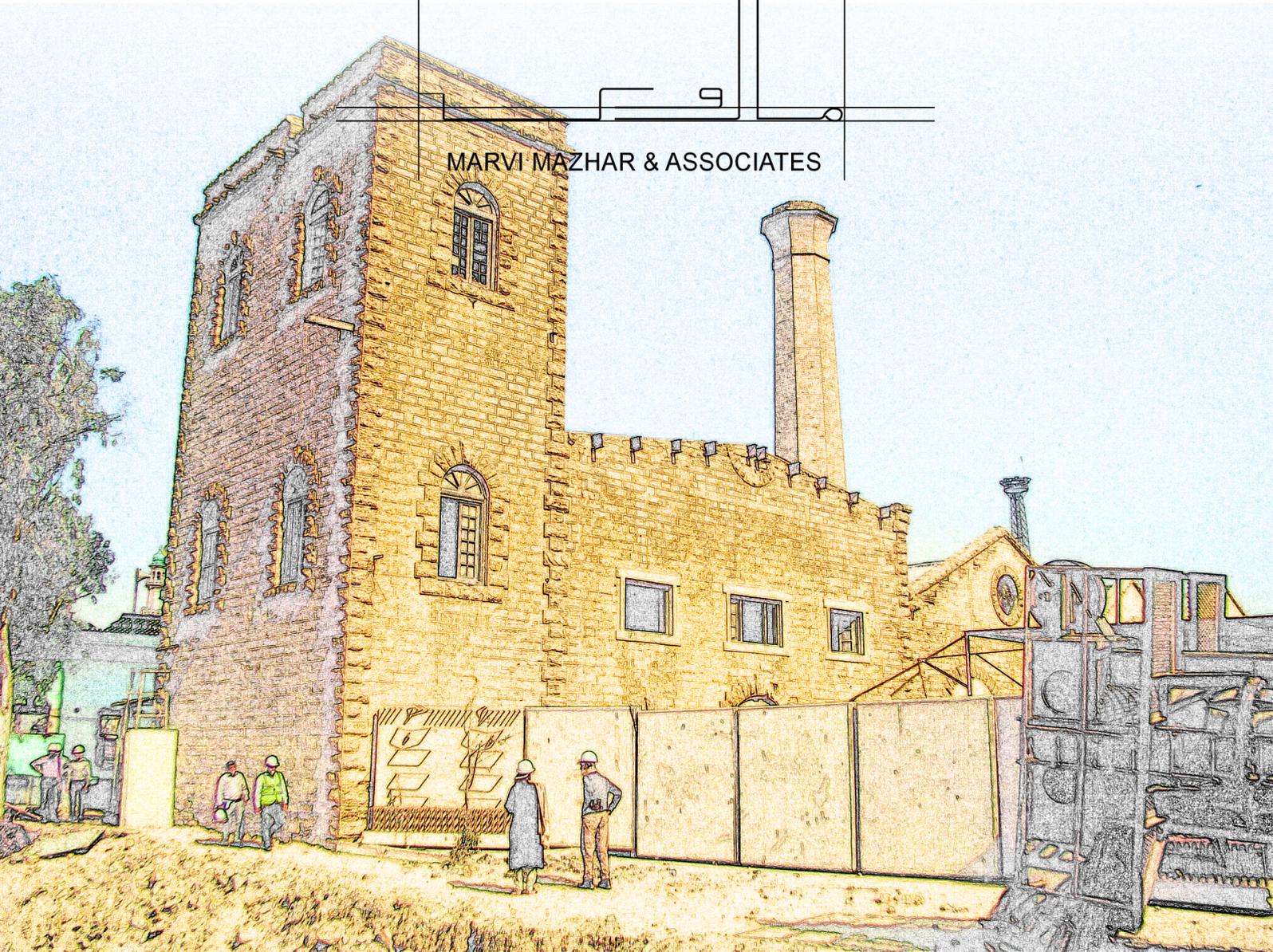
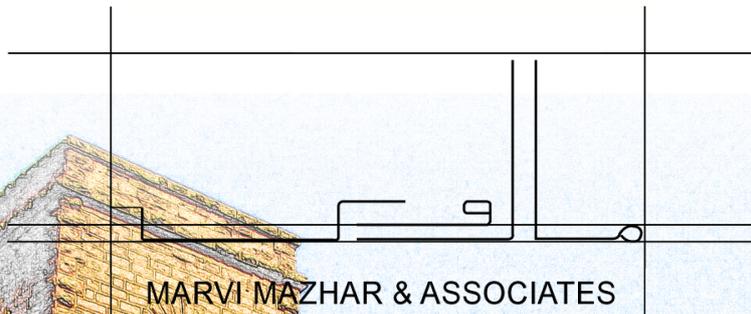
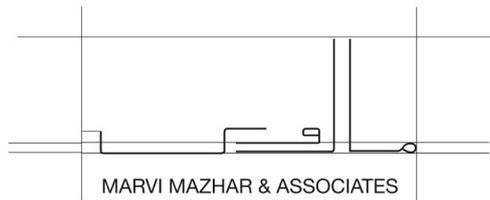


KPT - Karachi Port Trust

Documentation Analysis of Berth 15 to 17A
at East Wharf,
Karachi Port Trust.



Karachi Port Trust - Berth 15 to 17A at East Wharf – Technical Report

Project: Documentation Analysis of Berth 15 to 17A East Wharf

Building Type: Warehouse/ Heritage

Location: Karachi, Pakistan

Province: Sindh

Period: Colonial

Construction Material: Limestone/Yellow Gizri Stone

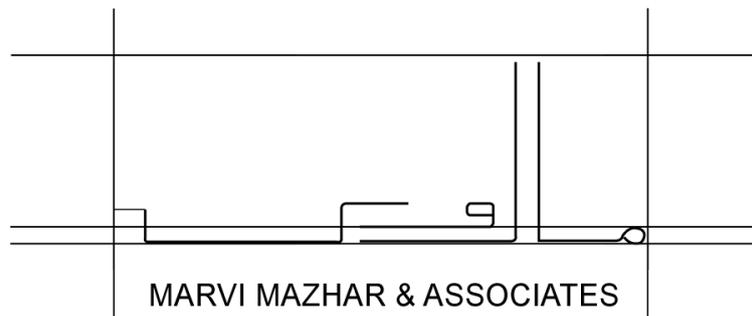


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Introduction

Karachi Port Trust has divided its real estate into eight main locations, namely, East Wharf, West Wharf, TPX, M.T. Khan Road, Keamari, Manora, Mai Kolachi Road and Bunder Road (M.A. Jinnah Road).

New construction is taking place in East Wharf, part of which is the pile foundation placement. This Pile Foundation is crossing the existing 15 to 17A berths which are categorised as heritage. The excavation and placement for Pile foundation near the periphery of these berths will cause severe damage and might lead to complete collapse of the entire structure. The on-going excavation has already led to the collapsing of the corner of the berth which was a later addition to the building and wasn't a part of the original heritage building.

A documentation analysis of 15 to 17A berth has been carried to record and determine the existing condition of the structure. After thorough documentation and analysis, a report has been presented on measures for further action keeping in mind the addition of Pile Foundations.

Location

The port of Karachi handles about 60% of the nation's cargo (25 million tons per annum). It is located between the towns of Keamari and Saddar. The geographic location of Karachi places the port in close proximity to major shipping ports such as the Strait of Hormuz.

The berth 15 to 17A are located at the East Wharf, KPT, Karachi.

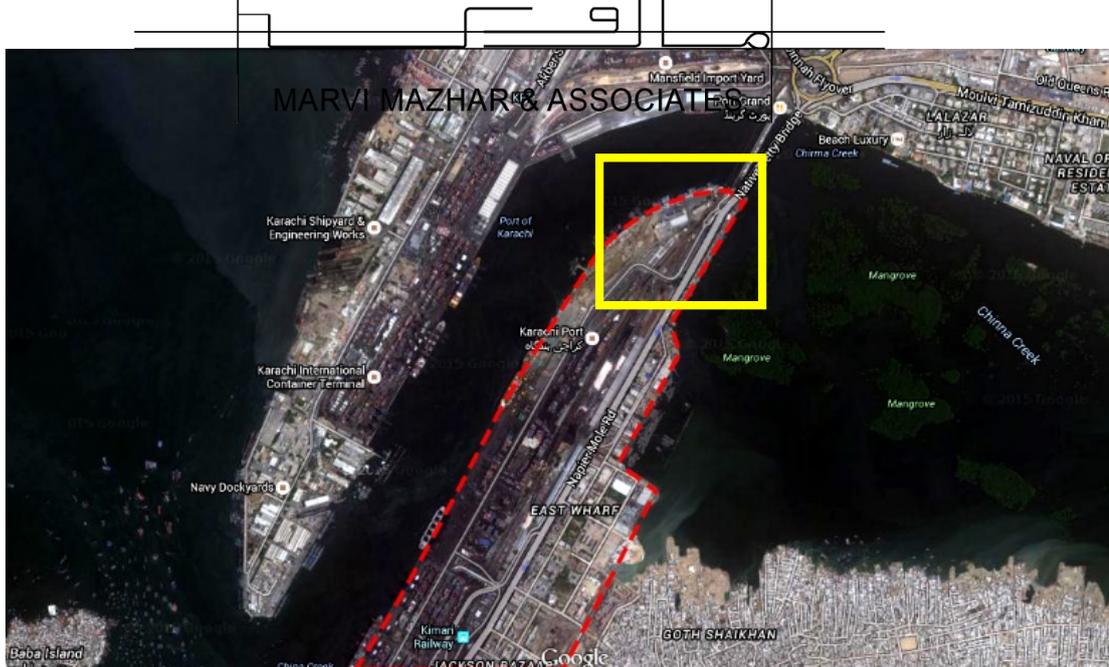


Figure 1 - East Wharf, KPT, Karachi.

