THE DESIGN OF A MARITIME MUSEUM IN THE DURBAN HARBOUR
Figure 01, Interpretation of Durban (Author, 2015)
THE DESIGN OF A MARITIME MUSEUM IN THE DURBAN HARBOUR
This document is submitted in partial fulfilment of the requirements for the degree of Masters of Architecture, MArch (Prof), to the Faculty of Arts. Nelson Mandela Metropolitan University 2015

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ACKNOWLEDGEMENTS

To my parents Richard and Leigh and my grandpa Tony, for all your love, trust and support, without you none of this would have be possible.

To my lecturers

My promoter: Hansie Vosloo
Andrew Palframan
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Graham Eckley
John Andrews
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ABSTRACT

This treatise focuses on the design of a maritime museum for Durban’s harbour. The building is concerned with the preservation of three vessels, namely the “JR More”, the “SAS Durban”, and the “Ulundi” that are currently stationed at the existing museum.

The purpose of the treatise is to investigate the issues and processes involved in the design of a maritime museum in Durban. The research begins with an analysis of the typology in order to better understand the spatial and physical nature of a maritime museum. A set of architectural issues are identified in response to which an appropriate architectural design is proposed.

Four particular precedents are investigated for which the spatial make up of each buildings is divided into categories, and the relationships between these are analyzed. The physical nature of the buildings is established, resulting in the identification of an appropriate architectural language. Analysis of the precedents leads to site selection criteria which are used to select an appropriate site from these possibilities. The nature of site is then investigated. A set of informants and constraints are developed by identifying the issues of site. The structuring elements of site are analysed individually and precedents are studied to establish a response to these issues. An architectural language that is site specific is then developed by investigating the nature of industrial harbours. With an understanding of the spatial and physical make up of the typology paired with responses to the specific issues of site, a maritime museum for Durban’s harbour is designed.
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INTRODUCTION

BACKGROUND; AIMS AND OBJECTIVES; DOCUMENT STRUCTURE; METHODOLOGY
BACKGROUND

This treatise is born out of an interest in the maritime history of Durban that began when I was a child growing up in a naval family.

Durban, like many other coastal towns in South Africa, owes much of its existence to early voyages of sea explorers and the colonisation that followed. In 1497 the Portuguese seafarer Vasco da Gama arrived at the bay of what is now Durban on Christmas Eve, and named it “Terra do Natal”, Christmas Country. Much later, in the year 1824, a proper settlement started, initially named “Port Natal”. Durban has since grown to become one of the most important cities in South Africa and even Africa, due to the importance of its port. It has a rich maritime history that in recent years has largely been lost in historical narratives of the city. However, a fairly large sized collection of maritime artefacts is currently housed in the Durban harbour at the Port Natal Maritime Museum.

The Port Natal Maritime Museum is located in the Victoria Embankment. The precinct is dominated by the industrial workings of the harbour. This has led to the decay of what was once a prime area within the city and the primary connection to the water for all Durbanites. However the Victoria Embankment today lacks connection to its surroundings which has resulted in very little exposure and activity for the museum.

Currently the facilities at the Port Natal Maritime Museum are not sufficient to safeguard the artefacts there and they are in danger of being degraded beyond repair. Amongst a large collection of maritime related items are three vessels that played a huge role in Durban’s maritime history, namely the “JR More”, a steam tug, the “SAS Durban”, a minesweeper and the “Ulundi”, a tug-pilot boat. An architectural intervention is needed to safeguard these historically relevant vessels.
The proposal for a new museum is part of a larger plan by the city to develop its cultural identity. The eThekweni municipality’s Spatial Development Framework has a vision that reads, “By 2020 eThekwini will be Africa’s most caring and liveable city” Part of the eThekweni Municipality’s Integrated Development Plan’s Eight Point Plan which outlines strategies to achieve this vision is to embrace its Culture, Diversity, Arts and Heritage. This has led to the planning of new cultural facilities in the Durban CBD.

This treatise aims to design a maritime museum that will provide the architectural intervention needed to preserve important artefacts, develop a relevant expression of a culturally diverse city, enhance Durbans historical and cultural narrative, and serve as a catalyst to regenerate the harbour precinct.

“People have a fundamental yearning for great bodies of water. But the very movement of the people toward the water can also destroy the water.” (Alexander 1977: 136)
AIMS AND OBJECTIVES

For clarity, the aims of this treatise are divided into project aims, research aims and design aims.

**Project:**

This treatise aims to design a maritime museum as a catalyst for development in the degraded precinct of Durban harbour.

**Research:**

- To understand the museum typology as it is today.
- To establish the spatial and physical nature of a maritime museum and its effects on its context.
- To undertake a precedent study survey of buildings with similar programmatic functions.
- To understand the layout of a museum and how the exhibits contribute to its spatial narrative.
- To investigate the particular urban urban qualities of Durban and to choose a suitable site for a maritime museum.
- To understand the harbour precinct context as a segregated environment in order to propose appropriate design solutions.
- Understanding the nature of a catalyst development within a planned cultural precinct.
- Explore the spatial and physical expression of Durban’s harbour as an industrial environment to develop an expression routed in place.

**Design:**

- To propose an urban design strategy in conjunction with the eThekweni Integrated Development Plan.
- To propose an appropriate architectural language particular to Durban’s harbour.
- To develop an environmentally conscious building that is respectful of the connections between man, water and the built environment.
- To communicate the rich history of Durban’s maritime history through the preservation of historical artefacts - (steam tug “JR More” minesweeper “SAS Durban” “Ulundi”).
PART ONE
RESEARCH

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- EVOLVING TYPOLOGY
- IDENTIFYING THE ISSUES
- EXPLORING THE ISSUES
- PRECEDENT STUDY
- PROGRAM DATA

CH TWO
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- SITE ANALYSIS
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- ACCOMMODATION SCHEDULE
- SITE READING
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- SECTIONS
- 3DS
- TECHNICAL SECTIONS AND DETAILS
- PORTFOLIO AND MODELS

FINISH DESIGN

PROGRAM
- ( UNPACKING & EXPLORING THE ISSUES )

CONTEXT
- ( DEVELOPING THE DESIGN IDEAS )
METHODOLOGY

This treatise uses a qualitative research methodology and is primarily of an exploratory nature. The research was applied research and the data was analysed qualititively. An empirical research strategy was used to obtain research information in the various chosen research topics. This raw data and unprocessed information was collected from numerous sources before being analysed, documented and organised in order to produce informed conclusions on the subject. These findings were used to formulate intervention strategies and relevant design responses, which result in the design of a maritime museum for Durban’s harbour.

Primary data collection methods

1. Field Research
Non-participant direct observation of site, activities, processes and spaces.

2. Interviews
Unstructured interviews and group discussions, with peers, lecturers and professionals.

Secondary data collection

1. Literature Study
A review of literature including: unpublished documents, books, academic papers, journals, photographs, websites, architectural drawings and precedents
CHAPTER 1
NATURE OF PROGRAM

THE MUSEUM AS AN EVOLVING TYPOLOGY; IDENTIFYING THE ISSUES; EXPLORING THE ISSUES; PRECEDENT STUDY; PROGRAM DATA
CHAPTER ONE  NATURE OF PROGRAM

INTRODUCTION

This chapter establishes the nature of a maritime museum by exploring the spatial and physical conditions of the typology.

It begins by investigating the development of museum architecture and how the architecture has developed into the museum of today. Principals identified are then applied in a precedent study of four museums in order to identify the different approaches and responses to these issues.

“Museums arrange the world according to the changing way we see it: from Renaissance memory theatres and Baroque cabinets of curiosity, via Enlightenment typologies, to Modernist teleologies and the current vogue for environmental contextualism.” (Marotta, 2012)
Figure 05, Perot Museum of Nature and Science (Morphosis, 2012)
In this section a brief study of the museum as an evolving typology will be done by analysing the spatial and physical changes of the architecture over time, in order to establish what the museum of today is and to identify the architectural issues.

The terms physical and spatial are taken from the writings of Bill Hillier and are used throughout the document.

Museum [n.] A building used for storing and exhibiting objects of historical, scientific or cultural interest. (The Concise Oxford Dictionary, 8th addition 1990)
**British Museum of Art, LONDON** completed 1753 extension 2001

**The classical museum**

The earliest “museums” in the fifteenth century were used for the gathering of art and artefacts for religious purposes and by the wealthy families of the time for private collections, which were open only to small groups of scholars.

With the French Revolution in 1789, the social outlook began to change and a demand to open museums to a wider public emerged. Museum buildings were now civic in nature and designed with classical pediments, roman pilasters, and vaults and cupolas inspired by 16th-century architecture. These palace-museums merged culture and power to convey an image of an idyllic past. (Marotta 2012).

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<table>
<thead>
<tr>
<th>Physical</th>
<th>Content OR the Container</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Container for artworks</td>
<td>• Abstracted form</td>
</tr>
<tr>
<td>• Figurative-Classical expression</td>
<td>• Universal expression -multicultural</td>
</tr>
<tr>
<td>• Regional expression -Specific cultural identity</td>
<td>• Permanent sense of materiality</td>
</tr>
<tr>
<td>• Civic building</td>
<td>• Container for artworks</td>
</tr>
<tr>
<td>• Timelessness-mass materials such as stone, brick and marble</td>
<td>• Not engaged with the public</td>
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In 1952 the typology notably changed with the completion of the Guggenheim Museum in New York, designed by Frank Lloyd Wright. The building had a completely new language that contrasted with the museums before it. What Wright had created was a museum that had a space and narrative of its own, in addition to that of the art. This museum is perhaps the best example of championing the cause of architecture over art (Marotta 2012).

Wright formulated a new approach to museum design, one where the spatial experience has an effect on the exhibitions and changes the viewer’s perception of the works on display. The space of the museum now had a meaning of its own.
At the peak of Modernism, Mies van der Rohe brought back the classical ideas of the typology with the New National Gallery. The museum was viewed as a cultural temple. Driven by modernist ideas of abstraction, minimilism, functionalism and the open plan, while using industrial materials such as steel, glass and concrete, it is square and symmetrical in plan and austere in its expression, being based on a highly ordered structural system. It sits on a raised concrete podium that reinforces its temple-like expression. Mies took this idea to the extent that, the permanent collection and services were housed in the podium underneath so as not to compromise the integrity of the temple above (Hoursten 2003).

In 1977, new trends in architecture led to the development of the museum as a kinetic, dynamic machine. The introduction of a movable skeletal structure allowed flexibility of use, as in Renzo Piano and Richard Rogers’ design for the Pompidou Centre in Paris. The Pompidou Centre was designed in order to free the internal space up for usable, flexible floor space. This flexible space created a museum architecture liberated from its contents. As a container, the museum embraces the contradictions of modernity and is an eloquent and abstract structure, independent of its artistic contents (Slessor 2012).
Guggenheim, BILBAO 
Architecture as the artwork

The Guggenheim Museum in Bilbao, designed by Frank Gehry continues the expressionist language of Wright’s museum. Again, the question arises whether the form of the building overshadows the art on display. When looking at the plans one can see that although the gallery spaces are not far removed from those in a classic museum, the spaces in between are dynamic and are not the typical nineteenth century linear arrangement. The specific configuration of the galleries is closely tied up to the programmatic requirements of the museum.

CaixaForum, MADRID
The Public backdrop to art

The CaixaForum by Herzog & de Meuron was constructed on the site of an old power station. The walls of the power station were retained and a oxidized cast-iron extension was placed on top of them. This extension contrasts with the brick but still respects its context. The building has been raised in order to engage with the public and spills out in the square in front of it. The building is very much a container for art but still has a strong quality of spatial experience within the exhibition areas.

<table>
<thead>
<tr>
<th>Spatial</th>
<th>Physical</th>
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</thead>
<tbody>
<tr>
<td>Open plan</td>
<td>Abstracted form</td>
</tr>
<tr>
<td>Fixed displays- No public spaces</td>
<td>Formally set apart from context</td>
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<tr>
<td>Spatial experience dictates experience of museum</td>
<td>Universal expression</td>
</tr>
<tr>
<td>A centralised building with circulation on a fixed, spiral route</td>
<td>-multicultural</td>
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<td></td>
<td>Sculpture aesthetic</td>
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<td></td>
<td>Modern materials</td>
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<td>Architecture as art</td>
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<table>
<thead>
<tr>
<th>Spatial</th>
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<tbody>
<tr>
<td>Fixed plan</td>
<td>Abstracted form (extension)</td>
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<tr>
<td>Spatial experience dictates experience</td>
<td>Regional/Universal expression</td>
</tr>
<tr>
<td>A centralised building with circulation on a fixed route</td>
<td>Modern clip-on element shows contrast in materials</td>
</tr>
<tr>
<td>Lets the public space flow into the building</td>
<td>Container for artworks</td>
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</tbody>
</table>
WHAT IS THE MUSEUM OF TODAY?

The role of museum today is no longer that of an archive in which to keep historically valuable items but a public building that connects both visually and physically to its context. The struggle between building as artwork and building as container for artworks remains a central question in contemporary museum architecture. It is generally agreed that there should be a relationship between the building and the exhibitions. The overall experience of building has moved away from having a dominant narrative to multiple narratives which can dialogue with one another and the museum audiences both meaningfully and respectfully (Obermeyer 2015). Museums now embrace technology, which has changed the nature and type of exhibitions and therefore impacted on the spaces that house them.

Museum buildings are cultural buildings by nature and the expression of the building should reflect this. Contemporary museums whilst being respectful of context opt for a universal expression as opposed to a regional or vernacular approach. Flexibility and Adaptability of museums has become key in keeping visitors interested. Using flexible exhibition space allows the museum to have temporary exhibitions that keep a contemporary and evolving feel to the museum and its visitors. As museums have evolved they have become more inclusive and mixed use.

Museums have increased in size and scope to reach a greater demographic by including essential components like restaurants and retail facilities. Museums are now seen as cultural “centres” with previously background activities such as art restoration being brought to the public.

The diagrams that follow illustrate central questions and choices identified in the study of the evolving museum typology. They inform the basic design decisions made in this project.
IDENTIFYING THE ISSUES

Museums are essentially used for the housing of historically and culturally important collections. They can vary considerably in size, organisation and purpose and is therefore important to consider the particular context, collections and overall public interface.

It is essential to establish the subject of the museum, the museum collection characterisation and the type of institution. The museum will primarily house three exhibition boats: the SAS Durban, a 42-year-old minesweeper, the 38-year-old JR Moore which was driven by an oil-burning engine and worked as a tugboat in the harbour, and the 75-year-old Ulundi with its coal-fired engine. The collection is a regional one relating to the maritime history of Durban. The museum will be an approved provincial one and its proposal is part of the eThekweni municipality’s vision of embracing the culture and heritage of the city.

Museums should encourage discovery and learning and be an educational tool. Good museums are well connected to their context, accessible to the public and are a continuation of public space. The relationship between the exhibits and the spatial connections within the building envelope are what will dictate the experience of the museum. A good museum is connected to its environment and has a varied spatial experience.

Issues of museums typology

<table>
<thead>
<tr>
<th>Physical</th>
<th>Contextual connections</th>
</tr>
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<tbody>
<tr>
<td>Spatial</td>
<td>- Activities</td>
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<tr>
<td></td>
<td>- Movement routes</td>
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<tr>
<th>Physical</th>
<th>Expression</th>
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<td></td>
<td>- Identity</td>
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<td></td>
<td>- Art or container</td>
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<td></td>
<td>- Building or non building</td>
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<thead>
<tr>
<th>Spatial</th>
<th>Circulation</th>
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<tbody>
<tr>
<td></td>
<td>- Spatial narrative or exhibitions</td>
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<tr>
<td></td>
<td>- Fixed or open plan</td>
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<tr>
<td></td>
<td>- Flexibility</td>
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<tr>
<td></td>
<td>- Technology, types</td>
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<tr>
<td></td>
<td>- Relationship to each other</td>
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<table>
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<tr>
<th>Physical</th>
<th>Exhibitions</th>
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<td></td>
<td>- Technology, types</td>
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<td></td>
<td>- Relationship to each other</td>
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</tbody>
</table>

“A museum is an institution which collects, documents, preserves, exhibits and interprets material evidence and associated information for the public benefit.” (Museums Association(UK), 1984)
EXPLORING THE ISSUES

What is a maritime museum?

A maritime museum is a museum that specialises in the display and experience of artefacts relating to ships and sea travel. There are various types of maritime museums which focus on certain collections, namely naval, sea trade and exploration focused museums. The narrative of the museum is dependant on the content of historical artefacts in its possession.

Maritime museums are centred around their collections of historic ships (or replicas) and therefore also focus on the preservation of these artefacts. The displays range from the larger to much smaller vessels, from the more fragile ships or even partial ships to interesting pieces of ships (such as a figurehead or cannon), ship models, and miscellaneous small items like cutlery and uniforms.

The spatial arrangements and requirements, as well as the programmatic needs of a maritime museum are discussed here through the process of a precedent study.

The study will analyse

1. The necessary spatial requirements and their relationships to each other (planning) and surrounding spatial structures (context).

2. The physical attributes and how they affect these spaces through an analysis of physical character, expression and the materials and tectonics used to convey this expression.

