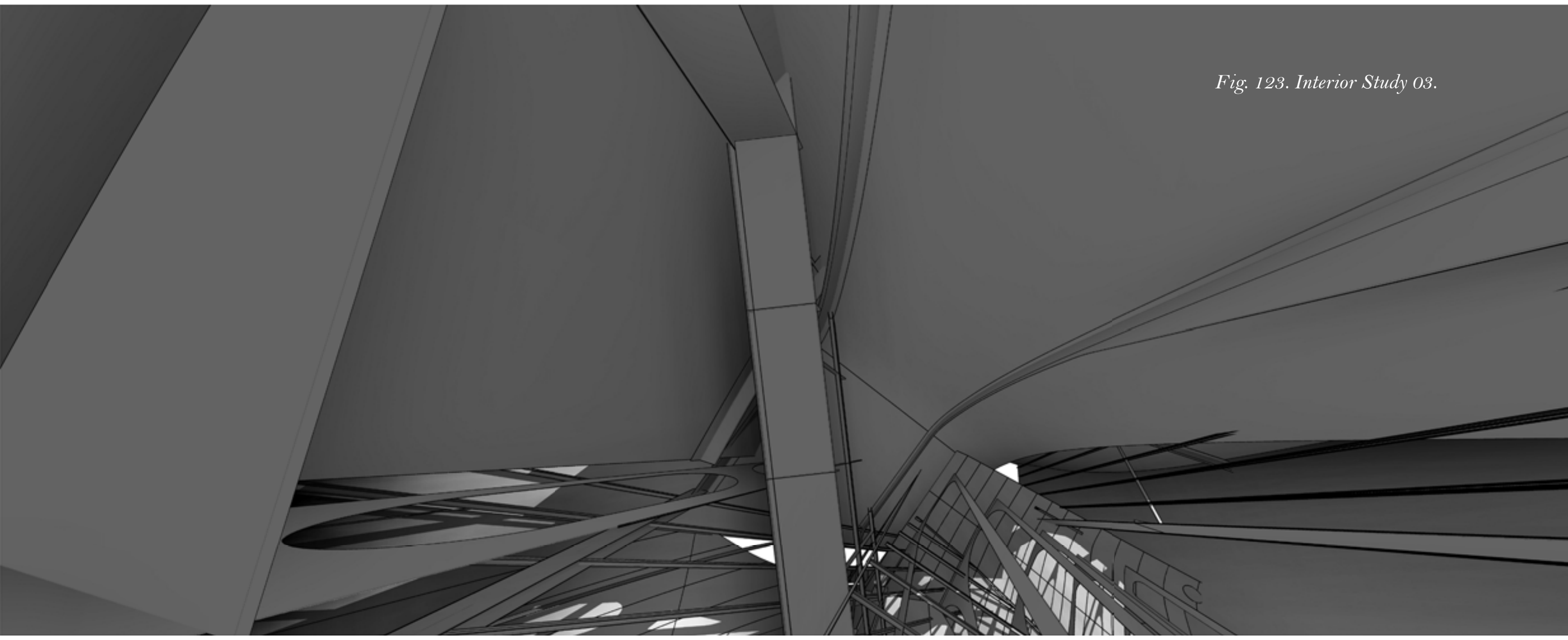


*Fig. 123. Interior Study 03.*

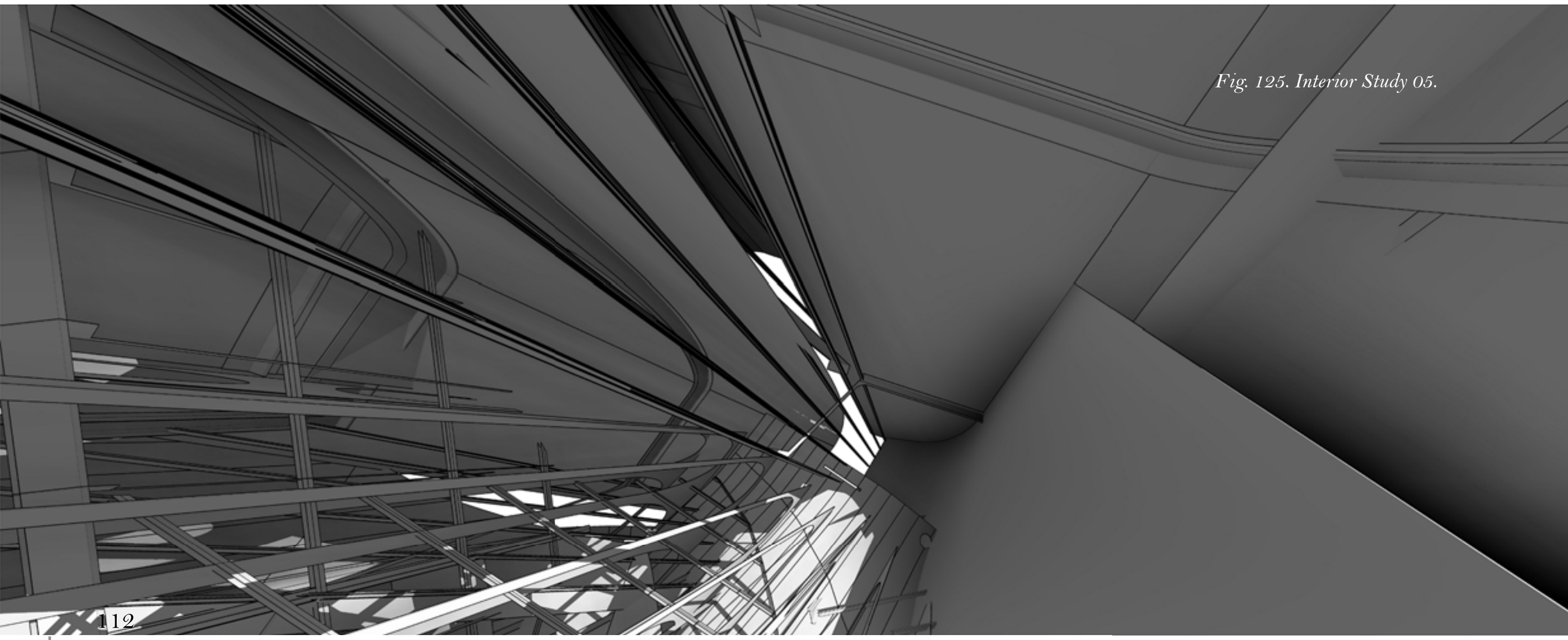


*Fig. 125. Interior Study 05.*

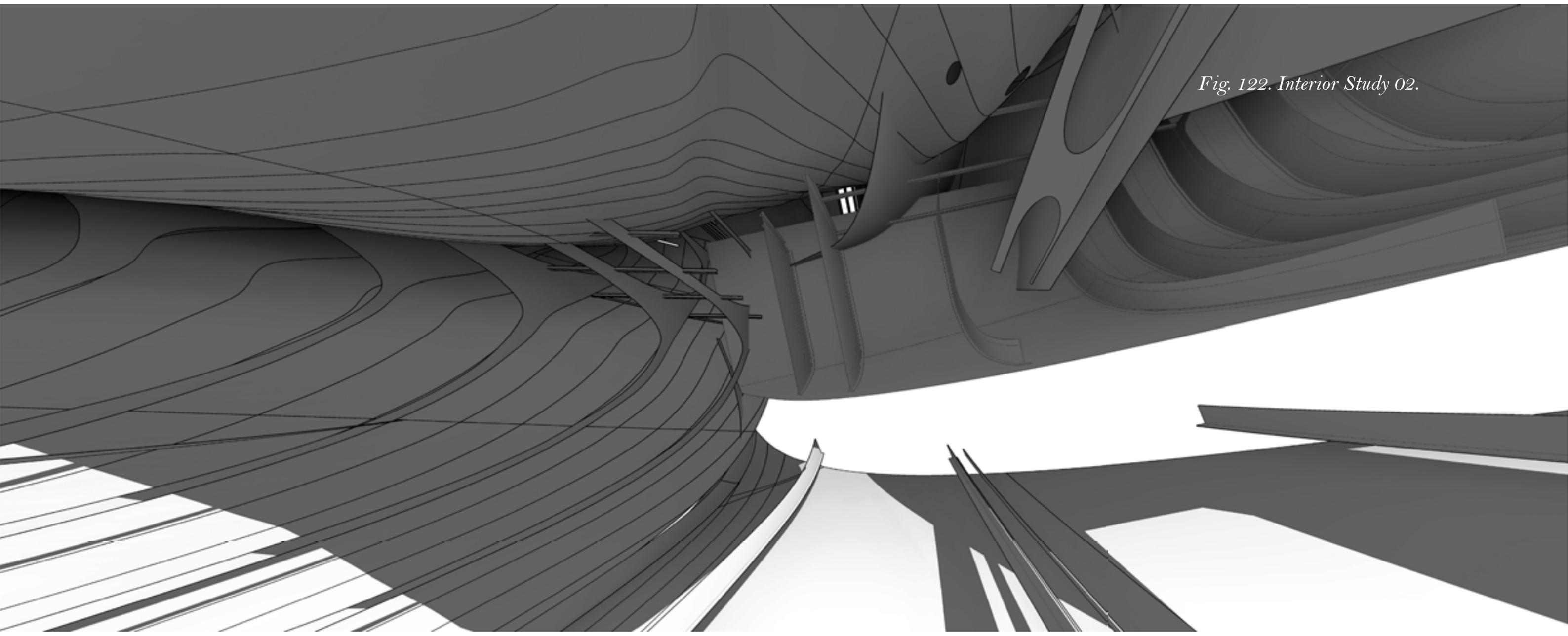