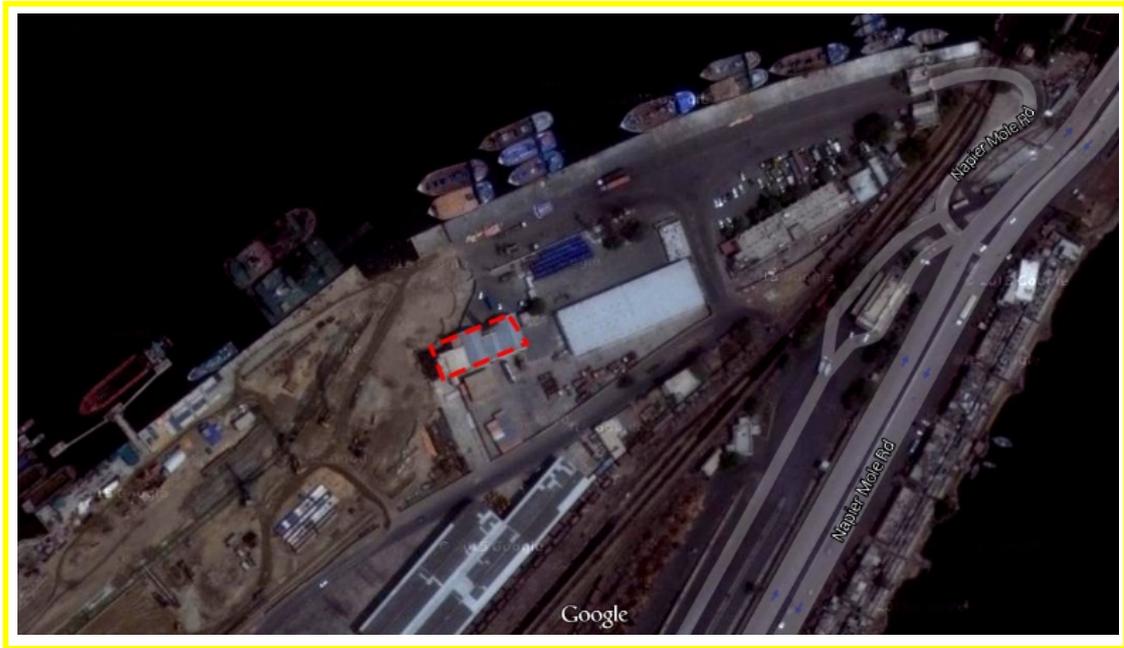


Figure 2 - 15 to 17A Berth - East Wharf, KPT, Karachi.

History of Karachi Port

Due to its geographical and strategic location, Karachi is known as the gateway to Asia. It started as a small fishing village in the early 19th century, and has been a witness of Alexander and Umayyad General Muhammad bin Qasim's reign.

The earliest mention of Karachi's port was in 1558 in an Arabic treatise 'Muhit' advising sailors to find refuge at the Karachi harbour to avoid whirlpools. This city has gone through various name changes becoming KARACHI in Qasim's *Debal*.

Through over-seas trading, Karachi prospered into a proper city by 1858 with a population of about 14,000. However the development of the port initiated in 1854 when a causeway was built to connect the main harbour with the rest of the city. Within 5 years construction of Manora Breakwater, Keamari Groyne, the Napier Mole Bridge, Native Jetty and China Creek, started leading to the development of the harbour into a developed port.

The construction of the wharves started in 1882 and by 1914 the East Wharves and the Napier Mole Boat Wharf had been completed. Construction of the West Wharf of the Port, the lighterage berths and the ship-repairing berths occurred between 1927 and 1944. Most of these facilities became obsolete by the time Pakistan came into existence in 1947. The port administration has undertaken various projects to develop the port in order to accommodate the increasing traffic at the harbour. Since independence, the port capacity has increased from 1.5 million tons of dry cargo and 1.0 million tons of P.O.L to 25.45 million tons of dry cargo and 11.74 million tons of liquid cargo, including 1,213,744 TEUs which constitute about 60% of import/export of the country.

Wharves at the Port

The port comprises of a natural harbour with an 11 kilometre long approach channel providing safe navigation for vessels up to 75000 metric tons deadweight (DWT). The port's main activities take place at the two wharves namely the East Wharf and the West Wharf. The former consists of seventeen vessel berths while the latter has thirteen vessel berths. The maximum depth alongside the berths is currently 11.3 metres. Extending in opposite directions along the upper harbour, the East Wharf is located northeast from Keamari Island while the West Wharf is situation southwest from Saddar Town. Both the wharves include a container terminal.

Development of the East and West Wharf

In 2007, KPT officials signed an agreement with the Korean Contractor M/s SsangYong for the reconstruction of the collapsed berths at the Karachi Port. The duration of the project was intended to be 15 months.

The first phase of the project was reconstruction of the berths No.10 to 14. KPT had already developed plans to reconstruct all the old berths numbering 17 at the East and West Wharf in four phases. However, the collapse of no.10 and no.14 at the East Wharf led to a change in the reconstruction order.

After construction of berths 10 to 14 in the first phase, the Korean contractors had to undertake construction of berth 15 to 17A, including SRB (ship repair berth) at the East Wharf in the second phase.

Berth 22 to 25 of the West Wharf have been categorised in the third phase of the project and berth 1 to 4 at the East Wharf will be taken care of in the final phase of the project.

East Wharf 15 to 17A Project

The official website of KPT states the reconstruction of Berths 15 to 17A as an ongoing project. Since the existing berths are categorised as heritage, the ongoing placement of Pile Foundation has stopped and proper measures need to be taken to protect the specific berths. Details about the project on the official Karachi Port Trust (KPT) are as follow:

Name	Reconstruction of Berths 15 to 17A including SRB's at East Wharf.
	Phase II:
Total Cost of the Project	Rs. 9.5 Billion estimated.
Date of Completion	Financing from World Bank has been Finalised – completion envisaged in 2014 and contract awarded to M/s SsangYong & Dongyong

KPT has 30 dry cargo berths and 560 m quay wall at Napier Mole Boat wharf for country crafts. 4 berths were reconstructed in near past and PICT was established there. 5 berths at KICT are recently reconstructed. KPT plans to reconstruct remaining berths in phases. The salient features of this programme are as under:

Berths 15-17A including SRBs designed to 16 m depth, length of Berths is 922 m. The Concept has been approved by CDWP of Planning Commission and the financing from World Bank has been finalized. The estimated cost is Rs. 9.5 Billion (approx.).

The contractor have been mobilized at site and demolition works are in progress at site. M/s. Atkins in association of Techno Consultant Int. as sub consultant have been appointed to supervise the project.

Completion envisaged by the end of 2014.

Architectural Influences

The construction of East Wharf happened between 1882 and 1914, 2 years before the construction and inaugural of the KPT Head Office Building on 5th January, 1916. There is no record of the architect responsible for the wharves but the KPT building was designed by G. Witted, who also designed the Prince of Wales Museum/ the Gateway to India in 1908. Since there's no written record on who built the berths, the architectural background of the structures can only be derived through visual study, comparative analysis and documentation.



Figure 3 - KPT (Karachi Port Trust) Building, Karachi, Pakistan. G. Witted, 1916.

Figure 4- Gateway to India, Mumbai, India. G. Witted, 1908.

The

berths 15 to 17A are built in yellow Gizri stone, which was the local stone available during that time. All of the buildings belonging to the same period such as the KPT Head Office, Merewether Tower and Empress Market were all built from the same stone.



Figure 5- Yellow Gizri Stone, KPT (Karachi Port Trust) Building Karachi, Pakistan.



Figure 6 - Yellow Gizri Stone, Merewether Tower, Karachi, Pakistan.



Figure 7 - Yellow Gizri Stone, Empress Market, Karachi, Pakistan.