3. The concerns for energy of the buildings will be analysed to better understand a maritime museum as an building typology.

The following is a analysis of four maritime museums chosen because of their particular approaches to site and resolution of spatial and physical issues. The physical nature of the building and use of specific materials and tectonics to achieve the intended expression. All precedents chosen deal with spatial, physical, and sustainability issues in a particular manner. The following precedents were chosen:

- Maritime Museum of Finland
- The Glasgow Riverside Museum of Transport
- Kaap Skil Maritime and Beachcombers Museum
- Danish National Maritime Museum

The buildings are analysed in terms of their location (connection to city and sea, movement routes, cultural activities and movement nodes), their accommodation schedules and the relationships between these activities. In order to determine the spatial nature of a maritime museum, the spatial configurations and relationships between the specific functions are examined. Relationship diagrams are used to show the similarities and differences in museum spatial configurations (program, spatial network within the building). The precedents are also be examined in terms of their expression and character, through a physical analysis of materials and tectonics and how these can add to sense of place and the experience of a maritime museum (the physical elements that give character). An investigation of any sustainable principles used in the construction of the building.

Figure 33, Collage of precedent study (Author, 2015)
Precedent Studies

Danish National Maritime Museum
Kaap Skil Maritime and Beachcombers Museum
Maritime Museum of Finland
The Glasgow Riverside Museum of Transport
Vellamo Maritime Museum of Finland
Kotka, Finland

Architect: Lahdelma & Mahlamäki, 2009
Building Length 300 metres
Height 30 metres from the ground level.
Floor area 14,601 m²
Volume 118,039 m³

Contextual

Vellamo Maritime Museum is located on a port quayside at the end of the planned culture harbour, and fulfils a visual as well as a strategic function within the cityscape. The figure of the Maritime Centre guides travellers from the heart of the city out to the north-eastern end of the City Terminal and into a harbour of culture. The Maritime Centre is the hallmark of the city’s cultural profile. (The role of an individual building in determining the direction of a city’s overall architectural development is nowadays recognised as a model for city planning (Lomholt, 2009)). The museum is located outside the city centre but is positioned on a major transport node which makes it highly connected while still separated from the city.

Figure 34, VMM of Finland (Lahdelma & Mahlamäki, 2009)

Figure 35, Spatial connections to transport routes. The museum is connected to the city centre by a network of roads and railways. The museum is not part of a cultural precinct but sits in an industrial harbour site.

Figure 36, Scale of site to immediate context. This gives it a spatial hierarchy in its context. The site is isolated by the transport systems in place.

Figure 37, Diagram. The museum is isolated by the transport systems that cut the site off from the surrounding residential area.

Figure 38, Diagram of isolated nature of the site.
Spatial

On the approach, the building has two separate entrances. One is a walkway that rises gently from the city centre, widening as it reaches the rooftop square. The rooftop is an external covered performance space that is an extension of public realm. The other is the main entrance which is located near the outdoor exhibition space.

The entrance and foyer are connected directly to a broad staircase which connects the entrance to the elevated, centrally located exhibition hall housing the permanent collections shared by both in-house museums. These play a key role in the Maritime Centre and give the interior its distinctive character (Lomholt, 2015). The Maritime Centre is home to two permanent residents: the Maritime Museum of Finland and the Museum of Kymenlaakso. Each museum’s exhibition tour can function independently or as part of a larger tour encompassing both exhibitions. A walkway forming both a visual and a physical link between the two museums’ exhibition spaces leads out of the shared foyer.

The bridges crossing the elevated permanent-exhibition room guide visitors from the main entrances into each individual museum and to doors leading into the spaces housing the numerous visiting collections. The museum shop, a restaurant, seminar and teaching rooms and an auditorium are all situated in and around the main foyer area. There are also workspaces that are divided between the ground floor and the second floor of the building. Spaces used for unloading, restoration, exhibition construction, storage and conservation purposes are organised according to function and situated on the ground floor. The museums’ shared administrative office spaces are located on the second floor (Lomholt, 2015). An extensive library is situated on the ground floor and is fitted with a separate entrance.
The building was designed as an abstract image of a large wave, a swell, which dominates the exterior of the building, and the façade, specially designed to capture the glint of the water, combine to create a physical representation of the sea. The Maritime Centre building is a prime example of modern engineering.

It is primarily built around a column and beam system of reinforced concrete girders. The rooftop square, the covering over the fitted upper floor and the maintenance area is a combination of steel, glass and aluminium. The outer walls are constructed using a lightweight skeleton structure. Sheet-metal cassettes, painted in a variety of different shades, are the primary building material on the exterior of the building, to which a lattice made of aluminium and pressed-silk glass has been affixed.

Physical

The building houses the museum exhibitions internally and an outdoor performance space on the roof. These are connected via a ramp. The primary exhibitions are higher in the spatial hierarchy and direct access on the ground floor.
Energy

The program of Vellamo is large, but the building itself is very compact to ensure the energy efficiency and sustainability. The heated spaces are optimal in shape and the façade area has been minimised and oriented optimally. The HVAC installations are designed to ensure energy efficiency (Lomholt, 2015).

Internally with the help of natural light, spatial layout and the choice of materials, individual spaces come together to form shifting, adaptable, dynamic spatial units. The form, colour scheme and built-in technical equipment in each room have been carefully chosen with regard to the varying nature of different exhibition environments. The clearly defined shape and proportions of these rooms, the neutral grey colouring specified on all surfaces and fittings, and the comprehensive lighting, electricity, heating and ventilation system make them suitable for housing a whole host of different museum exhibitions. The main entrance staircase gives the interior of the Maritime Centre its distinctive character; it is a material world dominated by oak-wood surfaces.

Figure 50, Container for artwork. The building has a respectful relationship between the exhibitions and the expression of the building.

Figure 51, Universal Expression. The museum reads as ‘building’ with a universal expression.

Energy

The program of Vellamo is large, but the building itself is very compact to ensure the energy efficiency and sustainability. The heated spaces are optimal in shape and the façade area has been minimised and oriented optimally. The HVAC installations are designed to ensure energy efficiency (Lomholt, 2015).
The Glasgow Riverside Museum of Transport
Glasgow, United Kingdom

Architect: Zaha Hadid Architects, 2011
Height: 25.7 m
Site Area: 22,400 m²
Size/Area: Gross floor area 11,300 m² (excluding basement)
Footprint Area: 7,800 m²

Contextual

The Riverside Transport Museum is located on the water’s edge in Glasgow, on an area of land known as Pointhouse. The museum is part of a larger, multi-billion-pound Clyde Waterfront regeneration project (Dispenza-2012). Although the transport networks connect people to the site, they also act as a barrier excluding the building from the built fabric. The museum sits as an object building and is shaped and formed by the surrounding water bodies. It was proposed that, due to the shape and mass of the building, it will in the future act as a connector between the city and the waterfront.

Figure 53, Spatial connections to transport routes.
The museum is connected to the city centre by a network of roads. The museum sits in an industrial harbour site.

Figure 54, Museum as catalyst. Scale of site to immediate context. This gives it a spatial hierarchy in its context. The site is isolated by the transport systems in place. The building is a catalyst for the area and will be the start of a cultural precinct.
Spatial

The museum is a three level structure divided on plan into three basic parts. The larger of the spatial structures is the exhibition area. Which is located centrally between an administration and a public services block. The exhibition space is large and uninterrupted space, with the resource facilities set up a periphery, controlling the movement of people and dictating the experience of the museum. The activities are grouped into private (staff meeting spaces, academic offices, student study spaces, service and storage areas), semi public (studios, library, lecture Theatre, research space) and public (exhibition spaces, gallery, museum shop, restaurant). Externally the building is anchored by two forecourts on either end which are linked by the internal exhibition space and entrances on both ends. The building’s exhibition spaces terminate on the water’s edge, where the museum’s historic boat exhibition is located.

Figure 55, Spatial structure and accessibility of the ground and first floor. The exhibition space is an uninterrupted space that allows for easy accessibility and flexibility of exhibitions and exhibition space. The exhibition space is flanked by the museum facilities (galleries, studios, lecture theatres and a library).

Figure 56, Scale of the building in its context. The museum is larger than its immediate context. It sits on the edge of an industrial waterfront.

Figure 57, Public building. The building sits within a public waterfront that forms part of a promenade.

Figure 58, Spatial hierarchy of exhibition space and staff component. The exhibition space is a large uninterrupted space that encourages exploration and learning.
Figure 59, Spatial layout. The building is anchored on each end by outdoor forecourts that are used for temporary exhibitions. Within, the building envelope is then divided into services, administration and exhibitions. The main boat exhibition is housed externally in the water.

Figure 60, Spatial relationship. The public space spills into the building and connects the outside to the inside. The outdoor exhibition spaces connect to the inside exhibition spaces.

Figure 61, Accessibility. Spatial narrative of the building. The building is open to explore. The peripheral resource facilities work with the exhibition spaces to create a narrative.
Physical

The building is characterised by its roof form of cresting waves that run the length of the structure; the roof and longitudinal walls are covered in 15,000 m² of zinc cladding, giving the building a uniform, sculptural appearance. End walls with glazed, transparent facades appear to cut a cross section through the building, emphasizing the wave-like roofline. The architects describe their building as “flowing” between the city and the waterfront (Dispenza-2012). The roof not only gives expression to the building but is also structurally important as it allows a vast uninterrupted area that is used for exhibition space. The wavy character of the roof was used in plan form to respond to the surrounding water bodies, and creates an interesting narrative within the building and externally.

Figure 66. Container for artwork. The building has a respectful relationship between the exhibition and the expression of the building. The building’s form and physical nature does not overpower the exhibitions.

Figure 67. Expression. The museum reads as “building” with its house typology truss form but a universal expression.

Figure 65. Public Private relationship. The exhibition component which is most public is defined by its wavy trussed roof, which was designed in such a way that the exhibition space is uninterrupted and does not require columns.
Kaap Skil Maritime and Beachcombers Museum
Texel Island, Netherlands

Architect: Mecanoo Architecten, 2011
Site Area: 1,200m²
Footprint Area: 400m²
Building Height: 12.3m

Contextual

The Kaap Sil is a contextually responsive building that articulates itself as complex parts that came together to create an iconic and recognizable image (Mecanoo, 2011). It is located in the small harbour town of Oudeschild on Texel Island, the largest of the Wadden Islands (Sypkens, 2012). The museum sits on the South side of Oudeschild’s main road which is situated between a canal to the south of Kaap Skil and a port to the East (Lomholt, 2012). The museum forms part of a bigger museum complex, whose grounds contain several other buildings to the south of Kaap Skil museum.

Figure 72, Spatial connections to transport routes. The museum is connected by a network of roads to the city. The building faces the main street. The context is primarily small scale residential buildings.

Figure 73, Cultural precinct. The museum forms part of a cultural precinct that forms a larger narrative in the area.
Spatial

There are three dominant spatial components that structure the program of the Kaap Skil museum: a service component compromising the service stairs and storage facilities, an administration and staff component housing offices, and the biggest space containing the exhibition space and restaurant facilities.

The building is spread out over three levels which are all linked by a central staircase. The entrance leads into a foyer area that includes the restaurant and is flanked on each side by the service and administration blocks. The staircase connects the entrance floor and restaurant to the upper and lower levels of exhibition spaces. The lower level is used as a temporary exhibition space and workshop and the upper level is the main exhibition space. The north and south ends of the museum are fully glazed and give an open feeling and a visual connection through the building. This also allows for a free open exhibition space void of columns and walls. The museum is designed in order to control the movement of people between public and private activities whilst still having an easy-to-read spatial environment.

Figure 74. Spatial layout. The museum has three main components. The public facilities are connected via the entrance which leads into the restaurant space that connects you to the exhibition spaces.

Figure 75. Spatial hierarchy, the exhibition space is highest in the spatial hierarchy and is an open and flexible space.

Figure 76. Open plan, flanked by service facilities.

Figure 77. Circulation. The floors are connected by a central staircase. The open plan floors allow for easy movement around the exhibition spaces.

Figure 78. Accessibility. The building is open at each end to allow visual connection throughout the building.
Figure 79, **Relationship of public space to exhibition space.** The public space continues through the building on the ground floor while the exhibition spaces are above and below.

Figure 80, **Circulation.** The floors are connected by a central staircase. The open plan floors allow for easy movement around the exhibition spaces.
Physical

The Kaap Skil’s four linked gabled roofs echo the rhythm of the surrounding rooftops. From the sea these look like waves rising out of a canal. The scale and relatively small size of Kaap Skil allows the building to exist in harmony within the fabric of the city but still be distinguished from the rest. The building facade that protects the interior shell from the stormy climate is made of driftwood found in the nearby North Holland Canal. This relates to the age-old Dutch tradition of using driftwood to create houses (Mecanoo, 2011). The massing of the building along with its wooden facade makes the building look like a reincarnation of the traditional Dutch house (Lomholt, 2012). The building is designed structurally to have a free floor plan, void of walls and columns in order to better experience the exhibits. It is open on opposite ends to create a visual connection through the building and an inside outside connection.

Sustainability

The reuse of driftwood from the area not only creates an overall sense of place but also is a sustainable practice which adds to the experience of the building both physically and spatially. The building also makes use of natural lighting on the upper floors to enhance the experience of the exhibits.

Figure 86, (Mecanoo Architecten, 2011)

Figure 87, Scale of museum. The museum physically is larger in scale than the surrounding context but is contextually responsive in its form which picks up the rhythm of the streetscape.

Figure 88, Lighting of exhibition. The roof allows light to enter the upper exhibition space by detailing windows in the trusses on the North side.
The Danish Maritime Museum is located in a unique historic and spatial context: between one of Denmark’s most important and famous buildings, the Kronborg Castle, and the Culture Yard - a new ambitious cultural centre. BIG proposed to place the museum underground, just outside the wall of the dock in order to preserve the dock as an open, outdoor display, maintaining the powerful structure as the centre of the Maritime Museum. By placing the museum this way, it appears part of the cultural environment associated with the Kronborg Castle and the neighbouring Culture Yard, while at the same time manifesting itself as an independent institution (BIG, 2012). The building and surrounding cultural precinct are located on the edge of the city in a historical port area but are connected by a major transport route. The cultural precinct acts as a buffer between the city of Helsingor and the water.

**Contextual**

Figure 90, **Contextual spatial connections.** Spatial connections to transport routes. The museum is connected to the city centre by a network of roads.

Figure 91, **Connections to cultural precinct.** The museum sits within a harbour that is part of a collection of cultural and historical buildings.
Spatial

The building has three movement routes which structure it spatially.

1. A bridge that acts as the main entrance to the museum. This bridge unites the old and new as visitors descend into the museum space overlooking the majestic surroundings above and below ground. The long and noble history of the Danish Maritime Museum unfolds in a continuous motion within and around the dock, seven meters (23 ft.) below the ground (BIG, 2012). As the bridge wraps around and descends into the dock it connects all floors. Connecting exhibition spaces with the auditorium, classroom, offices, café and the dock floor within the museum, this ramp slopes gently to create a set of exciting and sculptural spaces.

2. A bridge that connects one side of the site to the other

3. A staircase entrance that connects to the basement of the dried dock. Leaving the 60 year old dock walls untouched, the galleries are placed below ground and arranged in a continuous loop around the dry dock walls – making the dock the centerpiece of the exhibition, an open, outdoor area where visitors experience the scale of ship building (BIG, 2012).

Figure 92. Accessibility around site. The museum is connected to the surrounding cultural activities by a walkway that goes through the site.

Figure 93. Accessibility around site. The museum is accessed via the public walkway that drops into the dry dock and becomes part of the museum exhibition space and experience.
Figure 94. **Relationship between exhibition and administrative space.** The walkways link people from the entrance to the exhibition space and are themselves part of the experience. The periphery of the space houses the administrative activities.

Figure 95. **Layers of space that form the museum.** The dry dock is used to house the museum. It is carved into to house the exhibition’s which are connected by the insertion of walkways that connect gallery spaces.

Figure 96. **Danish National Maritime Museum (BIG, 2013).**

Figure 97. **Danish National Maritime Museum (BIG, 2013).**

Figure 98. **Danish National Maritime Museum (BIG, 2013).**
Physical

The building’s expression is dictated by the embracing of the dock. Instead of building up on the dock, the dock structure itself is used and with a zig-zagging walkway that descends into the historic dry pit. This decision was made to not interrupt the connections between city and the sea by introducing a physical barrier. The structure inserted into the dry dock is of contemporary timber and glass structure which is offset and contrasts with the existing concrete dock. This is a good reading of scale and the impact of the built environment on a sensitive seafront site.

Figure 102, Physical relationship to context. The museum is set into the dry dock which allows a respectful relationship between the museum and the surrounding historical buildings. Sinking the museum also maintains visual connections through the site to the surrounding context.

Figure 103, Relationship to water’s edge. The museum being sunken into the dry dock allows for a visual connection over the site to the water’s edge.
SUMMATION OF PROGRAM

Site selection, connection to transport nodes and movement systems, and spatial narrative of the museum have played an important role in all of the precedents investigated. The precedents studied either form part of existing cultural precincts or have been established as a catalyst for the development of a cultural precinct. To be a catalyst, the facility must be large enough to maintain attraction and be located appropriately. Site selection is key to the success of the museum as museums require supporting facilities. These normally form part of a cultural precinct, which could be made up of museums, theaters, libraries or historical landmarks. In the case of a maritime museum the site must be large enough to accommodate the programmatic needs and be located near to the water within a waterfront precinct with waterfront promenades. The precedents are all located near to movement routes and are well connected to public transportation and integrated into the city.