*Fig. 122. Interior Study 02.*

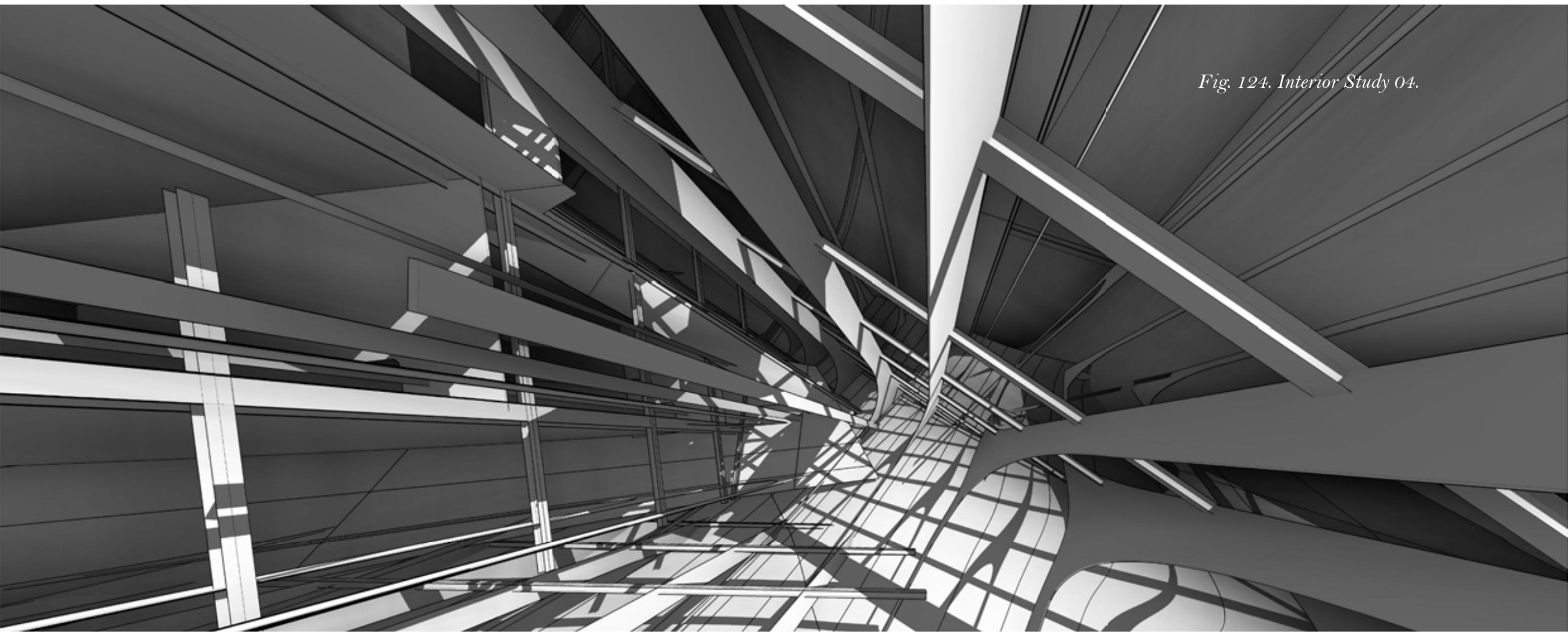


*Fig. 124. Interior Study 04.*

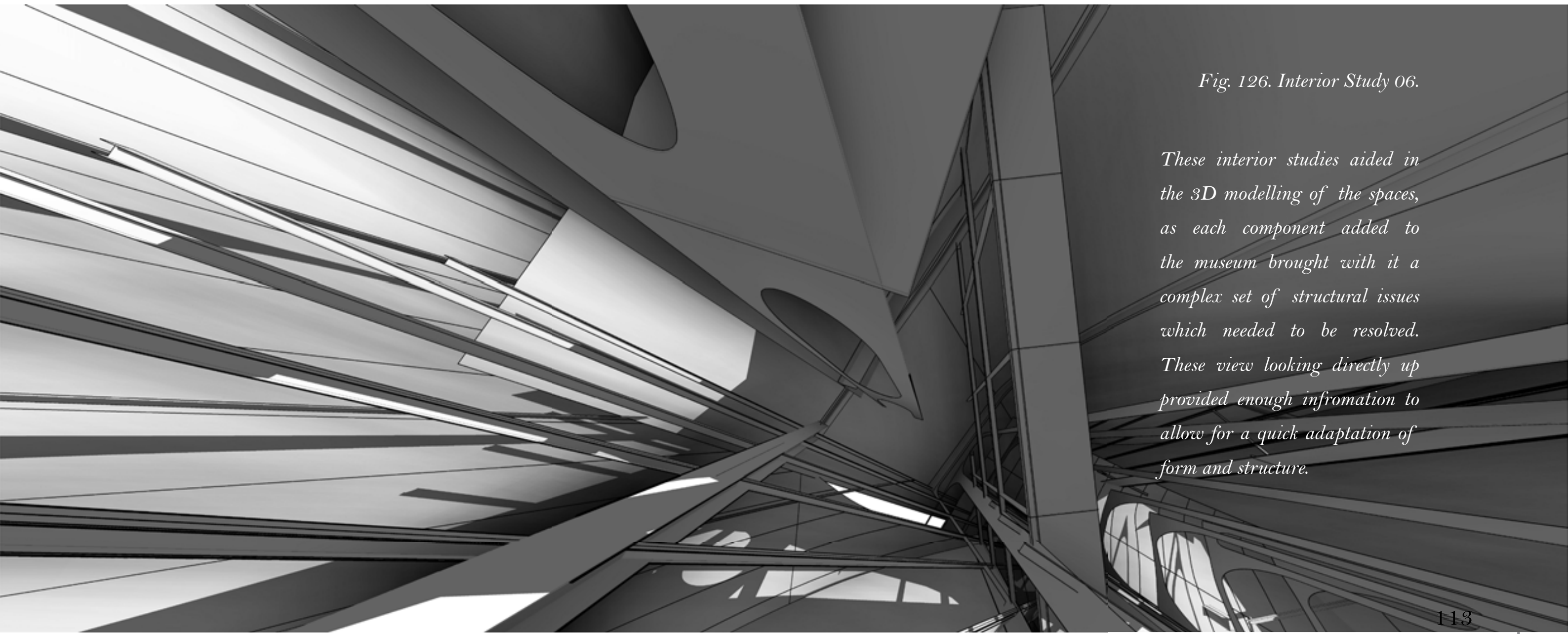


*Fig. 126. Interior Study 06.*

*These interior studies aided in the 3D modelling of the spaces, as each component added to the museum brought with it a complex set of structural issues which needed to be resolved. These view looking directly up provided enough infromation to allow for a quick adaptation of form and structure.*

*Fig. 127.*
*An artistic impression of the museum in the breakwater site after some time.*