The building style is Colonial, derived from the barrack architecture that arrived in this area in the middle of the nineteenth century. These barrack buildings topped by pitched roofs in Sindh were a direct influence from Anglo-Indian Cantonments like Bombay. The earliest surviving barrack of Karachi is the Army Station Commander's Office, built in 1856. These barracks had to be constructed

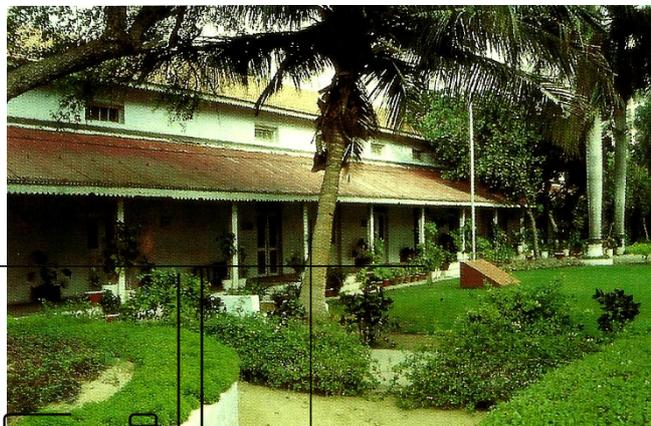


Figure 8 - The earliest surviving barrack of Karachi, Army Station Commander's Office, 1856.

from recycled wood transported from Bombay in order to save construction cost. However, due to unsuitability of material, General Charles Napier along with his brother Williams Napier, got army accommodation and barracks built with mud-built walls (*gonda*) or of sun-dried bricks (*katchi int*). Mud continued to be used until the 1878 when the Quarter Guard at Hyderabad was built using "sun-dried bricks and mud, on foundation and plinth of stone and lime." (ARPWD 1878-79:7)

Karachi became a military settlement in the early stages of British occupation. As described in Yasmeen Lari's book *Karachi under the British Raj*, the function of the buildings led to the particular barrack style of architecture.

Buildings were meant to provide accommodation for three categories of residents: the occupying army, the European administrative staff, and the native camp followers. This resulted in large single storey barracks and stores were constructed at the north end of the Cantonment for the use of the European and Indian troops, and single storey houses within spacious compounds were constructed at the opposite

end for Napier's 'soldier-civilians' who had been appointed to administer the newly acquired territory.¹

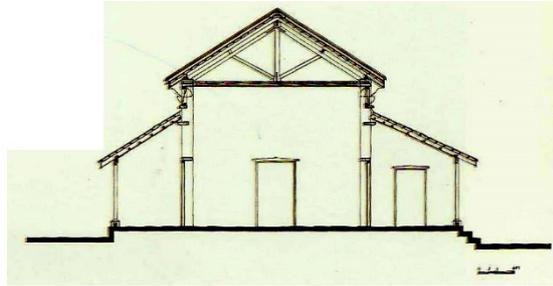


Figure 9 - Section of an Army Barrack, Karachi. Drawing prepared in 1936.

In 1840s, Richard Burton described barracks built by Charles Napier as "large, roomy barracks, oblong, single storied buildings, dressed with mathematical precision to the front and flanked by equally precise roads" (Burton 1851:1.69).

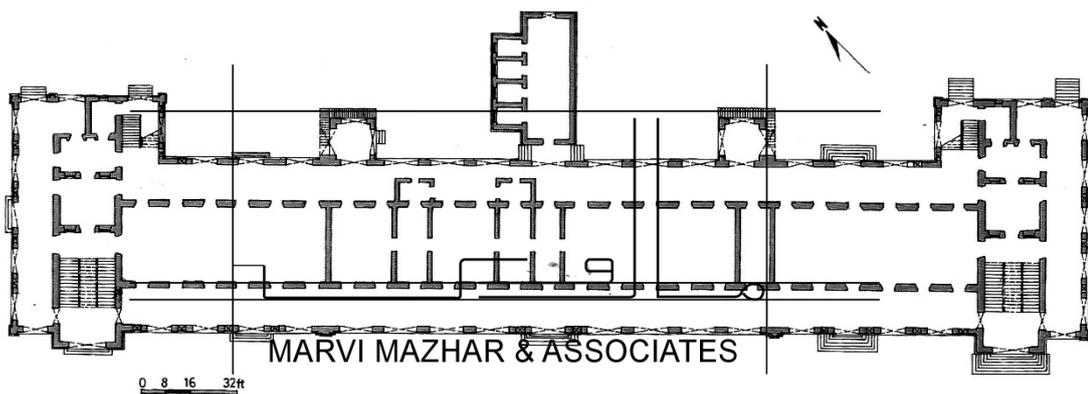


Figure 10 - Plan of Napier Barracks, Karachi.

The form of the barracks could particularly be described as one long room which was done to provide free flowing air. Hence the barracks were also oriented to face the south-west for prevailing wind.

Thatch and mud were initially used to provide a cool roof covering placed over a similar framing of recycled wood roof influenced from Bombay. Later, clay tiles replaced thatch and mud. This roof required constant maintenance as clay tiles needed to be replaced but stayed as signature roof style.

¹ The Dual City: Karachi During the Raj [Yasmeen Lari, Mihail Lari], Pg. 194.

Similarly walls were also improved with local Gizri stone replacing the wood and mud construction. This stone became the common material used for construction and continued to be used till as late as Second World War.

The first *pukka* barracks were constructed in 1844 in the Fitzclarence Lines. “Intended for the accommodation of British Infantry, and so used for many years,” by 1871 “they were converted into use for the accommodation of a Native Infantry Regiment” (ARMW App. A 1885-86:21).

The Napier Barracks, built in the “time of Sir Charles Napier” (Hughes 1874:349) that still exists is a relevant example of a barrack architecture in Karachi. The architectural style of these barracks, as described in Yasmeen Lari’s ‘Karachi under British Raj’ are similar to the barracks at the wharf.

All ten structures of the Barracks had originally been “single-storied buildings.” These barracks, with sloping roofs, deep arcaded verandas and high ceilings, were constructed with “stone and lime masonry with tiled roofs.” (ARMW App. A 1885-86:20)



Figure 11 - Napier Barracks, Karachi, Pakistan.



Figure 12 - Sloping Roof, Arches, Fenestration, Yellow Gizri Stone. Napier Barracks, Karachi.

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The four structures of 15 to 17A are designed in typical barrack style architecture, single storey, tile sloping roofs, high ceilings constructed with stone and lime masonry. However, since they were built for the purpose of storage rather than accommodation, they do not entail arcaded verandas. The berths have other similarities including arch-windows, round ventilators and roof spouts.

Architectural Features

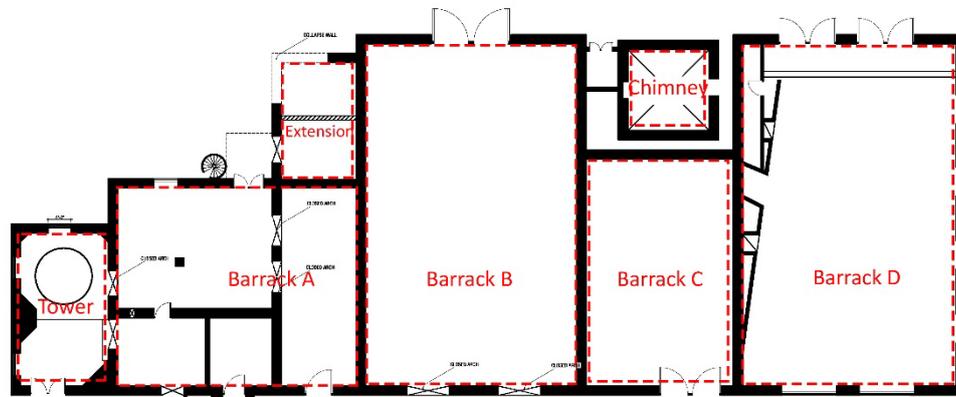


Figure 13 - Plan of Berth 15 to 17A, East Wharf, KPT, Karachi.

The structure of berth 15 to 17A comprises of a tower, four barracks, and a chimney tower. The oblong tower stands in the corner at a height of 54 feet. It is a triple storey structure with a window on second and third level on the South-East Elevation and two windows on each second and third level on the South-West Elevation. The entrance is on the South-East side, opposite the port, while the side facing the sea, north-west, and has no doorway.

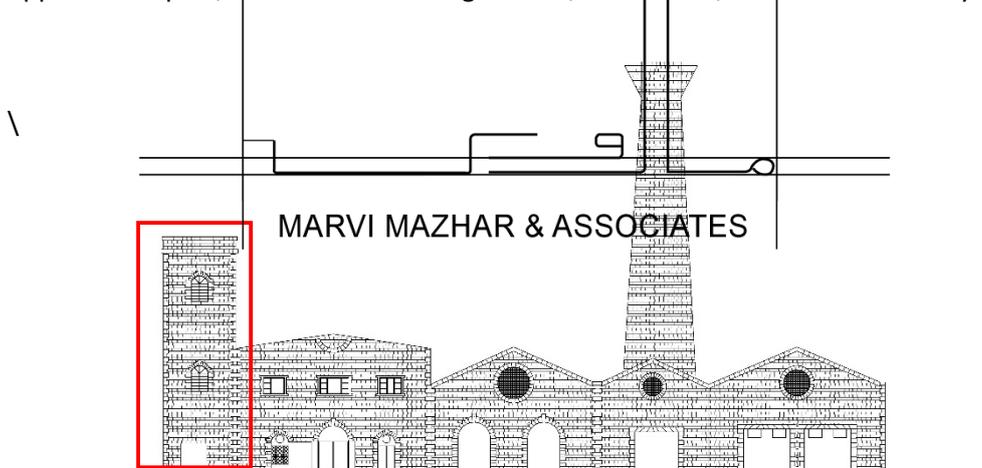


Figure 14 - Tower, South-East Elevation, 15 to 17A berth, East Wharf, KPT, Karachi.