Analysis of the spatial relationships of the precedents shows that all have three main spaces: the exhibition space, public resource facilities, and the staff component. The spaces work together to form the narrative of the museum and are organised spatially to provide maximum accessibility and flexibility to the user. The public resources and staff spaces are separated and used to form or house the exhibition space. This is done by stacking activities towards the periphery in order to give a large uninterrupted space in the centre for exhibition. These sets of spaces then either allow or inhibit connectivity, setting up a sense of hierarchy and a privacy gradient. The structuring of these spaces, their relationship to the exhibition narrative and the structural idea employed combine to achieve what becomes the form of the building. The privacy gradient is defined by the level of connectivity to the exhibitions and outdoors. This normally means a vertical layering of a privacy gradient, with the most public facilities on the ground floor.
Hierarchy is determined by manipulating the size, shape and order of space. An open free plan and large volumes of uninterrupted space are needed to house ships/boats and other large exhibits. These influence the size and scale of the building and its physical nature. The common sets of spaces within the building that make up its general spatial nature are:

- Permanent exhibitions
- Temporary exhibitions
- Library
- Research facilities
- Outdoor exhibitions and learning spaces
- Restaurant
- Auditorium
- Administration
- Maintenance workshops
- Conference rooms

Generally the primary spaces are the exhibitions and their circulation requirements. This spatial narrative dictates the spatial quality and the spatial experience of the user. A relationship between the exhibitions and the experience of space is essential in order to create the best possible environment for learning and exploring.
The physical nature of the building gives meaning to and adds to the narrative of its spatial conditions. The studied precedents all shared a sense of the building itself, a sense that the building was a container for the exhibits and a universal expression that leaves the interpretation of the cultural narrative up to the user. This is achieved through their form and physical expression via materiality and the tectonic nature of the buildings. The buildings vary in size depending on the size of the permanent exhibitions that are to be installed. Museums housing boats and trains have larger spatial requirements and because of this size, scale and height, the buildings achieve a sense of importance and in most cases the building is read as a datum in the landscape or a foreground building. The construction and tectonic of the buildings, due to the nature of the program, are usually a large spanning structure with elements predominantly of steel due to its ability to span large distances as well as be flexible and adaptable. The nature of activities and the underlying idea of museum as a place of exploration and learning leads to a form that is dictated by the size of exhibitions and the desired narrative of the museum.

Formal responses and ideas around form are also derived from the nature of a museum that deals with all things naval etc and is located in a waterfront area. The nature of a museum today is that of a public building and this has a direct effect on the form of the building. The museum of today is not a private experience and the inclusion of people inside and outside the building envelope is important. This is achieved by either playing a formal game of solid and voids or by using materials that allow for flexibility and act as skin and billboard as to include the public on the exterior of the building.
EXHIBITION AND CIRCULATION DATA

The following is a short discussion on exhibition and circulation data selected from a series of books on museums as well as architectural data handbooks. The information leads to a position that forms a basis for the final design.

Figure 115, Diagram, showing the relationship between museum functions and an approach towards zoning and expansion.

Figure 116, Layout options, possible layout of a small museum.

Figure 117, Collection diagram, a flow diagram of collection item movements in the operation of collection services. Exhibitions, conservation and collections management.

Figure 118, Privacy gradient, the grouping of public areas on a single level to control access and privacy gradients.

Figure 119, Massing strategy, a basic massing strategy to organise privacy gradients.
The narrative of the museum is dictated by the relationship of the exhibitions and public circulation within the museum.

There are five types of narrative arrangements:

1. A linear arrangement of spaces with, beginning, middle and end
2. A loop where the essentially linear storyline leads naturally back to the beginning
3. Core and satellites where each theme or secondary exhibition leads back to the main exhibition
4. A complex scheme combining linear, loop and core satellite arrangement of spaces
5. A labyrinthine, where the relationship between areas can be varied between exhibitions by managing public circulation

There are six ways in which a boat exhibition can be installed all having a different viewing opportunities and opportunities to interact with the exhibition.

1. External mooring - The exhibit is moored outside of the building envelope in the water. This extends the exhibition space into the water but does not protect the boat from the elements.
2. Wet dock internal - This exhibit allows for the boat to be viewed in its natural state (water) whilst in the shelter of the building.
3. Dry dock internal - The boat is propped up by a dry dock system which allows visitors to experience the boat from underneath and on top. The boat is sheltered from the elements.
4. Boat yard - This allows for people to experience the boat in the outdoors but still allows viewing of the boat from underneath. This way raises the boat off the ground but still is open to the elements.
5. Hanging exhibitions- This type of exhibition is dependent on the size and age or condition of the boat and its ability to be suspended. This allows people to move under the exhibit and get a different perspective of boat exhibition space.
6. Submerged - The boat is docked in the water outside the museum but the viewer views the boat from a submerged platform below the boat.
Exhibition spaces for smaller items are also required. These will range from actual artefacts to visual and audio displays. The types of possible exhibition spaces include

1. Facade displays - The building becomes an exhibition surface that interacts with the people outside the building envelope.
2. Audio visual exhibitions - Interactive exhibitions that are fully interactive. These displays are used to communicate information using different senses.
3. Display panels - Visual screens that play a narrative that informs the viewer while experiencing the surrounding exhibitions or information boards.
4. Free standing exhibitions - Exhibitions used to house actual artefacts of a range of scales. These exhibitions are used to define the space or the narrative of the museum.
5. Wall exhibitions - Walls used as thresholds and boards of information.

Lighting is an essential component that adds to the viewing of the museum exhibitions. There are two types of lighting sources, natural and artificial. Both have different qualities of light depending on the type of exhibition.

Figure 128: Interpretation of Durban (Author, 2015)
CHAPTER 2
NATURE OF SITE

SITE SELECTION; CONTEXTUAL MAPPING; LENS FOR READING SITE; PRECEDENT STUDY; ARCHITECTURAL LANGUAGE OF CONTEXT
In this chapter the nature of site is explored. To begin a site criterium will be established in order to select the appropriate site. A contextual analysis of the site is then conducted through a variety of scales that results in a set of informants and constraints which formulate responses towards the design of a maritime museum.
The criteria for site selection are discussed in this section. The analysis is done across scales highlighting space defining elements and the structuring elements of site. The aim is to critically engage with the context by exploring the spatial and physical conditions of the site at various scales. The gathered information is then be analysed and a set of constraints and informants are generated, contribute to a set of informed design decisions.

The city of Durban in the eThekweni metropole was chosen as the metropole for the site because of its origins as a harbour town and its rich maritime history. The precedent analysis revealed a basic criteria of being located within a harbour precinct that is close to the city centre and on a major transport route.

Knowledge gained through analysis of the precedents led to three potential sites in Durban’s harbour: the existing maritime museum site, Berths A to B, and Wilson’s Wharf. Various specific criteria will be looked into in order to determine the most suitable site.

Site selection, connection to transport nodes and movement systems and spatial narrative of the museum have played an important role in all of the precedents investigated. The precedents studied either formed part of an existing cultural precinct or have been established as a catalyst for the development of a cultural precinct. In order to become a catalyst the facility must be large enough to maintain attraction and be located appropriately. The site selection is key to the success of the museum as museums require supporting facilities. These normally form part of a cultural precinct, which could be made up of museums, theaters, libraries or historical landmarks. The site, in the case of a maritime museum, must be large enough size to accommodate the programmatic needs and be located near to the water within a waterfront precinct (waterfront promenades). The precedents are all located near to movement routes and are well connected to public transportation and integrated into the city.

**Site Criteria**
- Well connected to transport routes.
- Located within a harbour precinct or near the water’s edge.
- Located within cultural precinct or large enough to be a catalyst for a cultural precinct.
- Large enough site to accommodate the large program.
The identified sites are analysed in terms of their connectivity to transport routes and nodes, their accessibility to the waters edge, whether the size of the site is suitable for the program of the museum, location within city fabric and location in relation to other supporting cultural activities.

The Rating system is as follows.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Poor</td>
</tr>
<tr>
<td>S</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>G</td>
<td>Good</td>
</tr>
<tr>
<td>E</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

**Location within harbour precinct**

The site runs alongside the existing Wilsons Wharf complex which consists of a yacht mole, restaurants, the Catalina Theatre, and a craft market. The dilapidated site is isolated on the periphery of the harbour and is surrounded by industrial buildings.

**Connectivity**

The site is poorly connected to movement routes and transport nodes. It is isolated and major restructuring of the site will be needed to improve connectivity.

**Supporting facilities**

Although located near to the cultural and historical centre of the CBD and the BAT centre within the harbour, the site is isolated by the railway and road system. The site does however house the Catalina Theatre and craft market.

**Size of site**

As the site is small, there is limited potential for growth in a phased development. The site could house the museum but would not be able to extend to a cultural precinct if necessary.
**Location**
The existing maritime museum is located in the small craft harbour. The site is close to the CBD and is not affected by port operations.

**Connectivity**
The site currently is isolated from the CBD by the railway and roads around it. These connections are potentially very strong and could connect the waterfront to the city.

**Supporting facilities**
Cultural facilities such as The Playhouse Theatre, City Hall, the Workshop, The Durban International Convention Centre and the BAT centre are easily accessible and there is great potential for a cultural precinct in this area with the museum as a catalyst for the harbour precinct.

**Size of site**
The site offers the opportunity to link facilities at a large scale resulting potentially in a cultural precinct.
The site selected is the site of the existing maritime museum, Site B. The selected site will now be analysed through the scales and will result in a set of informants and constraints.

Figure 135, Location map (Author, 2015)
The figure ground study shows the grain of fabric in the Durban sub metro area. The map shows how the waterfront and chosen site sit on the edge of a coarse grain city fabric. The city is very compact with the majority of the negative spaces being transport routes. The area between the site and the city fabric are of importance in deciding how to respond to the water’s edge and the large scale, course grain fabric.

Figure 136, **Figure Ground**, showing the relationship between the built fabric and the spaces between. The grain of fabric in the CBD.
Eight precincts have been identified as “precincts of excellence” in the Durban sub metro. They have functions and cultures that are specific to these precincts and together make up the multicultural environment of the Durban sub metro.

Figure 137, **City Precincts**. The site sits within precinct 6, the Victoria Embankment. The precinct is isolated in the harbour basin from the other precincts.
The Durban sub metro area usage pattern has a central commercial core surrounded by mixed use buildings. The CBD core is isolated by the industrial strip to the East, railway line to the West and green spaces to the South. The site is located to the South of the CBD in the harbour precinct.

Figure 138, Usage patterns. The site is located between large scale mixed use buildings, industrial harbour activities and a large passive green space.
The Durban sub metro area is connected by two major vehicular routes connecting North to South (Samora Machel Street) and East to West (Dr. Pixley Kaseme Street). These main routes were designed to connect the city precincts by vehicle but by doing so act as barriers and segregate the urban environment. The site at this scale is left segregated from the city and requires an approach to better connect it to the CBD and its supporting structures.

Figure 139, **Connectors as barriers.** The Durban sub metro is structured by its transport networks and as a result is a segregated environment. The site has the potential to be well connected to the CBD and a possible cultural precinct.
The city of Durban has the potential to be a walkable city with transport nodes being located within walking distance from activity nodes. The chosen site has the potential to be a catalyst for development for the harbour precinct by being a node of a cultural precinct.

Figure 140, *Walkability of the city*. The site sits in a good location to be accessed by foot traffic as it sits within a comfortable walking zone from all transport nodes.
The precincts identified are poorly connected to each other and to transport routes. This is in part due to the transport systems in place acting as barriers and not connectors. The site is isolated within the harbour precinct which is separated by a road and railway system.

Figure 141, Composite of Durban submetro. The precincts are poorly connected. Transport routes are barriers within the CBD.
Movement structures are barriers (roads and railway)

The precincts are isolated as a result of the barriers

Lack of connection, continuity and integration

Green structure fragmented movement systems lacks legibility

Site needs to be integrated into Durban built fabric

Figure 142, Diagram of segregated urban environment
Figure 143, Interpretation of Durban Metro
PHOTOGRAPHIC STUDY

Cultural and historical core

Several buildings have been identified within the immediate context that would serve as supporting facilities that would allow for the development of a cultural precinct. The proposed Maritime Museum would form part of this cultural precinct, which would help to connect and in turn start the regeneration of the harbour in the urban context. Currently there is no narrative between these cultural and historical buildings, so the result is that the buildings read as individual facilities instead as part of an overall narrative of a cultural precinct.

The Durban ICC serves as a cultural centre within the city. Although the building itself goes against the grain of the context, it promotes a sense a culture and identity for the city.

Working as an exhibition and overflow space for the ICC, the Durban Exhibition Centre is used to show off the best that Durban has to offer in terms of culture and commerce. The centre caters for global and local talent.
The Workshop building is a historical landmark in Durban. The old railway workshops are now used as a shopping mall, a centre to informal traders, and external performance spaces.

The old railway station forms part of the historical core of the CBD and is a reminder of a time of innovation in Durban’s history. The building now serves tourists as a centre for information among other things.
The Playhouse is home to Durban’s Culture heart. The facility is in close proximity to the City Hall and other supporting cultural and historical buildings.

City Hall is the centre of Durban’s Historical and Cultural core. The city was built around its City Hall and it will be used to form the centre of the proposed cultural precinct.

The Victorian embankment park has a collection of historical statues that are not used to their full potential. These items should be viewed as a collection of cultural and historical landmarks for the city of Durban.
These landmarks are a mixture of maritime and other historical items. These items should be provided a legible narrative as to serve their historical value best.

The BAT centre is the only culture building located within the harbour precinct. Although located in close proximity to the city and its cultural core, the facility is not used to its best potential as it is disconnected from any supporting facilities.
Primary connectors within the sub metro

The contextual photo assessment focuses on the streets that form the main movement systems within the CBD, its surrounding spacial and structural condition and the activities that these roads connect. These roads are the primary connectors of people between the cultural and historical buildings that will form part of the cultural precinct.

The pedestrian underpass that connects the city hall to the workshop is a vibrant space that houses informal markets and performance spaces.

Walnut Road is a primary movement corridor from the North connecting the Old Fort precinct to the site. The street is also used as a connector between the Durban ICC and the Durban Exhibition Centre, therefore the road is used as public space and spills out from the buildings.

Figure 164, Pedestrian church underpass

Figure 165, Looking North up Walnut Road

Figure 166, Location map (Author, 2015)
Dr. Pixley Kaseme Street is the primary movement corridor running from West to East through the city core. It is a four lane street that acts as a barrier. This creates hard edges with poor public space.

Dorothy Nyembe Street has contrasting spatial conditions on either side of the road. One side has an arcade-like space that allows for movement within the building and the other has a civic-like response with movement on a pavement.

Dr. Pixley Kaseme Street is the primary movement corridor running from West to East through the city core. It is a four lane street that acts as a barrier. This creates hard edges with poor public space.

The site is directly connected to the cultural/historical core by Samora Machel Street which has a poor sense of public space and poor surface treatment.
SITE ANALYSIS

This section starts with the analysis of site and how it sits within the harbour precinct. A set of issues are identified that lead to a set of informants and constraints at site scale. The reading of site is conducted using a deconstructivist process.

The structuring elements of site are then be identified. These elements will be analysed individually and a set of specific precedents are investigated to establish possible responses to these site issues. An architectural language particular to site will then be established by analysing the structuring elements of harbour.

LENS FOR SITE READING

The reading of site is through the lens of a deconstructivist, specifically using the process of Thom Mayne and his firm, Morphosis. The site is seen as a text, a layering of information that must be analysed, processed and reinterpreted. The layers of text to be analysed are the morphological information inherent in the site. These layers could be anything from the city grid to change of surfaces, green spaces, tree lines, industrial rhythms and movement routes. The process will aid in the rescripting of the site, which is done by blending the many layers to produce a set of drawings that will be developed towards the final design.
Figure 173, Site sections (Author, 2015)
After looking at the Sub Metro constraints and informants of Durban, a study will now be done on the harbour precinct to establish the nature of site.
Dispersed usage pattern

Figure 175, Dispersed usage pattern. As the private functions near the entrance flourish, the public facilities isolated on the periphery die off.

The harbour precinct is divided into three areas of usage: leisure (the Yacht Mole), cultural (maritime museum and BAT centre) and retail (Wilson’s Wharf). The leisure area is located at the only entrance to the harbour; this area functions primarily for the use of private yachts and the like. Due to this private area being the most accessible, the public facilities on the periphery have died off as they are secluded from the public realm.
North to South barriers

Figure 177, North to South barriers. The precinct is divided North to South by a set of transport infrastructure.

Although the harbour is located on the edge of the urban fabric, it is completely excluded from it by a series of barriers. These barriers are a railway, a road network and a Victorian park. The industrial railway is used twice a day for moving industrial cargo and cuts the site off from the city. The Victorian park was designed as a public space but instead has become a dead zone and a barrier between harbour and city.
East to West barriers

Figure 178. East to West barriers. The precinct is further divided running East to West by drainage outlets.