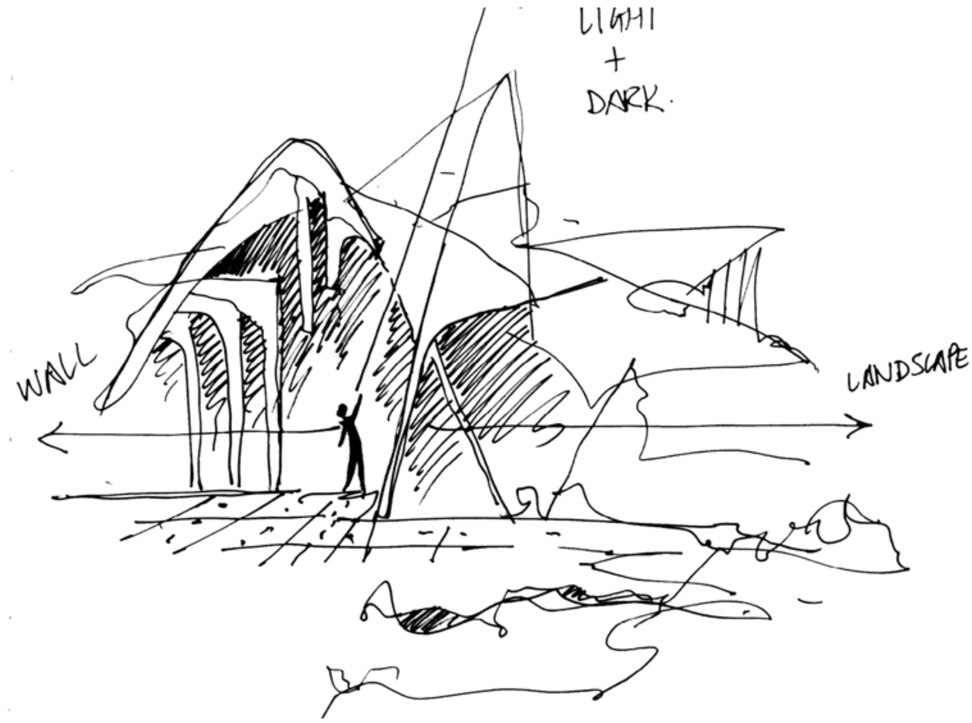



*Fig. 128. Early sketch exploring the sectional aspects of the gallery spaces.*

## REVELATION

This dissertation explored two key ideas towards architecture which were derived from Patrick Geddes' theory of the valley section in *The Valley Plan of Civilization* (1925).

The first idea was that of nature being the primary determinant of culture, whereby the inter-dependant relationship between man and nature is celebrated and used to generate a more sustainable culture. The proposed architectural outcome in the form of the new Iziko Maritime Museum was designed as an extrusion of the narratives which were uncovered at the breakwater site. The multiple layers of culture and history were researched across the Cape Town Harbour in order to establish a contextual foundation from which to begin the design, echoing the regionalist approach called for by Geddes and Norberg-Schulz.

The second idea which was drawn form the work of Geddes was conducted as an experiment to create architecture which was a sustainable expression of nature and, therefore, culture. This idea was based around using waste, defined by Mary Douglas as matter without place, to find value in both itself and its context. The ship breaking industry formed the spine of this idea as the container ship, named The Rose, was to be disassembled and then reconstructed in a new form as the Iziko Maritime Museum.

This process of using The Rose as a generator for architecture allowed for an interesting overlap of these two core ideas as both the breakwater site and The Rose were treated as a single landscape from which architecture was being extruded. The cross-section between theory and architectural resolution was explored and tested through many different methods which lead to the final outcome of the design of the museum.

This dissertation is an exploration of regionalism as the architectural development and outcome is the product of its context, that is, nature. Through this research, the idea that architecture is the mediator between man and nature is expressed in the form of a museum - a space to view historical artefacts where the space itself is also an artefact. The fundamental ideas are explored from their theoretical beginnings to their architectural resolution, the ideas carved out and sculpted, set aside and re-visited. Overall, imagination and playfulness was emphasized over regulation and practicality in the hopes of discovery.

*"Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution."*[1]

- Albert Einstein -

1 As quoted in "What Life Means to Einstein: An Interview by George Sylvester Viereck", in The Saturday Evening Post (1929).

## LIST OF FIGURES

**TABLES:**

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