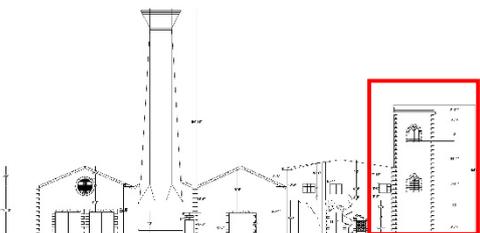


Figure 15 - Tower, North-West Elevation. 15 to 17A Berth, KPT, Karachi.

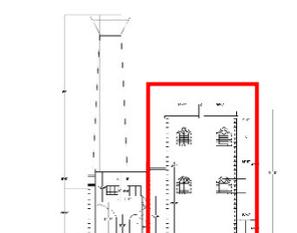


Figure 16 - Tower, South-West Elevation, 15 to 17A Berth, KPT, Karachi.

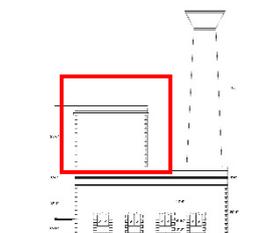


Figure 17 - Tower, North-East Elevation, 15 to 17A Berth, KPT, Karachi.

Barrack A shares its wall with tower on one side and Barrack B on the other. The elevation of this barrack suggests that the original height of this structure used to be higher than it currently is, and the semi-circular hint of a fenestration proves that the roof has been altered. An extra level was also added which was done to accommodate office spaces. This level also exists but wasn't a part of the original structure. The access to the second level was through the port side from a circular staircase. Originally this barrack was a single storey warehouse similar to the rest of the barracks next to it.

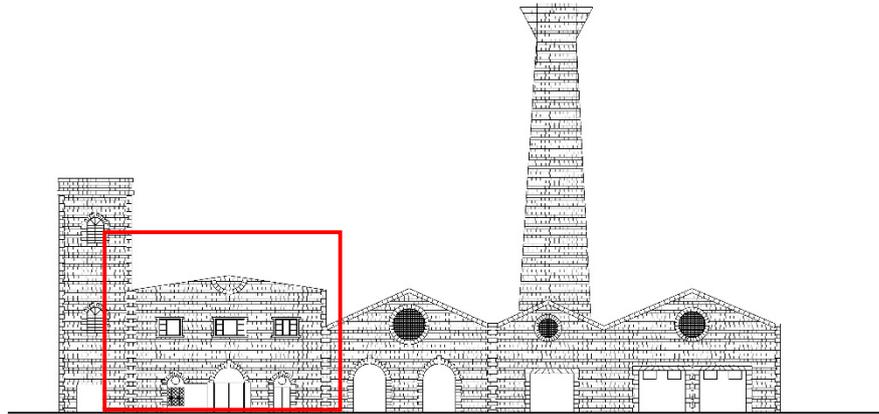


Figure 18 - Barrack A, South-East Elevation, 15 to 17A Berth, East Wharf, KPT, Karachi.



Figure 19 - Barrack A, North-West Elevation, 15 to 17A Berth, East Wharf, KPT, Karachi.

Figure 20 - Barrack A, South-West Elevation, 15 to 17A Berth, East Wharf, KPT, Karachi.

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Barrack B still exists in its original state with a single fenestration and two arch openings as entrances.

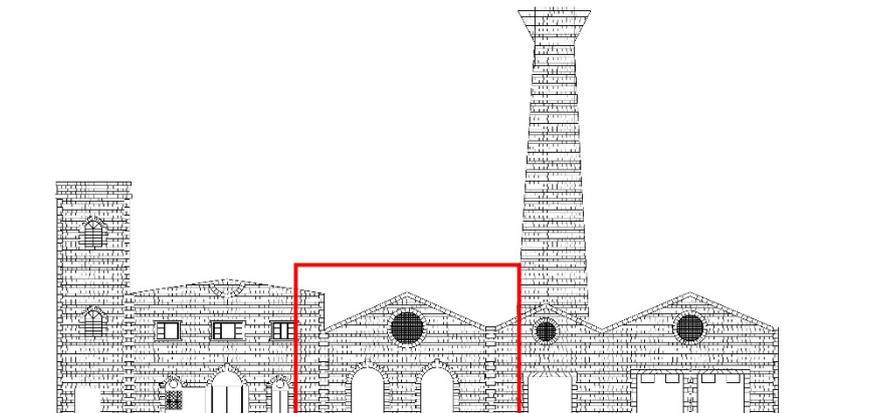


Figure 21 - Barrack B, South-East, 15 to 17A Berth, East Wharf, KPT, Karachi.

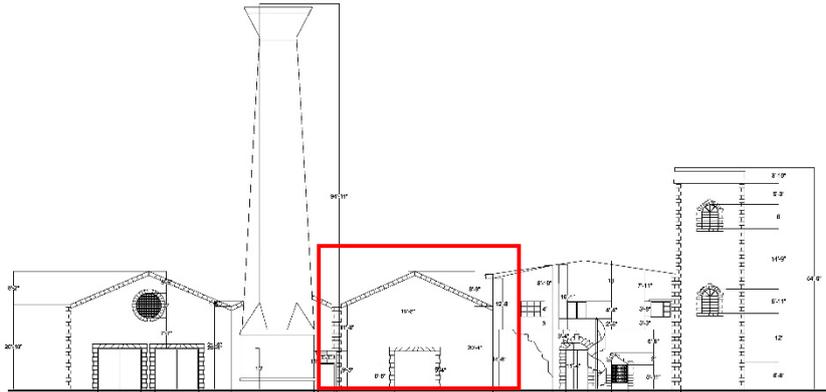


Figure 22 - Barrack B, North-West Elevation, 15 to 17A Berth, East Wharf, KPT, Karachi.

Barrack C and D follow the same language as B, but have rectangular openings instead of the arched ones. All of the barracks including the tower are bare of any ornamentation except for framing openings and the top profile which is expressed through difference in size and placement of the stones.

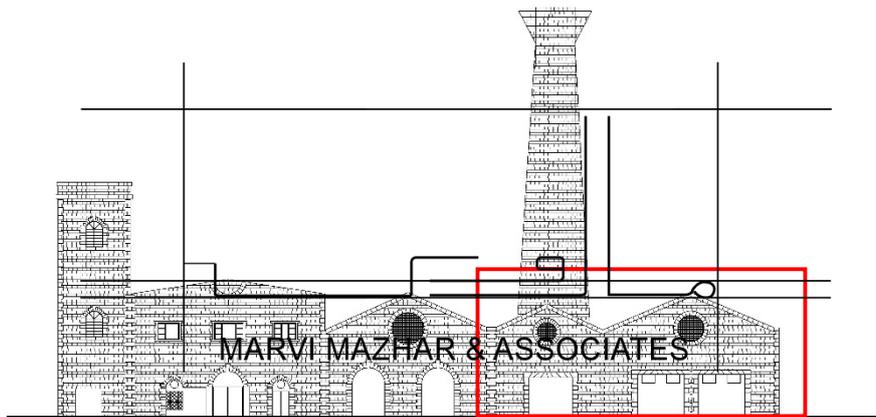


Figure 23 - Barrack C and D, South-East Elevation, 15 to 17A Berth, East Wharf, KPT, Karachi.

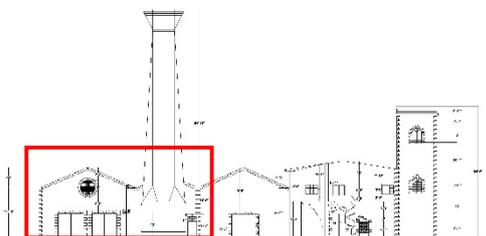


Figure 24 - Barrack C and D, North-West Elevation, 15 to 17A Berth, East Wharf, KPT, Karachi.

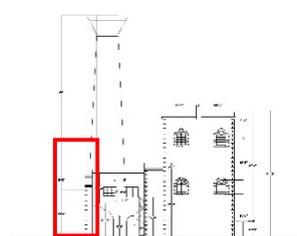


Figure 25 - Barrack C, South-West Elevation, 15 to 17A Berth, East Wharf, KPT, Karachi.

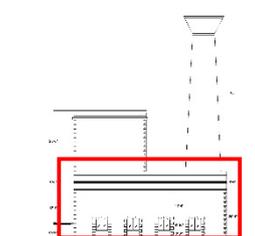


Figure 26 - Barrack D, North-East Elevation, 15 to 17A Berth, KPT, Karachi.

There is a chimney tower which rises to a height of approximately 94'. The tower sits on a square base on which the octagonal tower sits tapering as it increases in height. It has small arch openings at the base on the two side walls.