Large drainage outlets divide the precinct and interrupt continuity of movement through the site. This further interrupts the legibility of the harbour as a precinct.
STRUCTURING ELEMENTS OF SITE

Much like the urban transport issues that divide Durban into segregated precincts, the site is disconnected from the city due to infrastructure that acts as barriers. There are three main structuring elements that disconnect the site, namely the railway system, the public park and the Victoria Embankment road networks.

These layers are analysed individually and a set of specific precedents investigated to establish possible responses to these site issues.
Harbour road and industrial buildings

The harbour road network is used to service the buildings within the harbour precinct. Due to the isolated nature of these buildings and the treatment of the roads and walkways, these roads have become a barrier and restrict public movement. Connections off the road are restricted to driveways and parking lots. The road is industrial in nature and is used as a service road.
- Poor publicness
- Service road for harbour
- Divides the context
- No connection to immediate context (water’s edge and city)
The industrial railway is used twice a day to transport containers etc. It is a barrier that excludes context. The railway is defined by a low stone wall that runs the length of the harbour. The only access through the site is a public walkway that passes under the railway. The underpass is a hotspot for crime and is rarely used for safety reasons. The primary barrier that segregates the harbour from the city is this railway system.
The last spatial and physical barrier identified is that of the Victorian park that houses a collection of historical artefacts pertinent to Durban’s history. The park which once connected the city to the water’s edge now serves as an undefined barrier that separates the city and sea. The park is unused and undefined resulting in it becoming a dangerous unsupervised space. This space is under utilised and could be valuable to its context.
- Poor continuity
- Green space
- Unused space
- Barrier between harbour and city
In this section there will be a discussion and analysis of the site issues identified in the previous section. Specific precedents have been identified for analysis. The analysis is based on the responses the buildings take to overcome these contextual/urban issues. The issues identified were the barriers that divide the site.

1. Harbour road and industrial buildings
2. Industrial railway
3. A green space park

The following is an analysis of three buildings chosen because of their particular approaches to site and resolution of issues similar to that of this treatise. The following precedents were chosen:

- Norwegian National Opera and Ballet
- Dokk1
- Seattle Art Museum: Olympic Sculpture Park

The precedents are analysed in terms of how they connect to transport systems, the rescripting of site, their relationship of building to context and how the site was sensitive to pedestrianisation. These will lead to a conclusion on how each precedent overcame its specific issues.
The Norwegian National Opera and Ballet is located in a harbour precinct that is isolated by a transport system that previously was used as a service road for the industrial factories in the harbour. When the site was developed the architects retained all the transport systems that previously isolated the site and used them to connect the site to a greater context. The previously service orientated road was used as an informant in the design. It was detailed so that it became a pedestrian friendly space. Public access points were established to connect people to the site by foot, this was achieved by controlling level changes and managing surface treatments to create an extension of public space that is legible and pedestrian friendly.

Figure 188, Norwegian National Opera and Ballet (Snohetta, 2008)
Figure 191, **Contextual transport connections.** The building sits on a site that is cut off from the city fabric by a road system.

Figure 192, **Pedestrian connections.** A bridge for pedestrians and a pedestrian crossing enable access to the site by foot. The traffic on the road is reduced at this point to allow pedestrian usage.

Figure 193, **Treatment of pedestrian access.** The road becomes a pedestrian route and extension of public space through the treatment of walking surfaces and the managing of level changes.
The Dokk1 building in Aarhus is built in a waterfront precinct that is isolated by a railway and road system. The railway and road system are used to connect the surrounding areas to each other and cut through the site. As the transport routes were essential to the site, they were used as a design informant and became an integral part of the design. The building allows for transport to move within the building envelope whilst providing access through and over to the site.
Figure 197, Pedestrianisation. Pedestrian routes are established through the site and connect the site to its surroundings. A public promenade connects the harbour facilities along the waters edge.

Figure 198, Relationship of transport routes to the building. The railway line and road cut through the building envelope. The treatment of the floor allows for an extension of public space.

Figure 199, Transport interchange. A transport interchange is located where the railway cuts through the building. Surface treatment and the spatial hierarchy help to establish a pedestrian-friendly environment.
The Seattle Art Museum and Olympic Sculpture Park is a precedent that rescripted a derelict site to create a meaningful piece of public space. The design gave function to a vacant lot whilst still creating a connection between the city and the waterfront. The sculpture park becomes an extension of the public promenade that runs along the waterfront edge. The transport system that divides the site was used as a design informant and was incorporated into the design. The building reads as a landscape and extends from the city to the sea whilst still allowing for activities and building functions to happen un-interrupted by lifting the landscape above the transport routes below. By giving new function to the site, it is rescripted and transformed into an extension of public space whilst maintaining the transport structuring elements of site.
Figure 202, **Concept Diagram.** The landscaped building connects the waterfront promenade to the city, whilst maintaining the transport routes.

Figure 203, **Contextual connections.** The sculpture park folds down to the water’s edge, creating an extension of public space whilst allowing for movement of transport and giving function to the space.

Figure 204, **Transport systems.** The landscaped design allows for transport systems to be maintained whilst still connecting people through and over the site.

Figure 205, **Waterfront promenade.** Spatial connections to transport routes. The museum is connected to the city centre by a network of roads.
A harbour is industrial by nature but does have a leisure component. In order to design a building that is contextually relevant the architectural language of site must be established. The following is an analysis of what structures the harbour. An architectural language will be developed that is particular to the site.

The Durban harbour is a working and leisure harbour, dominated by private use and industry.

Elements that structure the harbour:
1. Jetty
2. Railway
3. Cranes
4. Industrial factory
5. Dry docks

**THE JETTY**

The jetties are imposed engineering on the natural harbour edge. This creates specific form between the natural tide and the man made jetty.
JETTY

Figure 209, Spatial Relationship of jetty to boat. The spaces created between moored boats to the jetty are industrial spatial forms that will be considered in the design stage.

CRANES

Figure 210, Diagram of industrial rhythm. Cranes act as a point of reference in the harbour (datum structure). The tall structures set up a vertical rhythm throughout the harbour.

Figure 211, Diagram of movement structure. The structure is used to elevate the functioning part of the crane, this allows for movement at lower levels.

RAILWAY

Figure 212, Railway structure. The gantries set up a rhythm and a framing structure that facilitates functions whilst the entire railway sets up a barrier.
INDUSTRIAL FACTORY

Figure 213, Factory in the landscape. The form of the warehouse is a single or dual pitched roof, very much a “shed”. The buildings sit close to the water’s edge.

Figure 214, Industrial shed. The buildings act as a shed for storing or repairing objects and not the objects themselves.

DRY DOCK

Figure 215, Industrial space of drydock. Dry docks show the spatial negative created by a ship and are the spaces that best represent this industrial vessel. Walkways to access and repair the ship are used as movement routes.
SUMMATION OF SITE

It has been established that the Durban harbour precinct is the most suitable site for a cultural precinct and new maritime museum. The chosen site is that of the existing Port Natal Maritime Museum. The site is located near the water’s edge, has great potential for reconnecting the precinct to the city, is connected to transport systems and is a culturally and historically relevant site. The harbour precinct has a mixture of private and public facilities but due to several transport systems that act as barriers, facilities have become enclaved. An industrial railway, a road system and a Victorian park are the primary structuring elements that act as barriers between harbour and the city. These barriers were analysed as a text; the identified layers act independently as thresholds but by rescripting the roles of these layers a cohesive site strategy can be developed. An approach to better integrate the harbour as a system and to the city is necessary, as it lacks accessibility and integration. This will bring the harbour back into the public realm and encourage activity and growth within the precinct. The proposed cultural precinct will develop a narrative between the city’s historical landmarks and cultural buildings, which will connect several divided precincts, provide a hub for cultural diversity and learning, and stimulate the economy of the CBD. An architectural language particular to site has been developed.

- By recognising the text of the layers and rescripting the roles of park, harbour, city to create a cohesive urban project
- Natural/built relationship. Using the landscape to inform site response
- There is an opportunity to connect the natural landscape of park to the natural waterfront.
- Connecting to existing infrastructure. Using the existing activities to enhance site
- The BAT centre is an isolated cultural building that can be used to develop a cultural node.

Issues of site

1. Elements that structure site acting as barriers
2. No connection between city and harbour
3. The site is further divided by a railway line
4. Lack of connection between harbour activities
5. Need to develop a coherent architectural for the site

Site responses

1. Blending the layers of site
2. Extension of civic space from city to harbour
3. Create thresholds that encourage both physical and visual connection
4. Encourage relationship between the natural and built environment
5. Connect to existing infrastructure within the harbour
6. Using the industrial railway as a building informant
Figure 216: Interpretation of Durban (Author, 2015)
CHAPTER 3
DESIGN DEVELOPMENT

URBAN PROPOSAL; DEVELOPING THE PROGRAM; ACCOMMODATION SCHEDULE
CHAPTER THREE  DESIGN DEVELOPMENT

INTRODUCTION

This chapter begins with the urban proposal that is used to form part of a greater context response. This proposal will set up a framework from which the site will respond. The program is then further developed in order to better understand the spaces required and how they relate to each other. Resulting in an accommodation schedule. This is followed by an analysis of site and the development of diagrams and architectural ideas which result in the design of a Maritime Museum.
INTRODUCTION

In this section a set of proposals to address the identified urban issues in the selected precinct will be developed. Through the analysis of typology and a precedent study, the nature of a maritime museum was uncovered. Key issues concerning the typology were, the location within the city and its relationship to the surrounding context (supporting facilities), the museum’s connectivity, and accessibility within the precinct (transport routes and nodes). Following these understandings a contextual study was done.

The established issues at precinct scale:

1) Poorly integrated and connected into the surrounding harbour precinct and the city
2) Isolated site that is disconnected from its surroundings. Large areas of undefined green space, road and railway systems which act as barriers
3) No narrative between existing historical and cultural buildings, activity corridors and public supporting facilities
4) Poor legibility, no clear points of entry to the site
5) Harbour waterfront in a state of neglect due to lack of activity

With the issues of the precinct established (the existing), the urban interventions aim to (the proposed):

- Integrate and re-connect the harbour as a precinct and to re-establish connections between the harbour and the city
- Develop a narrative between existing cultural and historical buildings
- Provide legibility and ease of accessability to the site
- Regeneration of harbour precinct

AIMS:
- Integrate and re-connect the harbour as a precinct and to re-establish connections between the harbour and the city.
- Develop a narrative between existing cultural and historical buildings
- Provide legibility and ease of accessability to the site.
- Regeneration of harbour precinct

OBJECTIVES:
- Develop a cultural precinct using existing infrastructure and proposed museum.
- Museum building as an urban catalyst to regenerate the harbour precinct

Figure 218, Urban diagram. Creating a narrative through a cultural precinct using the proposed maritime museum as a catalyst for development in the harbour precinct.
CULTURAL PRECINCT

Cultural precincts are created to stimulate economy and growth for a city by using its culture and heritage. To achieve this, buildings of historical and cultural value are grouped in clusters in order to stimulate surrounding economic activities.

Most great cities have identifiable precincts to which artists, cultural entrepreneurs and audiences are attracted, such as Soho in London, New York’s Lower East Side, or the Left Bank in Paris. Such places have a long history and appear to have happened by accident or at least in the general development of a city over time. What is new about the development of cultural precincts in more recent times, is that they have been (and are being) used as a deliberate model for urban regeneration and as a stimulus for economic activity. There are, typically, three key roles for cultural precincts throughout the world, which are based on their physical form, their relationship to other uses, and the way in which they are managed (or not). Cultural precincts should intensify the level of cultural and commercial activity, enliven the public realm, and offer a diverse and engaging cultural experience. They are a beacon for culture, diversity, and knowledge. But most importantly, the cultural precinct is the place where we all celebrate and experience our unique cultural identity.

A global and local precedent are analysed below in order to establish the key issues necessary to design a successful cultural precinct. The chosen precedents are the proposed Queensland Cultural Precinct (global) and the Maboneng Precinct (local).

Figure 219, **Vertical Portfolio**. The framework will be guided by the concept of a “vertical portfolio” cultural precinct. A cultural axis will connect supporting nodes to enhance the city scale development. The vertical portfolio cultural precinct uses larger cultural entities to stimulate and facilitate smaller cultural producers. The cultural precinct will be used as an economic and urban regenerator. The precinct will be structured around museum and cultural clusters and their relationship to supporting structures. Cultural supporting infrastructure includes “genuine cultural activities”, a variety of leisure, entertainment elements, bars and restaurants and retail space (Mommaas, 2014).
CULTURAL PRECINCT

The identified existing cultural and historical infrastructure will form the narrative of the precinct. The facilities will then be connected through the treatment of public space and public movement routes to allow for ease of access and legibility through the precinct. As the precinct is located within the CBD, the supporting commercial, residential and leisure facilities are all part of the scheme. The precinct will extend to the harbour which will in turn reconnect the water’s edge to the city.

Figure 220, Strategy diagram: connecting the cultural precinct to the historical core.

Figure 221, Connectivity diagram: the cultural precinct must be well connected to transport nodes and routes.

Figure 222, Cultural precinct diagram. The diagram illustrates the existing cultural and historical nodes to be used in the organising of the cultural precinct.
Figure 224, **Queensland cultural precinct**: through the development a large strip of underutilised and derelict land the precinct has connected city to the water’s edge and promoted culture and economic growth. The handling of transport connections is of utmost importance. Public space creation with courtyards and promenades promotes pedestrian friendly environments.

Figure 225, **Maboneng cultural precinct**: Upliftment of a derelict inner city area through the creation of a vibrant culturally centred precinct. The project is aimed at providing a cultural base which will stimulate housing and working environments.
**URBAN CATALYST**

A catalyst is an urban element that is shaped by the city and then, in turn, shapes its context. Catalytic urban design works not from a master plan, but from a master program. It sets out intentions and methods but not solutions.

It is characterized by sequencing of development. It thus calls for both idealism and pragmatism: idealism about the specialness of the place and pragmatism about making that place work in relation to contemporary traffic needs and local culture and values. This dual need calls for a unique vision for each urban place. The important point is that the catalyst is not a single end product but an element that impels and guides subsequent development.

Catalysis involves the introduction of one ingredient to modify others. In the process, the catalyst sometimes remains intact and sometimes it is modified. Adapted to describe the urban design process, catalysis may be characterized as follows: The introduction of a new element (the catalyst) causes a reaction that modifies existing elements in an area. The potential of a building to influence other buildings, to lead urban design, is enormous. Existing urban elements of value are enhanced or transformed in positive ways. The new need not obliterate or devalue the old but can redeem it. Instead of a city of isolated pieces, imagine a city of wholes. The catalyst need not be consumed in the process but can remain identifiable. Its identity need not be sacrificed when it becomes part of a larger whole.

The proposal for a cultural precinct will be structured by using the concept of the urban catalyst.

Urban catalysts are based on 8 principles

1. The new element modifies the elements around it.
2. Existing elements are enhanced or transformed in positive ways.
3. The catalytic reaction does not damage its context.
4. A positive catalytic reaction requires an understanding of the context.
5. Not all catalytic reactions are the same.
6. Catalytic design is strategic.
7. The product is better than the sum of the ingredients.
8. The catalyst can remain identifiable.

(Attoe 1989)

Figure 227, *Strategy diagram*: connecting the cultural precinct to the historical core.  
Figure 228, *Strategy diagram*: connecting the cultural precinct to the historical core.
Figure 229, Gateways
Existing cultural node
Proposed cultural building
Religious node
Educational node

Figure 230. Supporting cultural nodes
INTRODUCTION

This section aims to further develop the program by first establishing the primary categories of space, followed by understanding the nature of these spaces, they are to be expanded in greater detail, regarding their nature, relationship to other spaces and design considerations. The user groups and further relationships between the categories of space will then be discussed. The section concludes with a final accommodation schedule for the design of the building.

Categories of Space

Following the investigation of the precedents, certain primary spaces have been established. These spaces will be grouped into four main categories that make up the program for a maritime museum. The spatial make up of the building consists of the following categories.

- Educational spaces
- Museum spaces
- Research spaces
- Hospitality spaces

The connections between these spaces are of most importance. To ensure a cohesive narrative throughout the museum, the spaces must connected where necessary. This will be achieved through common spaces such as outdoor exhibition spaces, foyers, circulation and other public spaces.

The spaces can be further divided into the following

Educational spaces
- Library spaces
- Auditorium spaces
- Lecture spaces

Museum spaces
- Information Centre
- Exhibition spaces
- Commercial spaces
- Administration spaces
- Service spaces

Research spaces
- Laboratory spaces
- Preservation spaces

Hospitality
- Conference spaces
- Multi use spaces
**Nature of Spaces**

**EDUCATIONAL SPACES**

**LIBRARY SPACES**

**Nature:** The library space is a place of learning. It is a controlled environment that provides a “safe” learning environment for the user. This space will be used by the public, ranging from adults to children.

**Relationship to other spaces:** It is to be located on a public edge where there is ease of access, near the entrance to the museum. The library must be seen as part of the overall museum experience but not be part of the museum narrative.

**Design considerations:** This space requires as much natural lighting as possible. The space is of importance to the public realm and should be expressed as a public component.

**AUDITORIUM SPACES**

**Nature:** A performance space that will showcase local and international talent. This auditorium will be used in conjunction with the BAT centre to host events etc.

**Relationship to other spaces:** The auditorium is to be located close to the BAT centre with access from the public edge.

**Design considerations:** This space requires a controlled environment (sound, light). The auditorium space should double up as a live performance and digital performance theatre.

**LECTURE SPACES**

**Nature:** A flexible venue that will accommodate students for lectures and be used to hold events.

**Relationship to other spaces:** Must be directly connected to the library and other educational facilities.

**Design considerations:** To provide a flexible space that is accessible to the public.

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Figure 232, **Library space**, the library space requires natural lighting and as it is a public facility it should be expressed as such. Visual connections to the outside to extend the “publicness” of the space.

Figure 233, **Auditorium spaces**, technology allows for the auditorium space to be flexible in its usage. A controlled environment is achieved through technology.
MUSEUM SPACES

INFORMATION CENTRE

**Nature:** The information centre is the entrance to the museum for the public. The foyer space greets the public and is the start of the museum narrative. A space of interaction and gathering.

**Relationship to other spaces:** The entrance foyer will be the primary connector to all the public spaces of the building. It will act as a central access.

**Design considerations:** This space requires as much natural lighting as possible. The space is of importance to the public realm and should be expressed as a public component.

EXHIBITION SPACES

**Nature:** There are three types of exhibition spaces, primary exhibitions, secondary exhibitions, temporary exhibitions. These exhibitions are public in nature and help to create the narrative of the museum.

**Relationship to other spaces:** The exhibitions are to be part of the museum narrative and be part of the experience of the building. The exhibitions should feed off the entrance foyer.

**Design considerations:** Large volumes of space are required to house the exhibition boats. The control of natural lighting is important for the exhibitions. The building form should express the exhibitions.

COMMERCIAL SPACES

**Nature:** Located on the public edge to create a commercial area that is a place of gathering. These spaces include the restaurant, market and museum shop.

**Relationship to other spaces:** Located near the public entrance and plaza. To be connected to the BAT centre as an alternative to the market space

**Design considerations:** Provide a threshold for security reasons but still allow public access. Controlled access for different times of the day.
Figure 236, **Boat exhibition:** The boat exhibitions will form part of the permanent exhibitions. They will be the largest of the exhibits. The lighting is controlled and the spatial experience is of importance.

Figure 237, **Secondary exhibitions:** Natural lighting used to illuminate the exhibits. Spatial quality of roof providing an experience other than the exhibits.

Figure 238, **Secondary exhibitions:** These exhibitions will be fixed exhibitions that will add to the narrative of the primary exhibitions but provide a different experience.

Figure 239, **Temporary exhibitions:** A space provided for flexibility of installations. This provides the opportunity to feature different artists on a regular basis.
ADMINISTRATION SPACES

**Nature:** Private spaces that is not accessible to the public. The staff component will occupy this space.

**Relationship to other spaces:** The administration spaces are located in the most private part of the building. It must be connected to a staff entrance and carpark. There must also be access to the museum facilities.

**Design considerations:** Controlled access to administration area. Must be located in most private area but still have access to all facilities.

RESEARCH SPACES

LABORATORY SPACES

**Nature:** The information centre is the entrance to the museum for the public. The foyer space is the greeting of the public and the start of the museum narrative. A space of interaction and gathering.

**Relationship to other spaces:** The entrance foyer will be the primary connector to all the public spaces of the building. It will act as a central access.

**Design considerations:** This space requires as much naturally lighting as possible. The space is of importance to the public realm and should be expressed as a public component.

PRESERVATION SPACES

**Nature:** A workshop space that will help to preserve exhibits. The workshop space is a highly serviced space and normally of a private nature, however this workshop will be open in parts for viewing by the public.

**Relationship to other spaces:** Located within the museum circulation as an exhibit. Must have own access to be used as a service access.

**Design considerations:** A large space that is flexible to allow for work on several types of exhibits. To be open at certain points to be viewed by the public but not accessible to the public.

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*Figure 240, Outdoor exhibitions:* Public plazas and courtyards to be used as outdoor exhibition spaces. These spaces blur the lines between inside and outside spaces.

*Figure 241, Research space:* Research facilities to be located near the waters edge for direct accessibility to the water for testing.
HOSPITALITY SPACES

CONFERENCE SPACES

Nature: Private spaces that accommodate for events or meetings. A controlled environment with a strict privacy gradient. Specific group of users but should be a flexible space.

Relationship to other spaces: The conference spaces must be connected to the other hospitality spaces and the public components like the library outdoor exhibitions.

Design considerations: Large flexible spaces, must have secure entrance to allow for twenty-four hour usage.

MULTI USE SPACES

Nature: Spaces of learning and interaction, place for people to use computers, relax, eat and play. Controlled access but open to the public whilst being a flexible space.

Relationship to other spaces: A connective space that can link museum to library and other public space.

Design considerations: Flexible open plan that can be adapted to make use of the space in different ways. Open up to public plaza to create inside outside spaces.

Figure 242, Walkways as connectors: Walkways used to connect the various spaces.

Figure 243, Preservation space: Workshops that function in order to preserve the exhibits but be open to viewing by the public.

Figure 244, Multi use spaces: Used for different activities, internet stations, slow libraries, pause areas.
The museum is about experience and the narrative of its exhibitions, this experience is centred around the main exhibitions of the museum. As the museum has a rather large inventory it is important that these exhibitions are understood spatial and physical to best enhance the experience of these items. The main exhibition pieces for the museum are three large multi-ton vessels which are significant to Durban’s Maritime History. The three vessels are the Ulundi (1927), JR MORE (1961) and the SAS Durban (1957).

A full inventory of the exhibition pieces is located in the appendices.

Figure 245, Boat exhibitions: The three main vessels that will form the primary exhibitions and the centre of the exhibition narratives.
**USER GROUPS AND SPATIAL CATEGORIES**

The user groups are identified in order to better understand how the building will be used and how that influences the relationship between spatial categories and the user. Seven user groups are identified, namely:

- Visiting school groups
- Visiting student groups
- Research staff
- Admin staff
- Visiting general public
- Visiting conference groups
- Museum staff

**CATEGORIES OF SPACE**

- Educational spaces: 1, 2, 4
- Museum spaces: 1, 2, 4, 5, 6, 7
- Research spaces: 1, 2, 3
- Hospitality spaces: 1, 2, 4, 6

**Figure 246. User groups and access to the site.** Multiple modes of transport can be used to access the site. Pedestrian access, railway and shuttle are encouraged as modes of transport to the site. This will lessen the need for private cars and the resulting parking space needed on the sensitive site.

**Figure 247. Relationship of spatial categories**

**Figure 248. Relationship of spatial categories**
Figure 249, Relationship of spatial categories
ACCOMMODATION SCHEDULE

This accommodation schedule is compiled by understanding the program and activities involved in the various categories that make up the program for the building. This was achieved by understanding the nature of the program and by consulting various architectural handbooks.

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<td>- Entrance foyer</td>
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<td></td>
<td>- Seating</td>
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|                | 300    |                | 100    |
|                | 9      |                | 10     |
|                |        |                | 15     |
|                |        |                | 10     |
|                |        |                | 30     |
|                |        |                | 200    |
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SITE READING

The site is located in an area of the harbour that is excluded from the city and other supporting activities within the harbour precinct. The site sits between the water’s edge and the city. The harbour is still a working harbour which gives the site a very particular character which was discussed in previous sections.

An axis through site that was generated by lines pulled through the main access and visual connection from the city is used throughout to order the site. The axis is used to break down the barriers and blend the layers of site, connecting harbour to the city.

Site conditions will play a big role in the design of the museum. The site is a sensitive one located on the water’s edge of the harbour. The building will have a North to South orientation with the South side opening up to the water for maximum use of natural light.

Figure 251, Location map: Disconnected site between water and city.

Figure 252, Recognising the layers of site: Connecting city to sea. The site must blend the layers of the site in order to connect a greater urban precinct.

Figure 253, Connecting site to its surrounding harbour context: The site will be used to connect the harbour as a cohesive precinct that is no longer segregated.

Figure 250, Blending the layers of site: connecting city to harbour by recognising the text of the layers and rescripting the roles of park, harbour, city to create a cohesive urban space.
Figure 254, Site analysis
DESIGN PRINCIPLES

Following the investigation and developing an understanding of site,
Issues of site

1. Elements that structure the site acting as barriers
2. Lack of connection between harbour activities
3. The site is further divided by a railway line
4. No connection between city and harbour
5. Need to develop a coherent architecture for the site
6. Sensitive site

A set of diagrams were developed as responses to the site constraints

1. Encourage relationship between the natural and built environment
2. Connect to existing infrastructure within the harbour
3. Rescripting the railway
4. Extension of civic space from city to harbour
5. Create thresholds that encourage both physical and visual connection
6. Response to a sensitive site

Figure 255, Natural/built relationship: Using the landscape to inform site response. There is an opportunity to connect the natural landscape of park to the natural waterfront.

Figure 256, Connecting to existing infrastructure: Using the existing activities to enhance site. The BAT centre is an isolated cultural building that can be used to develop a cultural node.

Figure 256, Rescripting the railway: Using infrastructure as an informant. The barrier set up by the railway line, can be rescripted and used as a positive informant, used to connect at an urban scale.
Figure 257, **Extension of civic/public space**: Giving preference to public space. Using the building envelope to assist movement through and around the site.

Figure 258, **Outdoor/ indoor relationship**: Where does exhibition begin or end? thresholds that determine spatial continuity, both physically and visually.

Figure 259, **Relationship of building to site**: Building sits in the site, this stops the continuity through the site and is not sensitive to the harbour context.

Figure 260, **Relationship of building to site**: Building as part of site. The building promotes movement through and over site.

Figure 261, **Relationship of building to site**: The building sits on the site but allows for movement through the site whilst still maintaining visually connections between city and sea.
DESIGN DEVELOPMENT

Design Development 1.0

CONCEPTUAL MASSING

An exploration through model and drawings of the massing on site in response to the diagrams developed.

Site response: Building massed along railway axis to allow for North to South orientation. Datum point along city axis as a point of reference for the city.

Section: Building as a mediator for movement to and through the site. The building is split into levels allowing for movement through the envelope.

Plan: The building is set back off the water to allow for a pedestrian promenade. The building does not engage with the water’s edge. The city axis divides the building into two separate parts.

Figure 264, Site arrangement diagram: The site is massed as a spatial arrangement diagram that responds to the water, railway, city axis and a datum point used to make the site visible from the city.

Figure 262, Site section: Building sitting in landscape but allowing for movement through the site. Landscaped transport interchange.

Figure 263, Site section: Building sits on the land but allows movement through the site and maintains visual connections.

Figure 265, Relationship to the water’s edge: Building set back of water’s edge, allowing for movement on promenade connecting the buildings on the site.
Figure 266, 3D diagram: The datum tower serves as an attractor and a moment whilst using an architectural language of the harbour. The promenade is a public movement path and runs through the site. There is access to the water from the museum.

Figure 267, 3D diagram: The building has a layering a thresholds that run from public to private access. Access from the BAT centre side is for museum admin and research staff.

Figure 268, 3D diagram: The city access is used as trace of site and is used to reduce the barriers of site. This is the key to re-scripting site.
Design Development 2.0

PLAN AND SECTION DEVELOPMENT

Further exploration through model and drawings of the massing on site with the development of the plan and section diagram

Site response: Establishing hard edges on the city edge to reduce noise from vehicular activity and control North light. Integrating the site by pulling the landscape through the site by using the “plinth”.

Section: Using a plinth that the building rests on, the building becomes an integrated part of site whilst giving importance to the museum.

Plan: Using the city axis as the most public area of the site, therefore housing the educational facilities and outdoor exhibitions and the area closest to the BAT centre being used for the research component.

Figure 269, 3D diagram: The city axis is used as a formal informant and sets up the entrance plaza. Views are offered off this space to the South. Access to the water is directly to the South from under the plinth.

Figure 270, Massing diagram: Organisation of the building components on the site.

Figure 271, Planning Diagram: Hard edges face the railway to reduce noise from the North. The South side is opened up to natural light and to allow ease of access to the water’s edge.

Figure 272, Circulation diagram: The circulation dictates the narrative of the building. Circulation is centralised around the primary exhibitions.
Figure 2/3, **Section diagram**: The building is set on a plinth to allow for movement through the building envelope.

Figure 274, **Section diagram**: Movement is encouraged through the site. A datum point is set near the entrance to the building as a visual marker.

Figure 271, **3D diagram**: Building set on a plinth to allow for access through the site. Movement of the railway runs through the plinth.
**Design Development 3.0**

**MATERIAL AND TECTONIC DEVELOPMENT**

**Further exploration through model and drawings of the massing on site with the development of the plan and section diagram**

**Site response:** Viewpoints and access to site established. The building to read as one continuous space, given hierarchy by the structures and a moment as attractor. North side is building as barrier.

**Section:** Public space and building envelope extend over water to maintain a stronger relationship with the water’s edge. The roof plays an important role in controlling light for exhibition purposes. The flat roof structure houses different activities that are given hierarchy by increasing the size of space by simply lifting the roof plane.

**Plan:** External viewing tower. Narrative of museum structured around main exhibits. Outdoor exhibitions are partly in water and out of water. By extending roofline over water the building has a stronger relationship with the water’s edge. A promenade is still maintained as the main mover a public space.

**Materials and tectonic:** Large spans are needed to house the exhibits which calls for a specific structure. The structure used is a steel frame structure that is clad in a metallic skin which allows light in at certain points. The overall aesthetic is driven by the sense of place and takes cues from the harbour’s context.

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**Figure 276, Site response diagram:** Using the building as a barrier to reduce noise from the road. Allowing the building to open up for South light. Finding the best possible opportunities for views etc.

**Figure 277, Arrangement of spaces on site diagram**
Figure 278, **Spatial arrangement diagram**

Figure 279, **Relationship to the water’s edge diagram**: Building as part of water, allowing for the exhibitions to be part of the building envelope whilst still being in the water.

Figure 280, **Floor plan diagram**

Figure 281, **Floor plan diagram**
Figure 282, 3D diagram
Figure 283, **Section diagram**: Walkways used to connect the various spaces.

Figure 284, **Section diagram**: Walkways used to connect the various spaces.

Figure 285, **3D South elevation**: The South elevation is open to the water and South light. The structure opens and closes to allow for visual connectivity. The roof extends over the water to house the external vessel exhibit. A viewing tower is located on the South side as it offers the best views of the harbour.
Figure 286. 3D North elevation: The North elevation is a hard edge to control North light. The structure of the building is of the architectural language of the harbour. The ganties and railway are retained on the exterior of the building.
Figure 286, Movement pattern diagram: The movement patterns of the educational, museum and research facilities.

Figure 287, Spatial layout of uses diagram.
Figure 290, Section

Figure 291, Sectional elevation
promenade
viewing tower
water's edge
sunken boat exhibition
main exhibition space
large open space
railway
road access
secondary exhibitions
natural lighting
promenade

Figure 292, Section
Figure 293, Interior view
Figure 294, Interior view
Design Development 4.0

PLAN, SECTION AND MATERIAL DEVELOPMENT

Further exploration through model and drawings responses on site with the development of the plan and section diagram and a better understanding of materials.

Site response: A central foyer space is set up on the most public edge. This space is designed to encourage pedestrian use and ease of accessibility to the site.

Section: A new section development using a skin to house the program and better define public and private thresholds. The waters edge is cut back into the landscape to improve the relationship of building to the water’s edge.

Plan: The promenade is elevated over the water’s edge and feeds off the central foyer space. The promenade extends to a point on the bay landscape. The waters edge is cut back under the building envelope. External exhibition space is made more public by better orientating the education block.

Materials and tectonic: The materials are explored and a sense of tectonic established. Considerations include the reactions of the materials on the water’s edge, the depth and weight achievable on the water’s edge, the sustainable factors of the materials on a sensitive site and the process of construction as a design informant.
Figure 298, **3D diagram**: The skin protects the building from direct North light whilst still letting in a controlled amount of light for exhibitions and offices. The structure sits within the skin and houses the museum etc. Parts of the skin fold up in places to expose the exhibitions and to allow for entrances.

Figure 299, **Section diagram**: The building structure sits within a skin as a loose fit object. Movement paths move through the skin envelope and to the water’s edge. Maintaining visual and physical connectivity.

Figure 300, **Section diagram**: The privacy gradient runs from the centre of the building towards both the water and the road.
Figure 301. Spatial layout of uses diagram

Figure 302. Movement pattern diagram: The movement patterns of the educational, museum and research facilities.