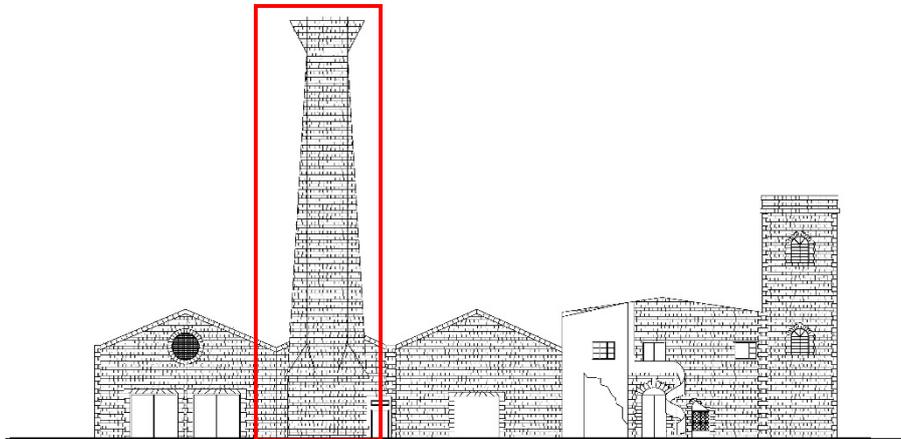


Figure 27 – Chimney Tower, North-West Elevation, 15 to 17A Berth, East Wharf, KPT, Karachi.

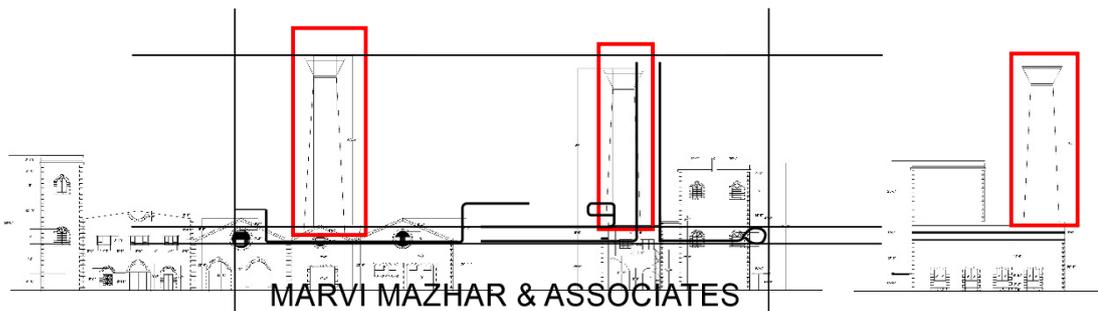


Figure 28 – Chimney Tower, South-East Elevation, 15 to 17A Berth, East Wharf, KPT, Karachi.

Figure 29 – Chimney Tower, South-West Elevation, 15 to 17A Berth, East Wharf, KPT, Karachi.

Figure 30 – Chimney Tower, North-East Elevation, 15 to 17A Berth, East Wharf, KPT, Karachi.

Original use of the Building

These barracks were originally built for the purpose of storage. Barrack A, B, C and D all functioned as warehouses. The tower was built to act as a lighthouse, meant to keep a look-out for ships.

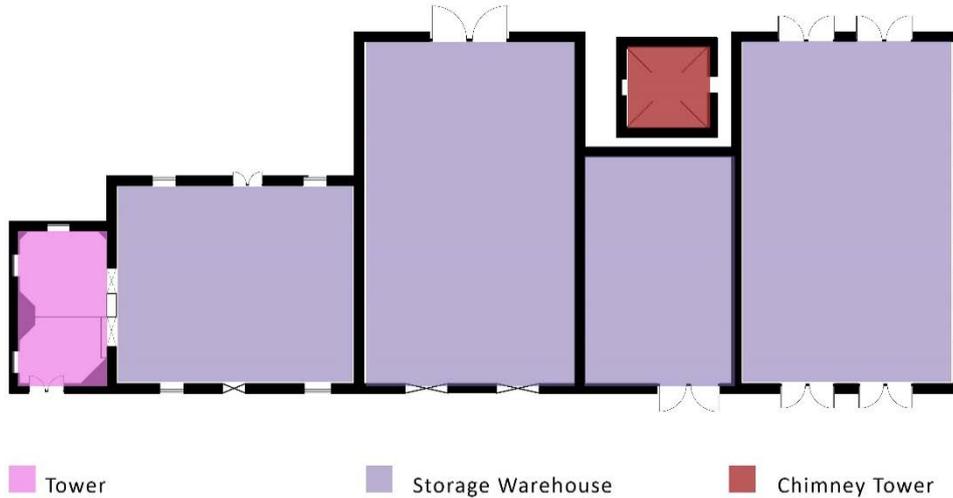


Figure 31 - Original layout and use of the building.

Existing Use of the Building

The corner tower currently accommodates a boiler while Barrack A is abandoned and not being used for any purposes. Barrack B and C are still being used as storage warehouses and Barrack D has been converted into a mosque. The chimney tower hasn't been used in a long time and has accumulated trash and dust with time.

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Figure 32 - Existing layout and use of the building.

Damage Assessment

Paint over Surface



Figure 33 - Paint over Surface - Barrack A, 15 to 17A, East Wharf, KPT, Karachi.

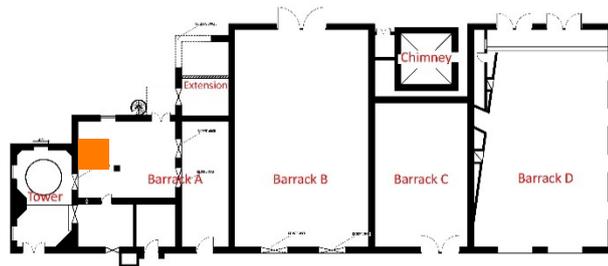


Figure 34 – Plan - Paint over Surface - Barrack A, 15 to 17A, East Wharf, KPT, Karachi.

The interior stone surface of Barrack A has been painted white.

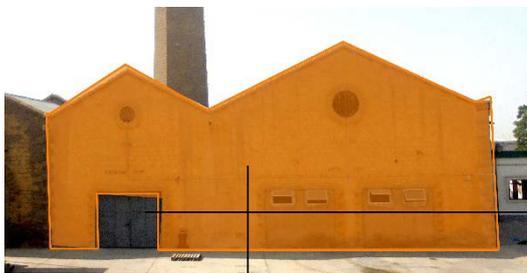


Figure 35 - Paint over Surface - Barrack C and D, 15 to 17A, East Wharf, KPT, Karachi.

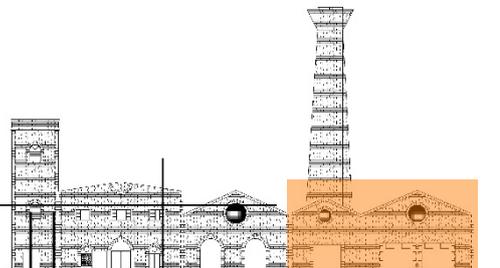


Figure 36 – South-East Elevation - Paint over Surface - Barrack C and D, 15 to 17A, East Wharf, KPT, Karachi.

The exterior surface of Barrack C and D has been painted to a light peach tone.

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Figure 37 - Paint over Surface - Barrack D, base of Chimney Tower, Extension, and Barrack B, 15 to 17A, East Wharf, KPT, Karachi, Pakistan

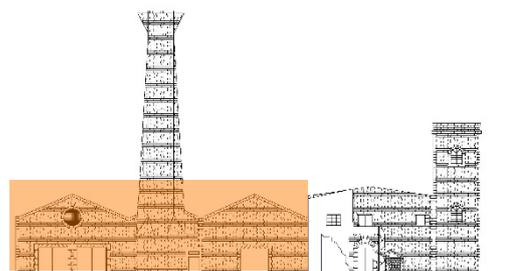


Figure 38 – North West Elevation - Paint over Surface - Barrack D, base of Chimney Tower, Extension, and Barrack C, 15 to 17A, East Wharf, KPT, Karachi, Pakistan.

The exterior elevation on the North-west side of Barrack D, base of Chimney Tower, extension next to it and the north-west façade of Barrack B has been painted.



Figure 39 - Interior walls of barrack B and C painted.

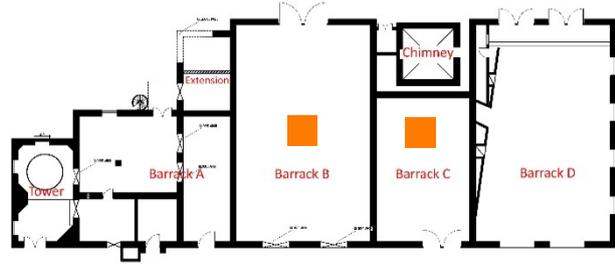


Figure 40 - Interior walls of barrack B and C painted.

Interior walls of Barrack B and C, which are being used as storage warehouses have also been painted.

Use of Concrete



Figure 41 – Concrete - Openings on Barrack D, North – East Elevation.