Figure 303. Concept model

Figure 304. Concept model
Figure 305, Materiality
Figure 306: Interpretation of Durban (Author, 2015)
CHAPTER 4
FINAL DESIGN
FLOOR PLANS; SECTIONS; ELEVATIONS; 3DS; PORTFOLIO MODELS AND LAYOUT
Figure 307, Perspective (Author, 2015)
GROUND FLOOR PLAN

Figure 308. Ground Floor Plan (Author, 2015)
FIRST FLOOR PLAN

Figure 309, First Floor Plan (Author, 2015)
SECOND FLOOR PLAN

Figure 310, Second Floor Plan (Author, 2015)
Figure 313, Section progression (Author, 2015)
Figure 3.4: Elevational perspective (Author, 2015)
Figure 315, External entrance (Author, 2015)
Figure 316, Internal boat exhibition (Author, 2015)

Figure 317, External promenade (Author, 2015)
Figure 317, External promenade (Author, 2015)
Figure 3.19, Exploded perspective (Author, 2015)
Figure 320. Part wall section through walkway (Author, 2015)

- Marine grade Cor-Ten A sheeting
- Cold rolled C section channel purlins
- Galvanized cold rolled I-beam roof truss system with 150 board ceiling and insulation, supporting cold rolled C section channel purlins bolted in place and flat roof sheeting to engineer's detail.
- Steel support bracket mounted to wall with anchor bolts in accordance with engineer's detail and specification.
- 6mm suspension cable connected to roof structure to specialist detail.
- Perforated steel screen wall on guide rails secured to structural column to specialist detail.
- "Solarvon" SHL 14/5 Glazed Curtain wall - Glazing thickness to comply with SANS 10400-1 and SANS 10672, fixed by means of spider clamps and 25mm 316 Stainless steel 304 tubes.
- Power floated and diamond polished cement screed floor laid to 30mm cement screed on 300mm in situ concrete slab on 50mm sand bed on hardcore basefill not exceeding 100mm increments.
- Suspended walkway with laminated timber floors tongue and groove connection and 50mm pre-cast concrete slab core encased with cold rolled C section channels, suspended from roof structure, slot to engineer's specification and detailing.

PART WALL SECTION THROUGH WALKWAY
Figure 321, Part wall section through North wall (Author, 2015)

**Customized natural anodized aluminium window from “WISPECO” or equally approved product.**

**Weephole with stepped PVC DPC in brickwork.**

**Drip groove cut into concrete downstand.**

**500x430mp Fibre Glass gutter.**

**Marine grade Cor-Ten A sheeting.**

**Cold rolled C section channel purlins.**

**Galvanized cold rolled I-Beam roof truss system with ISO board ceiling and insulation, supporting cold rolled C section channel purlins bolted in place and marine grade Cor-Ten A roof sheeting to engineers.**

**Connected to roof structure to specialist detail.**

**Flush plastered ceiling board suspended below roof structure, with white Aluminium (Powder coated) shadeline coromice.**

**Flush plastered ceiling board suspended below slab soffit, with white Aluminium (Powder coated) shadeline coromice.**

**90 Concrete Block cavity wall, with brick forcing every third vertical course.**

**Concrete stormwater run off drain, with galvanized steel grate covering.**

**HDF AC3 Laminate flooring with V Groove and unlin click connection system with 75mm Meranti Skirting secured to 3mm cement screw on 50mm in situ concrete raft foundation slab with ring or Shank screw nails.**
**DETAIL 1**

1000mm High Stainless steel balustrading, welded onto L-section steel plate connected to Cold-Rolled Steel C-section.

Customized natural anodized aluminium window from “WIPREC0” or equally approved product.

50mm Steel Tension cable Connection to steel plate Rance secured to C-section

150mm Precast Concrete Sections at 100mm and secured to C-section, to specialist detail

Laminated timber floors tongue and groove connection on 150mm pre-cast concrete slab c

**DETAIL 2**

90mm x 190mm Concrete Block cavity wall

Brickforce every third vertical course

Weephole with stepped PVC DPC in brickwork

RC Slab to engineers specification and detailing

Raked ‘V’ Plaster Drip

15mm Smooth plaster to exterior and interior of 195 x 195 Concrete block walls. Painted as specified

**DETAIL 3**
Figure 323. Portfolio layout (Author, 2015)
Figure 326, Photograph of model (Author, 2015)

Figure 327, Photograph of model (Author, 2015)
Figure 328, Photograph of model (Author, 2015)
Figure 327: Interpretation of Durban (Author, 2015)
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<td>A diagram to show the museum typology based on a museological approach, collection characterisation and institution characterisation (Matthews, 2012)</td>
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GOOGLE EARTH
Brief history of the bay

Durban has grown from an initial settlement of hunters and frontiersmen, to one of the most important cities in South Africa. Situated on the eastern seaboard, the port has served as the premier gateway to much of the country through-out the history of the country. It played a major role as the gateway for the British during the Anglo-Boer War and continues to exist as an important hub port for much of Southern Africa. To add to this, the city and surrounding areas, with its sub tropical climate, are major role players within the national and international tourism market. Durban has a rich history, multi-cultural diversity and unique character. This being primarily due to its initial colonial beginnings and its global position on the Indian ocean with links to Asia, while situated around an African bay and being African in terms of climate, vegetation and people.

1497 Coast of Natal is sighted by Vasco da Gama on Christmas day, naming it terra de Natal.
1497-1800 The only European visitors to Natal between 1497 and 1800 are the crews and passengers of shipwrecked vessels, and no permanent settlements are established.
1510 Portuguese settle in Mozambique.
1823 Two ex-officers of the British Royal Navy, Farewell and King enter Port Natal. As a result of their visit, Farewell decides to establish a trading post at Port Natal.
1826 Farewell commences the building of a fort at The Point.
1835 On the 23 June a meeting is held for selecting the site for a new town. The town is named D’urban, after the governor of the Cape colony.
1837 Piet Retief arrives at Port Natal.
1838 July - the decision is made to establish Pietermaritzburg Dec- The Battle of Blood River, first British occupation of Natal.

APPENDICES
Appendix 1- History of the bay
Source: http://www.fad.co.za
1842 Second British occupation of Natal.

1843 Sir George Napier announces to the Legislative Council of the Cape that the Queen would take the inhabitants of Natal under her protection.

1845 William Bell becomes the first port captain.

1848 The main body of Trekkers leave Natal. Those that remain are settled in Pietermaritzburg, Weenen and the Klip River and Umvoti districts.

1848 5 000 English and Scots arrive in Natal, due to the potato blight and population explosion in England.

1860 Labourers from India arrive. 1860 The first railway line is built between The Point and the town.

1879 Anglo Zulu War

1899 First action of the Anglo-Boer War at Kraaipan.

1899 Vereeniging peace conference, and peace treaty signed.

1902 Maydon Wharf built.

1904 Pier no. 1 is built due to demand for containerisation.

1970 Pier no. 2 is built, the current container terminal.
Appendix 2- Port of Durban: Small craft harbour
Source: eThekweni Municipality
2. HARPOON GUN

This harpoon gun was used in Durban during the early twentieth century and was produced by the Norwegian weapons company Kongsberg Vapebfabrik.

The harpoon gun was invented in 1864 by whaling captain Sven Foyn. When fired, the harpoon barb would hook into the whale. An explosive charge in the head of the harpoon would cause a wound big enough to kill the animal. The dead whale was retrieved by a winch, pumped full of air to keep it afloat, and then towed to the processing location.

With the introduction of steam-powered boats and harpoon guns, whalers killed more whales in 40 years than had been killed in the previous 400 years. The modern age of commercial whaling opened up the hunt for larger and faster whales and forever changed the industry.

The first evidence of whaling appeared approximately 8000 years ago in Korea but the whaling industry only reached a massive scale in the seventeenth century. By the 1800s, whaling was a well-organised global industry producing oil and many useful and fashionable items including the rare and expensive ambergris used for the stabilization of perfume fragrances.

The Durban whaling industry started in 1907 when Jacob Egeland, the Norwegian Consul, fellow Norwegian Johan Bryde, started a processing plant. They founded the South African Whaling Company and started hunting in 1908, killing 106 whales that year. Durban's whaling industry quickly became the largest land-based operation in the world.

By the late 1960s there was growing global pressure to abandon whaling. The pressure increased in 1974 when fuel oil prices skyrocketed. Whaling boats used between 8 and 16 tons of fuel oil a day, and whaling stations used a lot of fuel to power steam winches and process carcasses. The Durban whaling station on the Bluff was renowned for causing bad smells and eventually closed in 1975.

3. STEERING ENGINE

This is the steam-powered steering engine which at one time drove the movement of the rudder on the Unicorn coaster the MV Gamtoos.

In principle steering engines such as this offer power assisted steering to the helmsmen and can be likened to that enjoyed by the driver of a modern car fitted with power steering.

In both cases even small hand-based movements on the wheel are amplified to create precise and more powerful forces acting on the steering mechanism, in this case a ships rudder.

While this steering engine is a steam-powered engine, today electric or hydraulic-powered ones are used. Prior to the invention of the steering engine, sailing ships were mainly maneuvered by using the force of the wind supplemented with the use of the rudder.

The first steam-powered steering engine without feedback was invented in 1849 by Frederick Sickels and first patented by him in 1853.

As ships increased in size steering became increasingly difficult therefore it was not surprising that the use of steam-powered steering engines on large steamships took off immediately.

These engines were an important part of the industrial revolution and while this object may look old-fashioned, its principles are still in use today.

4. THE STEAM TUG “ULUNDI”

Tugboats owe their existence to the invention of steam power, a key moment in the industrial revolution that redefined our world. They were the first seagoing ships to be powered by steam engines, which meant that they were not dependant on the wind, and were much more manoeuvrable.

Tugboats manoeuvre vessels by pushing or pulling them, and their designs vary depending on their intended use.

The boilers of early tugboats were coal-fed, making steam engines particularly suitable for use in South Africa which had an abundance of cheap coal. Only in the 1950s, nearly a hundred and fifty years later, did steam power give way to the diesel engines which are used in today’s modern tugboats.

Durban’s first steam tug was The Pioneer, which began its service in 1859, towing sailing ships in and out of the harbour.

The Ulundi, on display here, is the oldest surviving pilot tug in South Africa. Commissioned by the Union Castle Mail Company, she is 23.3 metres in length and 5.5 metres wide. When in operation, she was powered by a steam engine. She began her working life in 1927 in Algoa Bay, where she was the third ship to bear that name.

In 1935 the Ulundi was bought by the South African Railway Administration and placed in service in Durban Harbour. Initially employed as a pilot tug and tow boat, she was later used mainly to transport labourers to various work sites around the harbour.

The Ulundi was built by Henry Robb Ltd, a British shipbuilding company based on the east coast of Scotland. Robb was notable for building small-to-medium sized vessels, particularly tugs and dredgers, and was responsible for building the Wolrad Woltemade, the biggest tug in the world at that time, which was delivered to Cape Town Harbour in 1976.
The Ulundi was retired in 1982 and was moved to its present location on the cradle here at the Maritime Museum by the floating crane.

5. **PROPELLERS FROM JR MOORE**
These two large bronze propellers were removed from the tug JR More and weigh about 3.5 tons each. You may ask why they are here. The reason is electrolysis. If both the steel hull of the JR MORE and the bronze propellers were linked in close proximity under sea water which is an excellent electrolyte, the propellers would “rust” away. So to prevent this from occurring, the museum decided to remove them and place them on the quay-side, but even without the propellers and due to other dissimilar metals being present a certain amount of electrolysis occurs on the Tug. Small sacrificial zinc anodes which can be seen on the hull minimize this effect. They “rust” away in preference to the steel hull and need to be replaced as part of the vessels ongoing maintenance programme.

6. **CRANE**
The large machine you see in front of you is a dockside crane, a piece of equipment designed to pick up a heavy load, and then put it down in the desired location. This Crane is also called a Derrick and uses metal cables fed through a pulley-based hoisting mechanism, with a lifting hook at one end and a winch, or winding mechanism, at the other end.

There many different kinds of derricks, but they all operate on similar principles using a mast either as a tower or as in this case a guyed mast hinged at the bottom. In order to hoist a load on this particular derrick, you would manually turn the winding mechanism visible on the side of the derrick closest to the water. The winder is connected to a series of gears which amplifies the small human movement into a far more powerful force.

Large derricks are commonly found in docks and on ships. Large ‘floating Derricks’ are also widely used and have the added advantage of manoeuvrability, many being self-propelled.

7. **LIFEBOAT “FT BATES”**
This lifeboat is from the steam tug FT Bates which like our museum tugs, the Ulundi and JR More once did duty in Durban Harbour. The FT Bates, sister ship of the AM Campbell was ordered from Ferguson Brothers in Glasgow in the early 1950’s and originally operated in Cape Town. After serving for some time in Durban the FT Bates was eventually retired and scrapped in the early 80’s but this lifeboat remains here reminding us of her service and in particular the dramatic rescue of the freighter “The Tristiana” which broke down off the South African coast in 1952.

Life boats and life rafts are designed primarily to aid evacuation and enable people to survive at sea in times of disaster. Their importance is obvious and was highlighted after the ill-fated sinking of the “Titanic”.

While old fashioned lifeboats like this one would be challenged in rough seas, modern lifeboats are designed to be almost unsinkable and are equipped with many survival aids including flares, rations and radios.

Inflatable life rafts also play an important role in facilitating survival at sea. Look out for these on the JR More, they are easily identified by their rigid cocoon like white plastic casings. It is possible for the crew to deploy these manually but in an emergency they may also be released automatically, inflating as they are dragged beneath the water. In comparison rigid lifeboats such as this one were designed to be swung over the side of the vessel by the crew using the cranes, called davits under which they were stowed.

This lifeboat like those you can see on the JR More is built of wood and has a cover. The maritime museum in attempting to protect her has fiberglassed the sides and added a tougher more weather resistant tarpaulin. On the side of the lifeboat you can also see the name of the ship with which she was associated as well as the number of persons she was certified to carry and her dimensions.

8. **WHALER**
This boat donated by the SA Navy is called a whaler.

Made of wood and 16 feet in length it was latterly used for training and during the annual fleet pulling regattas. These rowing regattas were contested in the South African Navy by all ships and shore establishments. The ships competed for a trophy known ans the “Cock o’ the fleet”. During these races the boats were crewed by six people, a cox and five oarsmen. 4 of the oarsmen used 16 foot oars while the oarsman in the bows used a 14 ft oar. A spare 16 foot oar was also carried. The oarsman closest to the coxswain was called the stroke as he determined the rate at which the oarsmen rowed. The other oarsmen were: second stroke, midships, second bows and bows.

The origin of these boats dates back to a time when boats of similar design were used to hunt whales. They were later adopted by various Navies to carry stores and sailors between ship and shore in the event that the ship was not able to come alongside.

Take note of the planking on this whaler and compare it with that of other vessels on display. Notice in particular how the planks overlap along their edges. The technique of overlapping the planks along their edges is the distinguishing feature of all ‘clinker-built’ boats.
9. THE YACHT “NCS CHALLENGER”

The NCS Challenger was named for a voyage embarked upon by Anthony Stewart who at the age of 27 became the first man to circumnavigate the world in an open craft.

Selling everything he owned, Stewart designed and built this boat with watertight bulkheads and lockers in which he was able to store food, clothing, and a VHF radio powered by small solar panels. A friend gave him a one-man life raft.

Steward was proud of his connections with Durban and sailed under the Penant of the Royal Natal Yacht club and set sail from Cape Town in February 1991. He nevertheless did excellent passage times, often exceeding 125 miles a day, and regularly recorded speeds of 12 knots.

Steward’s voyage was dramatic and eventful and during the journey Challenger capsized so many times that he lost count. One of the most devastating was a “knock down” on 13 July 1992 which bent the mast and flooded the boat destroying the self-steering gear and all the electronics. He cut the rig away and spent the night bailing. The wind continued to blow to 30 to 40 knots for four days during which he covered 240 miles with no sail.

After the storm, Steward set up a makeshift rig and headed for an island where the boat was washed across an outer reef because of impaired maneuvrability. He managed to hang on in the cockpit while the hull rolled over and over. Both the keel and rudder were lost.

Anthony left the boat stranded on the reef but found himself surrounded by sharks. With only a knife and marline spike he swam the distance to the beach slashing at sharks all the way. The island, which turned out to be Cerf Island in the Seychelles group, was deserted, with only a derelict fisherman’s cottage and no fresh water. He lived on paw-paws and coconuts for nine days until he was rescued by a fishing boat which he attracted with a flare.

Meanwhile the NCS Challenger had washed up on the beach with the hull surprisingly still intact. After hospitalization, Stewart shipped the wreck back to South Africa, and in order to complete the voyage repaired and then returned it to Cerf Island on an MSC freighter.

His final leg from the Seychelles to Cape Town was no picnic. Bad weather in the Mozambique Channel damaged the boat again causing more repairs and delays. Persistent gales kept him in port and he hit a whale which caused another leak.

When he finally arrived in Cape Town, boats of all types and sizes, from dinghies to harbour tugs spraying their water cannons were there to salute him.

Anthony remains the only person to have circumnavigated the globe in an open craft.

10. ANCHOR

Anchors are very important in shipping. Two main classes exist, temporary anchors including anchors such as this stocked type and permanent anchors often referred to as moorings.

The 5th Edition of “The Africa Pilot” published in 1889 indicated that the holding ground associated with the anchorage off Durban was good, but that there was nearly always a heavy swell along the coast and that the ground was “encumbered with lost anchors and cables.” It goes on to advise that vessels should lie at single anchor and in the event of parting and “not being able to work out” that the ship should run for the beach... “keeping the head sails set.”