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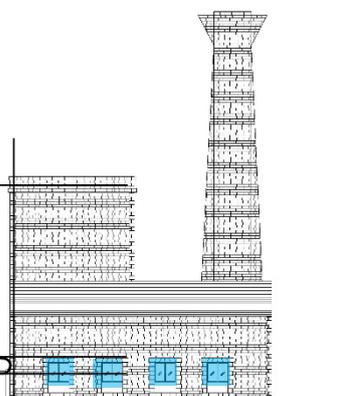


Figure 42 – Concrete - Barrack D, North – East Elevation.

Openings on the north-east elevation of Barrack D have been filled with concrete and converted into windows.



Figure 43 - Concrete - South-east elevation, openings on Barrack D, 15 to 17A, East Wharf, KPT, Karachi.

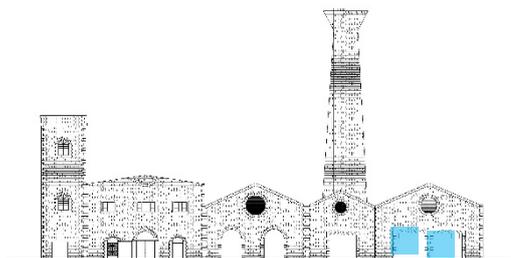


Figure 44 - Concrete - South-east elevation, openings on Barrack D, 15 to 17A, East Wharf, KPT, Karachi.

Openings on the south-east elevation of Barrack D have been covered with concrete with two ventilating window added on each of the two openings.



Figure 45 - Concrete encroachment on Barrack A, South-east elevation, near doors, arched openings, and openings made on the added level.

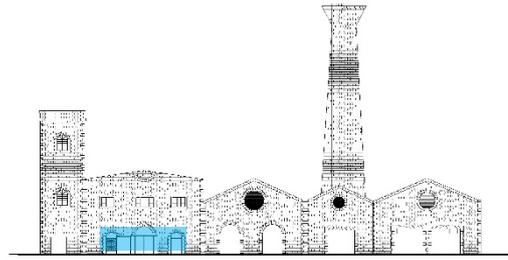


Figure 46 - Concrete encroachment on Barrack A, South-east elevation, near doors, arched openings, and openings made on the added level.

Three openings have been made on the upper level (later addition) of Barrack A. Arched openings on the ground level have been covered with concrete and converted into half openings. Concrete encroachment and pillars on either side of the central arched opening are all later interventions and will be removed.

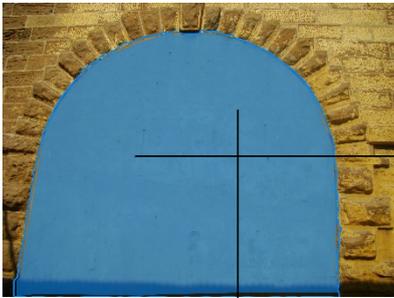


Figure 47 - Concrete - arched openings, Barrack B, south-east elevation, 15 to 17A East wharf, KPT, Karachi.

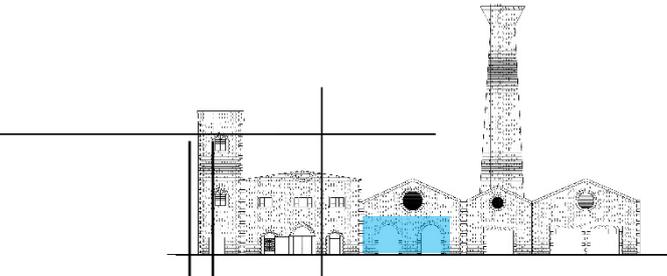


Figure 48 - Concrete - arched openings, Barrack B, south-east elevation, 15 to 17A East wharf, KPT, Karachi.

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Two arched openings on the south-east façade of Barrack B have been completely filled with concrete and closed off.



Figure 49 - Concrete - Interior of Barrack A, 15 to 17A East Wharf, KPT, Karachi.

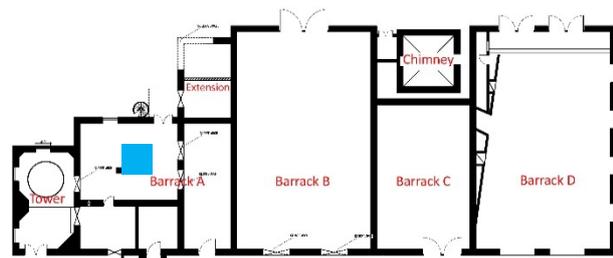


Figure 50 - Concrete - Interior of Barrack A, 15 to 17A East Wharf, KPT, Karachi.

Interior of Barrack A has been covered with a layer of concrete. Both ground and first level of this barrack has concrete internal walls.

Encroachment



Figure 61 - Encroachment - South-east Facade, Barrack A, 15 to 17A, East Wharf, KPT, Karachi.

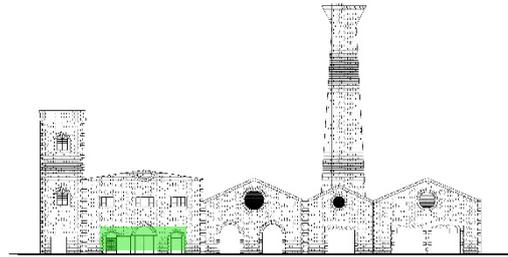


Figure 52 - Encroachment - South-east Facade, Barrack A, 15 to 17A, East Wharf, KPT, Karachi.

Encroachments in the form of concrete extension is present on the south-east façade of Barrack A.



Figure 53 - Encroachment - North-west Facade, between Chimney Tower and Barrack B, 15 to 17A, East Wharf, KPT, Karachi.

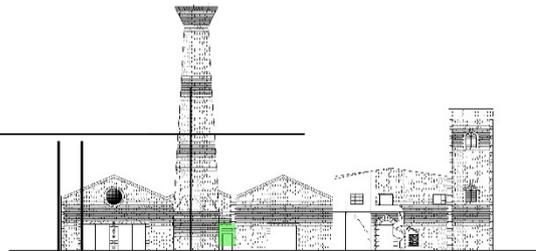


Figure 54 - Encroachment - North-west Facade, between Chimney Tower and Barrack B, 15 to 17A, East Wharf, KPT, Karachi.

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A store has been built on the space between the Chimney and Barrack B on the north-west side. This is an encroachment and should be removed.



Figure 55 - Encroachment - North-west Facade, extension Barrack A, 15 to 17A, East Wharf, KPT, Karachi.

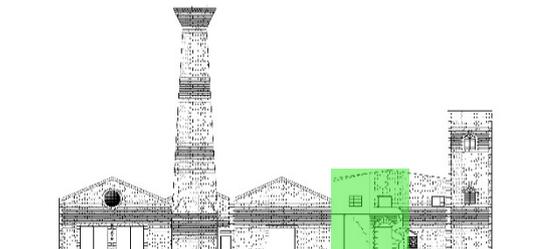


Figure 56 - Encroachment - North-west Facade, extension Barrack A, 15 to 17A, East Wharf, KPT, Karachi.

A corner extension was built connecting with Barrack A. Since this wasn't a part of the original construction it has been deemed as encroachment.

Later Addition



Figure 57 - Later Addition - openings, south-east facade, Barrack C and D, 15 to 17A, East Wharf, KPT, Karachi.

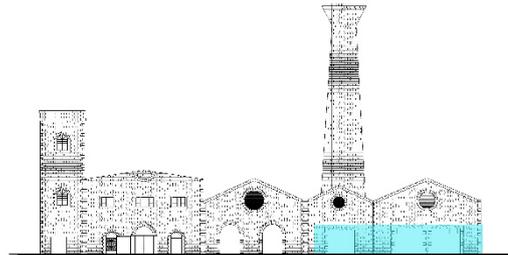


Figure 58 - Later Addition - openings, south-east facade, Barrack C and D, 15 to 17A, East Wharf, KPT, Karachi.

Square openings on the south-east façade of Barrack C has been closed by an iron door and the two openings on Barrack D have been covered with concrete. Both of these interventions have been done much later and are not a part of the original structure.

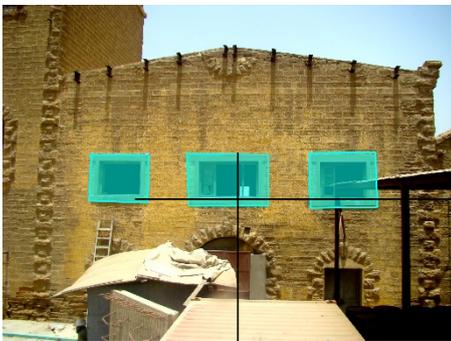


Figure 59 - Later Addition, openings on Barrack A, south-east facade, 15 to 17A, East Wharf, KPT, Karachi.

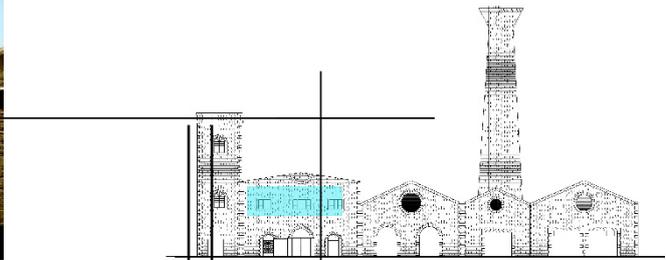


Figure 60 - Later Addition, openings on Barrack A, south-east facade, 15 to 17A, East Wharf, KPT, Karachi.

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An entire floor has been added inside barrack A, and three openings have been added on the south-east façade.



Figure 61 - Later Addition, opening on north-east facade, Barrack D, 15 to 17A, East Wharf, KPT, Karachi.

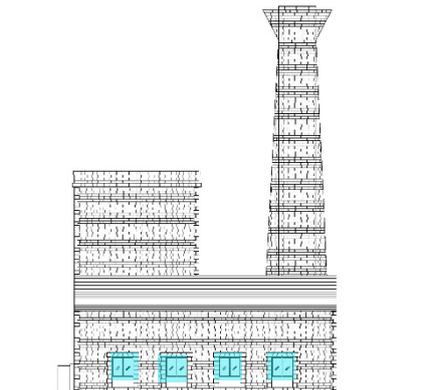


Figure 62 - Later Addition, opening on north-east facade, Barrack D, 15 to 17A, East Wharf, KPT, Karachi.

Openings on the north-east side of barrack D, have been converted into windows.

Prone to Rust



Figure 63 - Prone to rust - Iron door, barrack C, south-east facade, 15 to 17A, East Wharf, KPT, Karachi.

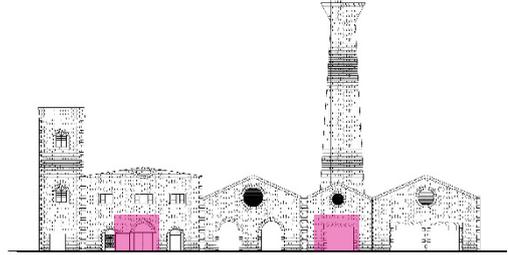


Figure 64 - Prone to rust - Iron door, barrack C, south-east facade, 15 to 17A, East Wharf, KPT, Karachi.

Iron door on Barrack C and on barrack A, south-east side, are prone to rust.



Figure 65 - Prone to Rust, Roof Structure, Extension, Barrack A, 15 to 17A, East Wharf, KPT, Karachi.

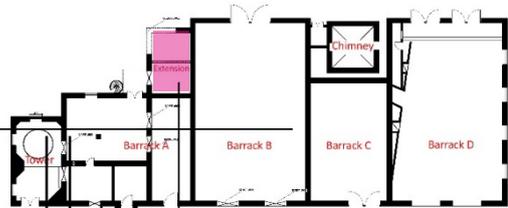


Figure 66 - Plan - Prone to Rust, Roof Structure, Extension, Barrack A, 15 to 17A, East Wharf, KPT, Karachi.

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Roof of extension built alongside Barrack A and B has iron beams and girders used. These have caught rust overtime and would need immediate treatment.

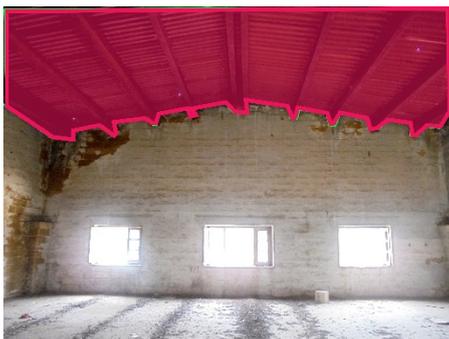


Figure 67 - Prone to rust, Roof structure, Barrack A, 15 to 17A, East Wharf, KPT, Karachi.

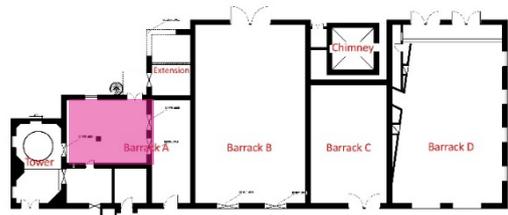


Figure 68 - Prone to rust, Roof structure, Barrack A, 15 to 17A, East Wharf, KPT, Karachi.

Iron girders and beams used in the roof structure of the barracks is prone to rust.

Termite Infestation



Figure 69 - Termite Infestation - Roof, Extension, first floor, Barrack A, 15 to 17A, East Wharf, KPT, Karachi.

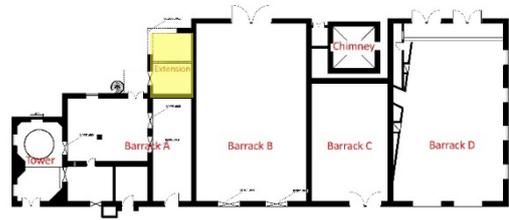


Figure 70 - Termite Infestation - Roof, Extension, first floor, Barrack A, 15 to 17A, East Wharf, KPT, Karachi.

Wooden roof used in the extension part of Barrack A might be infested with termite, therefore action must be taken against it.

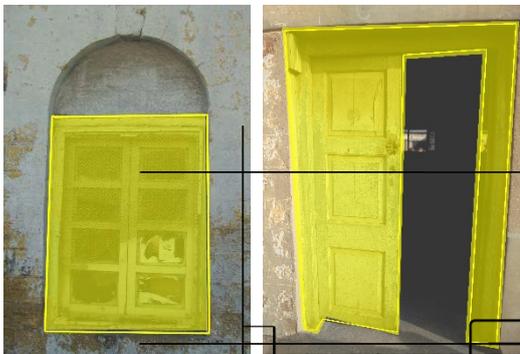


Figure 71 - Termite Infestation - Wooden doors, windows on Barrack A and its extension, East Wharf, KPT, Karachi.

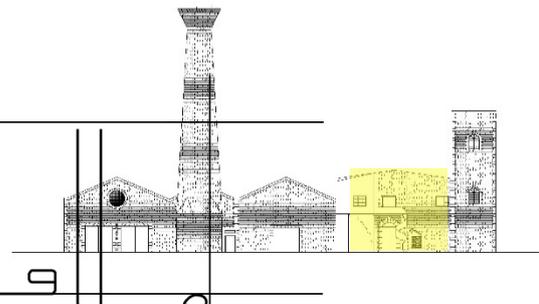


Figure 72 - Termite Infestation - Wooden doors, windows on Barrack A and its extension, North-west Elevation, 15 to 17A, East Wharf, KPT, Karachi.

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All the wooden doors and windows might have been infested with termite over-time and proper measures would need to be taken to determine if they can be used or replaced.

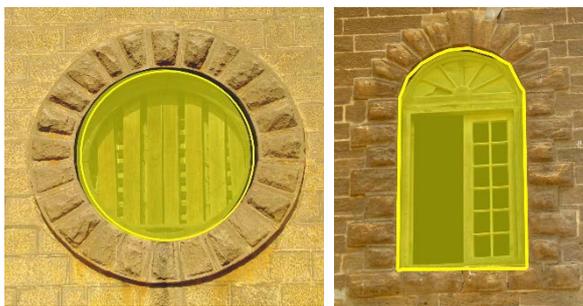


Figure 83 - Termite Infestation - Fenestration, Windows and Doors, South-east Elevation, Tower, Barrack A, B, C and D, 15 to 17 A, East Wharf, KPT, Karachi

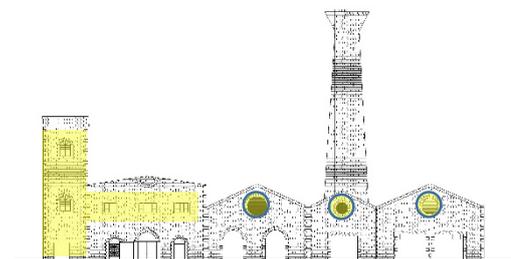


Figure 84 - Termite Infestation - Fenestration, Windows and Doors, South-east Elevation, Tower, Barrack A, B, C and D, 15 to 17 A, East Wharf, KPT, Karachi

Wood is material used in fenestrations on barracks, arched windows and door of the tower, and windows of Barrack A. Termite infestation is therefore likely and needs to be checked.

Existing Condition

The pile foundation being placed at the wharf for the reconstruction of the berth 15 to 17A has caused a corner of the barrack A collapse. Due to vibration caused by drilling the ground for pile placement, the corner couldn't withstand the pressure on its structure and therefore collapsed. The excavation around the barracks shows the 6 feet deep foundation on which the yellow brick structures rest. The collapsed area of the berth was an extension built later on with concrete. The upper storey of the extension remains however with no support underneath it is prone to collapsing. The roof of the barracks which is done in typical wood trusses and framing has become termite infested, therefore in need of restoration.

Threats

Although the structures are currently sound except for the later extension built on the port side of Barrack A, the construction of pile foundation has increased the risk of building collapsing completely. The documentation conducted has identified both internal and external threats to 15 to 17A. The placement of pile foundation being one of the major threats, needs to be adhered to in order to save the building from complete destruction. Other threats include termite infestation on the wooden construction within the building such as roof structure, windows, fenestrations and doors. The rust on the iron girders visible on Barrack A façade, and the boiler would need to be looked upon.