The earliest evidence of anchors are found in salvaged artefacts from the Mediterranean and East Asia; places of concentrated seafaring activity. Early anchors consisted of large rocks that were chained or tied to vessels to halt movement.

Only in the 18th century, with the development of cast metal, did mass production of anchor shapes become possible.

One of the special features identifiable on this anchor is the buckle placed near the lower end of the shank. A line attached to the buckle would be used to ‘fish’ the anchor from the sea bed.

As you walk around the museum take note of the variety of anchors and their different designs.

11. SKI BOAT S131

The seas of Durban and along the KwaZulu-Natal coast have long been exploited and enjoyed by local commercial and recreational fishermen.

This red ski boat S131 was one of Durban’s earliest ski boats and was built by Mr. Les Robinson and Mr. Peter Fatooros. It was built by applying 6mm masonite over a philipine mahogany frame and was completed in March 1952. The skipper Peter Fatooros believed that the red lead paint which was used stopped the water from penetrating the masonite and hence helped preserve the boat.

The original motors used on the boat were a 16hp Johnson and a 5hp Seagull but both were later replaced.

It is reported that fishing was good in the early days of Durban. The best catch made from this ski boat consisted of 61 Barracouta which were caught off Glenashley, just north of Durban in March 1967.

12. GRAB BUCKET

The handling of cargo is a specialised activity and over time equipment has been developed to move it as efficiently as possible. Grab buckets in a maritime context are designed to move bulk cargos
generally between ship and shore although other activities such as dredging might also be carried out with the aid of a grab.

In Durban harbour grabs like these on display have been used to move free flowing dry bulk cargos such as cereals, mill scale and coal. The design of the grab is relatively simple. The bucket itself is divided into two equal halves connected with hinges which open and close with the use of a winch, or with the aid of hydraulic mechanisms.

The grab bucket is usually attached to a crane which swings the bucket into a position where the two halves can be opened to "grab" the material to be moved. The bucket is then hoisted to a location where the contents can be deposited. On a crane, it is usually hung from cables.

Grab buckets can be very large, like the ones which are used to transfer ore or grains from cargo ships but may also be very small, such as the ones used by deep-sea exploration vehicles. Grab buckets with interlocking teeth are called 'clam shell' grab buckets and are used to dig into the ground during earth moving and construction operations, as well as to trawl the ocean floor to redeposit silt.

13. FORKLIFT TRUCKS

Forklift trucks such as these Clark and Yale ones are very manoeuvrable and are typified by the power-operated forked platform located on the front of the vehicle. They are mostly used for moving items assembled on pallets and are commonly found in places such as factories, warehouses and ports such as Durban.

Until the beginning of the 1920's goods were loaded by hand but the advent of assembling multiple small items into "unit loads" permitted their handling as a single object often on a pallet.

In 1924 the "Clark" company produced a prototype lifting machine without a tilting mast, a feature which makes it unlikely to have been suitable for handling unit loads. Yale however incorporated this feature in 1925 and built the first commercial battery powered truck having raising forks and a tilting mast.

The forklifts on display here were operated by, Rennies. The company started trading in 1849 and was founded by John Thomson Rennie. Rennie and his sons were instrumental in developing Africa's fledgling shipping industry in the second half of the 19th and early 20th centuries, moving cargos in and out of South Africa as the economy blossomed. Although no longer a family business, the name has continued for more than 150 years.

14. THE ROPE-LAYING MACHINE

The use of rope dates back to prehistoric times. The Egyptians developed special tools to make rope from water reed fibres more than 4000 years before the birth of Christ.

Leonardo da Vinci sketched a concept for a rope-making machine, and by the late 1700s several working machines had been built and patented. Ropes were originally hand-made from natural fibres such as hemp, cotton, coir and sisal. In the 1950s, with the accelerated growth of the petrochemical industry, synthetic materials were introduced. Modern ropes are made by machines from synthetic materials for improved strength, lighter weight, and increased resistance to decay.

Rope, used in rigging and lashings of sailing ships, has been central to the history of man's life at sea. Most rope-making operations from the 18th to early 20th centuries were concentrated around large seaports.

Despite the changes in materials and technology, rope making has changed little since ancient Egypt. From the 13th to 18th centuries, ropes were constructed in 'rope walks'; very long buildings where strands of full length rope were spread out and then 'laid up' or twisted together. The rope length was determined by the length of the available rope walk.

In walk-laying of ropes, bundles of fibres are first combed, drawn out and spun into strands. The strands are then pulled out along the ropewalk by a traveller which sits on rail lines. They are twisted by the gear end while at the other end the counter tension causes them to twist together on the traveller, as a guide is drawn back down the rope. The guide, which you see here to your right, is a grooved cylinder of wood which holds the strands in place. The ropes are supported on a series of gate rests and stake posts which are hinged beams fitted with timber or iron pegs between which the ropes are guided.

This rope layer was manufactured and used by Romatex Mills and used in the modern version of the original rope-walk which could produce ropes between 24mm and 144mm in diameter, with a maximum length of 220m. In 30 years of service it produced approximately 20 000 kms of rope. This rope layer was decommissioned from service by Romatex in 1982.

In 1996 Romatex was unbundled from Barlow Rand and joined the Frame Group.

15. KHAYA LETHU

This launch was purchased by Dick Turner from the then South African Railways and Harbours (SAR&H) in 1964. It was on blocks on the wharf next to where the tugs were moored at the time, and in a poor condition, painted PWD Brown.

The hull, which Turner really wanted, was basically sound and covered with brass sheeting. It was originally a Flying Boat tender craft based at St. Lucia during the Second World War. Turner and his son, Terry, were told that the launch was sometimes used to race ahead of a landing Sunderland Flying Boat to "smooth" the water for its landing. The original motors two hundred horse power petrol engines so that was believable.
Turner worked at Huletts Sugar Mill at Mount Edgecombe and the launch was transported to Turner’s home in Mount Edgecombe for conversion into a deep sea fishing launch. For the next two years, Turner and his son worked every evening and weekend to complete this transformation. It started with removing the existing superstructure and stripping it down to the hull. It was then built to a “thingy of beauty” thereafter. One of Terry’s jobs was to strip the brass sheeting on the hull, repair where necessary and replace the sheeting after putting on a coat of Bitumen. 142 gross of brass screws with a “Yankee” screwdriver which was the closest thing you could get to an electric screwdriver at the time!

Khaya Lethu was finally lowered into the harbour with a crane on the 5th of October 1966. The launch was named an isiZulu word for “Our Home” as it was intended to become the weekend home of Turner and his son moored at the Yacht mole after it was launched. 

About a year launch, two petrol engines were replaced with a 58 horse power Perkins diesels. This was after a launch named Seven Cs owned by Collier caught alight after refuelling its petrol engines one Friday evening for a Bay cruise. Of the seven family members, no one was killed but it was enough to the Turners to the conversion on their launch; sacrificing speed for safety. The launch certainly lived up to its name as the Turners used it for deep sea fishing every weekend, weather permitting, after its launch until Dick Turner sold it in 1970.

The Glow Worm was designed by the friend of a previous harbour master named Ginger Thompson. Thomson's friend designed the boat by drawing the plans in the sand on one of Durban's beaches. The plan was subsequently transferred to paper and sent for planning approval to Johannesburg, but by the time the plans were passed, Thompson had already built the boat.

The Glow Worm is a towing boat or launch boat which means that it tows other boats when their engines fail or helps to launch them into the water. This is very different to a tugboat which guides a larger ship through difficult passages such as harbours and canals. Due to its need to tow much greater vessels than itself, the Glow Worm had a very large propeller, which meant that it had a powerful thrust or acceleration. The size of the propeller also meant that it was able to come to a halt very quickly – which it did by reversing the propeller direction, in turn applying great resistance to the boat’s momentum.

The Glow Worm was built in the early 1960s and decommissioned in the early 1990s. As well as towing and launching boats, it was also used to turn around barges and punts. One of its more particular tasks was the towing of the grab barge into the yacht mole for dredging.

The JR More was built by Ferguson Brothers in Scotland for the South African Railways and Harbours in 1961. She was designed to undertake both deep sea salvage work as well as the more typical harbour duties.

20. AFT DECK
You are now on the teak covered after deck of the JR More. As you look around the deck you will see a large winch. This is the docking winch and was steam driven. Notice the silver painted cylinders and pipes that were used to convey the steam from the boiler room to the winch. This winch was not used for towing but was used for winding in mooring ropes which enabled the tug to be pulled tight alongside the wharf. The curved beam above the winch was called a towing beam and prevented the towing wire from falling onto equipment like the winch and the deck below. Also visible on this deck are the entrance hatch to the rope and paint store, red fire fighting equipment and the yellow ventilators which could be covered with canvas covers during bad weather.

21. TOWING WINCH HOUSE
This room called the “towing winch house” contains the deep sea towing line, typically some 500meters in length. The wire is stowed on this steam driven winch which is driven by the pistons below. During towing operations the wire was led out over the towing beams to the after end of the tug from where it was passed on to the ship to be towed. The length of wire between the tug and the towed ship was dictated by the weather as any sudden jerk could break the line. Enough wire was always paid out to ensure that it lay below the surface of the water. This was done to enable the wire to absorb any sudden shocks caused by wave action.

So why is the towing winch located here almost in the middle of the tug? The answer is that old tugs like the JR More were designed with propellers located at the back, or stern of the vessel with the winch position being located midships. This enabled the tug to manoeuvre and swivel under the wire, but the danger in making fast in this way was that if the wire goes out too far over one side, the tug can be girted and turned over. This was a very real danger so to solve this problem the new tugs have the propellers positioned midships. This makes them manoeuvrable but importantly also “Auto stable”, meaning they cannot be pulled over by the towing wire.
22. **STARBOARD ALLEYWAY**

As you move down the starboard alleyway you pass the toilets, or in nautical terminology “the heads”. They are called the heads because of their location at the ‘head’ or bow of the old sailing ships. Next to the heads on this tug are the shower rooms and then the galley, where whilst at sea the cook would rustle up large communal meals cooked from the victuals supplied by the company. Captain Rick van der Kroll recalls “In port I can remember each crew member bringing on his own food. While at sea it was anyone’s guess as to what was served up. If you include that at sea the crew was often sea sick. It did not matter much.”

23. **FOREDECK**

In port most of the ship assistance activity would take place here. For tug assistance to vessels like the RMS Windsor Castle docking in the port, the tug would send out a very heavy steel wire rope through one of the forward fairleads and then make fast on a bollard. The bollards are the twin sets of metal posts you see dotted around the foredeck. The ship would be alternately pushed and pulled until it was alongside the dock and made fast to the shore.

If you look on the sides referred to as bulwarks, you will see large rectangular openings. These were provided to let the sea water quickly flow off the deck. When at sea it was fairly common for large waves to come over the bow and so it was critical for each wave to flow off the deck thereby enabling the tug to face the next. In very bad weather the whole foredeck was under water for most of the time and was inaccessible to the crew. Please bear in mind that at sea the work of the tug was conducted over the stern which was fortunately sheltered by the accommodation.

Bad weather also affected the visibility of those on the bridge and if you look up at the bridge you will see two round windows - these are called “clear view screens”. A motor spins the glass in the window clearing the glass and giving a better view. More modern tugs are fitted with heavy duty wipers which work more like those on cars.

The heavy machinery on the bow of the JR Moore used for controlling the anchor is called a windlass. It was steam driven and also has large drums which were used to control the wire which was lead to the ship being assisted. The chain that lies over the windlass has one end led through the hawse pipe and connected to the anchor. The other or inboard end goes down the spurling pipe and into the chain locker. While the tug is in shallow water it therefore becomes possible to lower the anchor in order to hold the tug in position. The engine can then be placed at rest. On ocean going vessels it is always “the chippy”, the carpenter who drove the winch. On tugs there was no carpenter and this duty was performed by the bosun who was also in charge of the deckhands.

The ships bell is also located near the windlass and was used to signal the amount of chain being let out when anchoring and also for signalling, such as in fog when it is rung as a warning to other ships.

24. **FORWARD ACCOMMODATION AND FIRE MONITOR**

Below the fire monitor which we will mention more later, is the entrance to the crew accommodation which is ventilated through the yellow cowel covered pipes. One side was used for the stokers and the other for the deckhands who could also gain access to their quarters through the main accommodation. On older tugs this access was not provided. As a consequence in bad weather or in heavy seas the crew could not use their accommodation as it could be flooded if you opened the doors, and obviously this could have had disastrous consequences. Due to these problems it was a general rule that as soon as the weather got up, the crew would sleep in the main accommodation alleyways and anywhere where they could find shelter. From the late seventies the crews refused to go to sea in these vessels.

Tugs serve a dual purpose in harbour. They are both tugs and “fire boats”. Dock fires could therefore be fought from the sea side by the tugs and from the land by the fire department. This fire monitor on the JR More was able to swivel and direct large volumes of water or foam onto a fire. On the after deck are more fire hose connections. Remember to look out for the huge pump used for pumping the water to this monitor when you visit the JR More’s boiler room.

25. **FUEL TANKS**

These openings lead to the fuel tanks. It is here that the heavy furnace oil used to fire up the boilers was stored. Earlier tugs of a similar design were coal burners and this area would have typically housed the coal bunkers. Please do not open the hatches they are closed in the interest of safety.

26. **ABOVE BRIDGE/ WHEELHOUSE**

While you are on the foredeck look up at the mast, navigation lights and equipment above the wheel house. From the foredeck you should be able to identify the intertwined hoops of the radio detection finder, the canvass cover surrounding the magnetic cover on the “monkey island” and also the navigation lights and horizontal radar antenna which when in operation rotates. Also visible from here are a loud hailer and searchlights.

When on the bridge we discuss the use of some of these systems.

27. **BOAT DECK**

You are now standing on the Boat deck. The name derives from the life boats that are stowed on this deck.

On the after end of this deck you will notice a large hook. A very heavy tow rope used to stretch from this hook to the aft end of the tug. This rope was used whenever the tug’s full power in port operations was required. There was however the very real danger of the tug being pulled over or
girted as it was called which obviously would have threatened the lives of those on board. In port in the interest of safety a deck hand would therefore be stationed next to the towing hook with an axe and in extreme danger he could be given the order to cut the line.

Apart from the life boats the main feature on this deck is the funnel which was built to be high enough to vent the smoke and fumes away from the crew and also to create a good draft from the fires in the boiler room.

28. LIFE BOATS
Life boats are an essential part of any sea going vessels equipment. In terms of International regulations there has to be sufficient life-saving capacity to carry double the crew on each side of the vessel. This is achieved on the JR MORE by the life boats and the inflatable life rafts. The life rafts are enclosed in the white cylindrical objects which you can see just aft of each life boat. When they hit the water and a cord is pulled the life raft inflates and the crew are then able to get in. The wooden lifeboats are obviously much more cumbersome and have to be turned out by means of the quadrant davits under which they are stowed. Each davit would have been operated by a crew member who is duty it would have been to winch the lifeboat down into the water.

29. MASTER/ CAPTAIN’S CABIN
This is the Master’s cabin. On the tug the Master and the Chief Engineer are of equal rank and it is only in the matter of safety that the Master out-ranks the Chief.

30. FIRST ENGINEER
The Chief Engineer’s cabin is located here just next to the Radio Operator. The main duty of the Chief engineer was to take charge of the engine room its personnel and all machinery. Although the master was in overall command, the chief saw the engines and engine room personnel as his personal fiefdom.

In the days before VHF radio it was mandatory for the tug to carry a radio officer while at sea. This regulation and the practice of carrying a radio operator was done away with in the late fifties and the job is the mailship into P&O berth with pilot Smith on radio channel 13”. It would have been taken

on the bridge of the tug on the small VHF called PC1 set allocated for Port Control communication only. The pilot communication would take place on the other external VHF set channel 13 allocated for ship to ship communication. The captain also recalls that when he started work on the tugs as a mate, they did not have the luxury of vhf radio.

Communication between Port Control and the tug took place in a mixture of whistle and hand signals. Sometimes the ship’s whistle that you see attached to the funnel would be used, but more often communication was performed using a referee type whistle e.g. a short blast was for stop, two blasts push, and three pull on the wire.

31. BRIDGE
Welcome onto the Bridge, you are now in the tug’s command centre as it was from here that all operations were directed. On the JR More the bridge would normally be manned by the Skipper manoeuvring the tug, the Mate answering the radios and passing orders from the pilot to the Skipper, and the Quartermaster sometimes referred to as the Helmsman, turning the wheel. Nowadays, all this is done by one man or woman on our modern harbour tugs.

The name “Bridge” stems from the design and development of vessels. Old sailing ships were steered from right aft where the rudder was located, but later with the advent of steam engines and propellers the steering was moved forward. It was obviously necessary to be able to move from side to side of the vessel and so the aptly named “bridge” was constructed with the much needed shelter in the form of the “wheel house” being added sometime later.

The main feature in the centre of the wheel house is the “wheel”. It controls the movement of the tugs rudders and was linked by hydraulics to hydraulic pistons in the steering flat down aft. This control mechanism was the latest available at the time the tug was built and is a method still used today. All the tugs before this class had rod and chain steering similar in design to that on the ULUNDI, so remember to look out for this when visiting the museums other but much older steam tug.