Measures for Further Action

After careful analysis of the data collected during documentation, it is concluded that there are two options available in order to conserve the building. Provided that the placement of piles cannot be altered, one option is to provide external support in the form of staking or steel jacketing. The second option is the relocation of the entire building. Each possibility has its own process and guidelines to be followed.

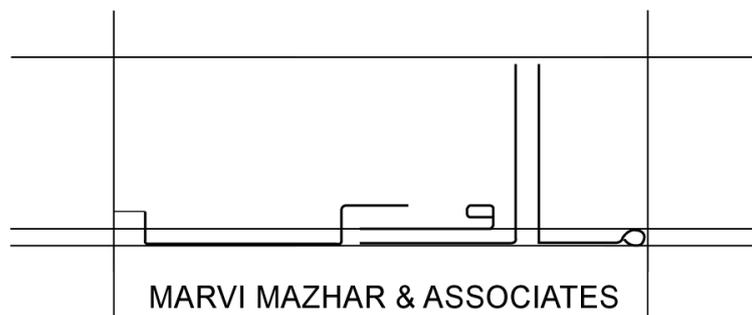
Option A – Staking or Steel Jacketing.

In order to prevent the building from collapsing due to the vibrations caused from pile construction, the building needs external support. Staking is one method through which the building becomes less liable to collapse. This is done through steel girders and scaffolding with bamboo and wood. This should prevent the building from collapsing but can cause cracks and damages to the structure as the vibration caused during excavating the ground for pile placement can range from 60 to 250 KW. Since the building date backs to early 1900s, staking might not be enough and vibrations can still cause the structure to collapse. The extension corner of Barrack A has already fallen apart. This was caused by vibrations occurring at the strength of 60 KW.

Another method to prevent the building from collapsing is steel jacketing. Which means making an entire steel structural grid wrapping the building through steel bars running horizontally and vertically to support the structure. This was suggested by Dr. Noman Ahmed,

who is an Architect with a Master's degree in City Planning and PhD in Civil and Building Engineering. He is also currently the head of the Architecture and Planning department of NED University. He further suggested that providing a barrier between the pile foundation and the building can prevent vibrations travelling towards the building. One method to do this is to add rubber padding between the structures' foundation and the piles while the construction is taking place.

A third alternative was provided by Mushtaq Dawood, a renowned engineer, who has also provided his consultancy in conservation of Lallan Building, Kharadar. He explained framing the entire building with the help of iron rods and angle iron, both internally and externally can reduce the risk of collapsing to a huge degree. However, it cannot guarantee complete prevention of damage and cracks can occur nonetheless. Therefore, according to him, the best option is the relocation of the entire building.



Option B – Dismantle and Reconstruction of Berth 15 to 17A (Advised)

One solution to conserving the heritage is to dismantle the entire structures and construct it at the same place after the pile foundations have been placed. Or even rebuild it on a site that wouldn't require its dismantling in the future. This solution has also been suggested by Mushtaq Dawood. He said, 'I can see that new pile lines are passing thru building you want to save. Am I right? If so you have no choice but to relocate whatever is worth saving.'

An example of this is the Nusserwanjee Building which was transported from its original site in Kharadar and rebuilt brick by brick at the current location of Indus Valley School of Art and Architecture, Karachi.

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Case study – Nusserwanjee Building Kharadar to Clifton, Karachi

An example of this methodology is the Nusserwanjee Building which was relocated from Kharadar to Clifton to become a building accommodating art studios and galleries for the students of Indus Valley School of Art and Architecture. The procedure entailed in transformation and rebuilding the structure has been explained by Architect Akeel Bilgrami who was also a part of relocating and conserving Nusserwanjee Building.

... The hundred-year-old Nusserwanjee Building is one structure in two blocks of three and four storeys with large halls and high ceilings, originally used as warehouse and offices – ideal spaces for art and design studios.

If this building was to be transplanted at the new campus, the school would be able to (i) save it from the inevitable demolition and destruction (ii) introduce a novel method, an alternative way, to save our architectural heritage (iii) provide a hands-on, once-in-a-lifetime experience to both the faculty and students, in the area of architectural conservation and, finally, (iv) through this process of giving a fresh lease of life to the building, pay tributes and homage to, and perpetuate the memory of, the Nusserwanjee family, particularly of Jamshed Nusserwanjee Mehta, philanthropist, theosophist, the first mayor, the architect and father of modern Karachi – and without doubt, its most outstanding citizen.

The Nusserwanjee Building was originally constructed in 1903 by Jamshed's father, Nusserwanjee Rustomji Mehta, as warehouse and offices of Nusserwanjee and Co., a very prosperous trading and manufacturing enterprise. An additional wing was

constructed in 1919, using R.C.C. for columns, beams and roof, the latest construction technology then prevalent, and plastered rubble stone and coursed stone masonry.

... There were numerous suggestions about the various possibilities of dismantling, transportation, conservation etc. Also discussed was the possibility of inviting an expert conservationist through UNESCO or one of the funding agencies. The school however, in its wisdom, decided to use indigenous means and local know-how.

Detailed documentation of the building was carried out through measured drawings and photographs. Three demolition contractors were invited to offer bids and to suggest the safest and quickest means of dismantling, transporting and storing.

Contractor Haji Mohammed Shah Akram Baloch was selected not only for his lowest bid but for what, understandably, was a very sound dismantling methodology suggested by him. A period of three months was specified for the whole process. The sale of the property however did not materialize until almost four years later, in 1995.

In the meantime the new campus of the Indus Valley School was designed and constructed, with an appropriate space earmarked for the location of Nusserwanjee Building.

Detailed identification of all the material was done and each stone, piece of timber etc., properly marked prior to the dismantling which commenced in April 1995, stone by stone, piece by piece, and completed within three months.

The 'illiterate' demolition contractor with a team of 'unskilled' labour managed to do all this, a mere 50 stones having being broken or damaged out of the 26,000 that were retrieved. The procedure involved the careful removal of each piece of timber and stone which was then tagged permanently for identification, carried to the ground floor, stacked temporarily, loaded on the trucks for transportation to the Clifton site, unloaded and re-arranged according to a given layout.

One has grave doubts if the mortality rate of the stones and other material could have been any less if an 'expert' was to handle the operation!

When complete, the Nusserwanjee Building will provide an additional space of 25000 sft. It will house the Architecture, Design and Painting studios and also have an exhibition hall and a gallery to house Indus Valley School's permanent art collection.

Although the exterior of the building and most interior spaces would look almost exactly the same as the original, the construction methodology had to be altered to cater to the current building codes. Vertical and horizontal steel sections, (which are encased in masonry during construction), had to be introduced to brace the structure.

Contrary to popular belief, the cost of relocating the Nusserwanjee building has not been any higher than that of any other similar new institutional building. The school makes no tall claims about the Nusserwanjee Building as an ideal case of architectural conservation or restoration. A modest attempt has been made to relocate a historical building for adaptive re-use in an art school.



Figure 85 - Basement roof, east wing - laying girders, Nusserwanjee Building, Karachi, 1999.



Figure 86 - East wing masonry, Ground Floor, Nusserwanjee Building, Karachi, 1998.



Figure 87 - Steel structure east wing, above ground floor, Nusserwanjee Building, Karachi, 1998.



Figure 88 - Completion of 2nd floor masonry - east wing, Nusserwanjee Building, Karachi, 1999.



Figure 89 - Completion of 3rd floor masonry - east wing, Nusserwanjee Building, Karachi, 1999.



Figure 90 - Finishing east wing, Nusserwanjee Building, Karachi, 1999.



Figure 91 - Stone facing, inner wall - east wing, Nusserwanjee Building, Karachi, 1999.



Figure 92 - Completed east wing, Nusserwanjee Building, Karachi, 2000.



Figure 93 - Steel Sections being embedded, Nusserwanjee Building, Karachi, 1999.



Figure 94 - Steel beams projecting out to lake balcony, Nusserwanjee Building, Karachi, 1999.

After careful restoration of the structures through a chosen option, measures will be taken in order to conserve the heritage from further damage and destruction. The encroachments on the original structures would be removed. Such as the extension on Barrack A and concrete encroachment on Barrack B. The windows of the mosque (Barrack D) would also be brought down as they are not part of the original openings. Additive concrete would all be removed. Stone will then be cleaned by washing, brushing, and pointing which should be done with lime. Wooden trusses will be cleaned and termite-proofed, provided that their structural integrity is intact. Red Oxide will be sprayed on iron and steel to prevent rusting.

Conclusion

Berth 15 to 17A are heritage and therefore cannot be allowed to get destructed. This documentation analysis consists of all the data collected, both tangible and intangible, about the structures. Through on-site documentation and studies, an analysis of the existing condition has also been conducted. This research then contributed in suggesting methodologies for further action for conservation. The solutions suggested for restoration and conservation of the building have been provided with careful consideration of similar cases in the past. In this report the architect has also provided original, existing and after restoration drawings of the Berth 15 to 17A. The concluding suggestion for the issue in hand which is the protection of the heritage is to relocate berth 15 to 17A.