To manoeuvre the tug the Quartermaster turned the wheel on command from the Skipper. The Skipper would bark out an order such as “10 degrees starboard” and the Quartermaster would respond “10 degrees starboard” and then carefully turn the wheel until the pointer on the rudder indicator which you can see just above the wheel was on 10 in the green or starboard sector. In this way the Officer on duty could also always easily check to see if the order had been carried out correctly.

32. RADAR
Various attempts to develop Radio Detection and Ranging or (RADAR) systems were made in the early to mid 1900’s, and its civilian uses became increasingly popular after its important military
contribution during World War II. This radar for instance which is located to the right of the wheel was used for navigation and to prevent collisions in the event of fog or mist. When the radar was working the background would appear black and the ships and the shore would appear as speckled dots. The distance between these dots and the tug was measurable enabling one to determine the tug’s position in relation to the other object. Early radar systems like all electronic devices took up relatively large amounts of space and although this “second generation” RADAR could be considered bulky by today’s standards the system was in those days very modern. Today radar technology continues to be used and developed.

Please continue to look around the bridge and chartroom for other navigational devices.

33. TELEGRAPH
You will note the engine telegraphs. Placed on the extreme outside ends, this was done so as to give the Captain the option of two positions from which to control the engines while also having a good view of the operating areas either side of the tug. Each telegraph is divided into two. The left or portside will telegraph what should be done with the port engine and the right hand side will telegraph the order for the right or starboard engine. By observing modern harbour tugs you can see how far development has gone as an almost telephone booth style of bridge now gives the skipper an all-round view.

Making the vessel move involved a series of tasks. First the skipper here on the bridge would move the telegraph levers to indicate the desired output he wanted from the engines. Then this information was transferred onto the telegraph which you can see in the engine room and finally the engineer would respond and repeat the order back and half ahead”, “full ahead” or whatever. The engineer would respond and repeat the order back and adjust the engine accordingly. Likewise if in an emergency the steering failed one could give helm orders such as “hard a starboard” etc. and still be able to manoeuvre. The ultimate failsafe proof.

On the JR More all navigation was done by means of the compass bearings taken on a light house or other prominent landmark. This information together with that obtained from the echo sounder and the radar were then used when plotting the tugs position on a chart. Today a completely different experience awaits those at sea who rely on the ease of the push button convenience related to GPS based navigational equipment.

35. VHF RADIO
This is one of two VHF radios located on the bridge. This radio has four channels, two of which (labelled PC1 and PC2) were used to contact Port Control. Typically the orders as to what ship the tug would need to assist would come from Port Control via this radio. When at sea, this radio was also used to communicate with other ships. When in port and assisting ships the pilot’s orders instructing the tug to push or pull would be received in this manner. The Mate or First Deck Officer as he was sometimes called would operate the radio.

36. VOICE PIPE
These are “Voice Pipes” but the JR More also had more modern electric systems that drove telephone and telegraph systems, but in the early days these systems were fragile and were prone to breakdowns. The safety authorities insisted that all systems had a backup and hence the existence of these simple yet effective communication devices.

If all electrics failed, communication to the engine room and the emergency steering flat down afloat could still be established by using the VOICE PIPEC. One would bark an order such as “engine orders half ahead”, “full ahead” or whatever. The engineer would respond and repeat the order back and adjust the engine accordingly. Likewise if in an emergency the steering failed one could give helm orders such as “hard a starboard” etc. and still be able to manoeuvre. The ultimate failsafe proof.

37. CHART ROOM
The Chart room gets its name from the fact that it is here where the maps called charts, used for navigation are kept. The chart room table is the main feature of this room and it was here that the charts would be laid out and positions plotted. The table has a number of shallow drawers and these were used for storing the charts.

Other items found here are the electromagnetic compass and the radio direction finder, to the left of the chart table.

The Radio Direction finder was an extremely important navigational aid, light houses sent a radio signal in morse code and this instrument by means of dials could pick up the direction from which it came. The operator listened through earphones and on recognising the letters he would find out
You are now about to visit the heart of the JR More which was the last of the steam tugs ordered for use in South African ports. Her sister ships the Danie Hugo and the FC Sturrock were launched in 1958 and 1959 respectively.

Built in 1961 the JR More was also the last of the Steam Tugs built by Fergusson Brothers and she is the only survivor, as both the Danie Hugo and the FC Sturrock were scrapped in Walvis Bay during the mid 1980’s.

At sea the tug was manned down below by a Chief Engineer, a second engineer, 3 assistant marine engineers, two greasers and five firemen. Fewer crew were required when in port.

Going down into the machinery spaces in ships as reflected on by Marine Engineer Peter Johns as being “commonly referred to as going down below”, and engineers might recall Rudyard Kipling’s poem about a marine engineer:

“LORD, Thou hast made this world below a shadow of a dream,
An’, taught by time, I tak’ it so
---
exceptin’ always Steam”.

Going below we get to the cylinder flat from where we will climb down to the engine room, walk through the tunnel and finally arrive in the boiler room.

This area is known as the Emergency Steering flat. Should there be a steering breakdown associated with the controls on the bridge this large wheel could be used to steer the tug, with communication still being maintained with those on the bridge. Note the compass repeater and the rudder indicator in front of the wheel.

This panel was used for controlling the navigation lights on the tug and each switch controlled a light. When switched on the associated pilot light on the box will light up and reassure the navigator that the outside light is on. Navigation lights are extremely important because at night at sea all is in darkness and one recognises a ship by the position and colour of the lights shown. By looking at the lights of another ship a seaman is also able to establish whether there is a risk of collision.

This curious piece of equipment is a “Deep Sea Lead”. In the event of an electrical breakdown the depth of the water could be determined by arming the lead with grease and lowering it into the sea. The grease was applied to the bottom of the lead and by doing this one could find out whether the sea bed was gravel, shingles or sand. The depth was measured using the mechanical gauge which measured the length of wire paid out. This information was then considered in conjunction with the details shown on the chart enabling one to establish the tugs general location.
44. **IMPULSE VALVES**
The impulse valves when opened allow steam to enter directly to the LP cylinder. In operation these valves when necessary were opened via the levers in the engine control area and immediately when the engine turned shut.

45. **ENGINE ROOM**
These engines are known as triple expansion steam engines. The advantage of these engines is that they are quick and easy to manoeuvre and have a high starting torque. Modern tugs with diesel engines and multi direction propellers are far more manoeuvrable and powerful.

The power of each engine is controlled by moving the large lever connected to the engines manoeuvring valve which admits steam into the HP or High Pressure valve. The steam developed in the boiler is first admitted into the HP cylinder at 200psi and then into the IP and LP cylinder. Each subsequent expansion extracting more energy from the steam which is eventually exhausted into the condenser which is maintained at a vacuum.

The overall thermal efficiency of this steam plant is about 12% where a turbine is about 25% and the diesel engine about 40%.

46. **ENGINE ROOM TELEGRAPHS**
These are the telegraphs displaying the engine orders from the bridge. When the tug was operational the Engineer who was also accompanied in the engine room by a greaser would stand somewhere between these two huge engines and would shift the levers to open and close the control valves. Settings on the telegraphs: dead slow, slow, half and full tell the engineer how much steam to open in order to give the required speed, and as can be seen also indicated whether the engines should operate ahead or astern.

During berthing operations the tug would proceed to the harbour entrance, turn and wait for the ship to enter. While waiting the fuel would be shut off to the furnaces with one or maybe 2 left burning. A few moments before the tug was required to manoeuvre the bridge would phone down to the engine room or use the voice pipe and let the engineer know when the tug was required to move. Sometimes the engineer would send the greaser up to the aft deck to shout down at the appropriate time for example “ship on port side” and on hearing this, the engineer would tell the boiler man to light up more fires in order to produce steam.

The JR More was the pride of Durban Harbour and was normally always on duty on mail boat days.

47. **HOTWELL**
This is the hotwell. Condensate from the condenser is pumped into here. On the side are 4 gauges operated by using an air hand pump. The gauges indicate the amount of fuel in each fuel oil tank. There are 8 fuel oil tanks and each gauge works on two.

48. **BOILER WATER FEED PUMPS**
These two boiler water feed pumps pump water from the hotwells to the boilers. One pump was used while the other was kept on standby.

49. **EVAPORATOR**
In order to make steam for the engines the boilers required their own source of fresh water. In port this could be piped on board from the wharf, but while at sea, this sea water evaporator was used to provide the boilers with the required fresh water. About one ton of fuel oil was used to produce 11 tons of fresh water.

50. **SALVAGE PUMP**
This is the salvage pump. Water can be pumped out of the tug if it is flooding or in the case of other flooded ships the JR More can assist by attaching hoses to the connections on the after deck which will then pump out the water.

51. **STANDBY DIESEL GENERATOR**
Just aft of the salvage pump is the stand by diesel generator. These steam engine rooms were very quiet and the diesel generator made a lot of noise, so was only used one day a week to keep it in operation.

52. **CONDENSER**
This is the condenser located here on what is termed the aft engine room bulkhead. All the steam from the LP or Low Pressure cylinder is exhausted into the condenser and is condensed back into water on the outside of a series of sea water cooled bronze pipes. The Edwards air pump, just forward of the condenser was used to circulate this water back to the hotwell on the opposite side of the engine room as well as to maintain the vacuum in the condenser.
53. **GENERAL SERVICE PUMPS**
These are known as bilge or General Service Pumps. One of the pumps was used to pump out the often oily bilge water and the other would be kept for pumping clean water onto the deck or to transfer fresh water which was sometimes required by ships anchoring in the bay.

54. **HYDRAULIC STEERING PUMP AND GENERATOR**
This hydraulic steering pump pumps hydraulic oil to the steering rams in the steering flat. Above this on a platform is the steam driven generator which would deliver 110v DC. Just aft of the generator is the main electrical switchboard.

55. **TUNNEL**
You are now in 'the tunnel' with the engine room and the boiler room on opposite ends. Separating the engine room from the tunnel and the boiler room is a water tight door which could be closed from the deck to in the event of either becoming flooded. Manoeuvring ships in the harbour was very risky as if a tug fell back the moving propellers of a twin screw ship could easily chop gashes into the tugs hull. At least two cases are known in Durban harbour of tugs sinking as a result, normally on sandbanks from where they could be salvaged.

56. **FUEL TANKS**
The JR More has 8 fuel oil tanks and could carry just over 400 tons of fuel oil. At full speed the tug would burn about 20 tons in a 24 hour period. It would travel about 290 miles at a speed of about 12 knots.

57. **BOILER ROOM**
The boilers would be considered the heart of a steam ship or tug, as without steam you are not going anywhere. The three Scotch multi-tubular boilers in this boiler room each hold 25 tons of water. Each boiler has 3 furnaces. Hot fuel oil at about 90 degrees Centigrade is pumped under pressure into the furnace. Air under pressure is also blown into the furnace and is controlled by the 2 lever handles to give a smoke free burn. Various changes could be made in the boiler room to generate either more or less steam for the engines depending on what power was required by the tug. While waiting to assist a ship for example only a few of the fires were generally lit, although if full power was needed the engineer would ask for more fires to be lit.

58. **FUEL OIL PUMPS AND HEATERS**
Looking forward on this, the starboard side are 2 fuel oil pumps and 2 fuel oil heaters. One pump and heater would be in operation while the others would be on standby. These pumps fed the heated fuel oil to the furnaces through the burners and tips located on the front of each furnace.

When firing the boilers up from cold, cold diesel oil was first pumped in using a hand pump or pneumatic pump, generally one boiler would be fired up with the associated 3 furnaces being alternately fired. Only once 100psi of steam pressure from the first boiler had built up was it possible to use the fuel oil heater, draught fan and fuel oil pumps and consequently the heavy fuel oil. The process was long and was designed to allow the boiler to expand and heat up in a uniform manner in order to prevent cracking and thus leaking. About 75 psi would be reached in the boiler after 12 hours but it would take approximately 24 hours to reach the Scotch boilers maximum 200psi pressure. The other 2 boilers were fired up in a similar way. It took a full 36 hours for all 3 boilers to be up to maximum steam. Due to this exhaustive process the tug could never shut down while on duty so unlike our modern tugs the JR More therefore operated 24 hours a day 7 days a week when on shift.

59. **BOILER GAUGES**
In the boiler room look up from the deck plates at the glass gauges. These are the most important gauges on the boilers and tell the engineer in the boiler room the level of the water in the boilers.

On the front of the boilers are the pressure gauges and by observing these and by opening or closing the furnace fires a constant pressure can be maintained.

60. **RED HANDLES: SOOT BLOWING**
On the after end of each boiler are 3 red handled valves attached to spindles which are attached to the soot blower valves. The purpose of these was to blow steam through the furnace tubes in order to clear them of the unavoidable soot build up which negatively reduces the transfer of heat to the water on the outside of the pipes. When in port this activity would be carried out normally weekly while at sea this took place daily. As this was a very dirty operation the tug would leave the harbour and turn sideways to the wind. The soot billowing out of the funnel would therefore blow off the side of the tug.

61. **FORCED DRAUGHT FAN**
This is the forced draught fan used to feed air into the boilers. There is only one fan with a rotating steam engine on either side. One engine was connected for use while the other was kept on standby.
62. **MAIN FIRE FIGHTING PUMP**
This is the main fire fighting pump and it has its own sea water and steam supply. From this pump water can be pumped through the large pipes to the fire monitor on the fore deck and to the fire mains on the main and the boat deck to which fire hoses could be connected.

63. **FUEL OIL PUMPS**
These two fuel oil pumps were used to transfer fuel from the forward tanks to the after tanks and from one side to the other. The most common reason to transfer fuel from one tank to the other was to spread the weight of the fuel as evenly as possible.

64. **DIESEL AND WATER TANKS**
This small diesel tank was used to provide the galley stove with fuel and to start up the first boiler from cold. Forward of this tank are two steel cylinders which were kept under pressure and used for supplying the tug with water for domestic use. One supplied fresh water for drinking etc and the other supplied sea water for the “heads”.

65. **VALVES**
On top of the boilers are the shut off valves and safety valves. The safety valves of which there are two on each boiler were set to blow at about 205 psi.

The South African Railways and Harbours had a very strict code of practice and boilers and pressure vessels like those containing the drinking water had to be examined every year by an inspector.

66. **TECHNICAL SPECIFICATIONS**
At one time the JR More was one of the most powerful tugs in the world. Her technical details are:

- Overall length: 53,72m (176, 3 ft.)
- Moulded breadth: 11,303m (35 ft.)
- Moulded depth: 5,48m (18 ft.)
- Mean draught: Full loaded) 4,712m (15, 5 ft.)
- Displacement: 1654, 94 tonnes.
- Gross Tonnage: 817, 689 tonnes.
- Built by: Ferguson Bros. Shipbuilders Ltd, Glasgow. 1961


Propulsion: 3 Scotch, 3 furnace multi-tubular boilers driving 2 sets of triple expansion steam engines of 3110 indicated horsepower of each Twin screw.

67. **THE PORT AND NEW TUGS**
From this point take in the impressive view of Durban’s busy harbour. The port of Durban handles the greatest volume of sea-going traffic of any port in southern Africa with a total of about 38 percent of all ships entering South African Ports or 4,500 sea-going ships to be more precise now calling at Durban every year. To assist these vessels the harbour authorities operate tugs much more powerful than the JR More. These modern tugs have huge Voith Schneider propulsion systems, and recently a huge new contract was awarded to Southern African Shipyards in Durban for the building of 5 new tugs, two of which are expected to go into service in Durban in 2010. The Durban tugs will have a bollard pull of 60 tons while the other 3 destined for the Eastern Cape port of Ngqura will have a bollard pull of 70 tons.
Appendix 3 - Declarations

DESIGN TREATISE LANGUAGE PRACTITIONER DECLARATION

Please type or complete in black ink

FACULTY: Arts

SCHOOL/DEPARTMENT: Architecture

I, (surname and initials of language practitioner)

L. L. CHRISTIE

Being the holder of the following qualifications (e.g.: BA (English))

BA (Hons) Architecture and Applied Language Studies

Certify that I am the language editor for (surname and initials of candidate)

HOLGATE R

(student number) 212278886, a candidate for the degree Master of Architecture (Professional), with a treatise entitled (full title of treatise):

THE DESIGN OF A MARITIME MUSEUM IN THE DURBAN HARBOR

Hereby certify that I have edited the language usage and referencing in his/her design treatise document in its entirety and believe that it is ready for examination.

Language Practitioner

Date: 18 October 2015

STUDENT

Date: 18 October 2015

DECLARATION BY CANDIDATE

NAME: RICHARD HOLGATE

STUDENT NUMBER: 212278886

QUALIFICATION: MASTER OF ARCHITECTURE (PROFESSIONAL)

TITLE OF PROJECT: THE DESIGN OF A MARITIME MUSEUM IN THE DURBAN HARBOR

DECLARATION:

In accordance with Rule G4.6.3, I hereby declare that the above-mentioned treatise/ dissertation/ thesis is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

SIGNATURE:

DATE: 18 OCTOBER 2015