HOW DOES MARITIME TRADE TRANSFORM THE ARCHITECTURE DESIGN OF THE PORT

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INTRODUCTION

Trade has had a lot of impact on architecture, it gives architects alternative materials other than the local materials, for example, concrete and steel made skyscrapers possible to be constructed from nowhere in a dessert, trade also brought cultural exchanges that resulted in foreign-styled building existing in a different culture, such as the Chinatown in New York. Maritime trade is a transportation method of trading overseas to reduce cost, it has crucial role in the exchanging global goods, therefore the importance of how port facilitate maritime trade should be highlighted in the history of trade and architecture, in this essay, I will talk about how maritime trade transformed the architecture design of ports.



(Figure 1.1)Workers loading goods at the port of Chicago, Source: Pinteret¹

Maritime trade is essentially complying with the most basic actions, loading, shipping, unloading, storing, to facilitate those actions, <u>a typology of architecture</u>² design port has been universally created and accepted to facilitate maritime trading. A few characteristics of port including having enclosed docks with lock gates to mitigate the effect of tidal variations, docks and Jetties were constructed allowing docking of <u>vessels</u>³, and cranes were introduced to unload heavy goods from the ship.

^{2:}Typology in architecture: A set of characteristics and feathers that makes a building and urban spaces identifiable, those characteristics are usually decided by the function of the building and spaces shaped by external influences like climate, art, culture, politics, materials, and technology, resulted in the uniqueness of the building in ways of construction, materials, forms, ornamentations and spatial configurations of a building or structure.

^{3:}Vessel: Generally, a water vessel widely refers to any watercraft that navigates the water bodies, therefore, according to this definition, a vessel would include all such machines, from boats to large ships.

To give a better picture of how maritime trade transformed the architecture design of port, it is necessary to understand the theory pushing this change, looking back at some of the historical examples like the EIC (English East India Company⁴) In the early seventeen centuries, driven by the huge profit of maritime trading, the problem of "how to trade fast? How can I save time, how can I make my shipping more efficient" became questions to many merchants. Other than the building faster ships, the efficiency of port should also be a consideration, and that is the reasoning behind the change in architecture, when the port can't facilitate more maritime trading, it creates congestion and results in merchants losing money, and from the perspective of port governor, it reduces the tariff income. All of these constitute demands of improving ports to increase capacity of port facilitate maritime trade, it is a positive-reinforcement situation, saying in a simple word: "trade makes money and then more money means better port, and which makes more efficiency in trading thus making more money by the end."



(Figure 1.2)Old India map in 1864⁴

METHODOLOGY

This essay will discuss how the architecture of ports improved the efficiency of maritime trade by adapting artificial designs, my methodology is to us secondary sources from mainly <u>JSTOR</u>⁵, some articles from websites, some information from books. My essay are constructed by two main parts, modernization of ports to support more trade, and containerization of ports to adapt to the intermodalism in maritime trading, first, I will investigate a case study about the modernization of Port Calcutta in British Raj under the management of British Power, then I will look at the impact of containerization on architecture design of ports, supported by case studies of the container port of Los Angeles, and by the end I will constitute all my arguments to form an answer to the research question.

MODERNIZATION OF THE PORT OF CALCUTTA

In the late nineteenth and twentieth centuries, Calcutta(Kolkata) was not only the capital of the British Raj, but it was also the centre of trade, manufacture, and commerce, located at the bank of Hooghly River, the port of Calcutta functioned as a gateway of Indian region to the world, the Calcutta port commissioner oversaw the need to facilitate more maritime trade, decided to invest into the modernization of the port, particularly in the construction of several jetties, sheds, and crane. In this chapter I will discuss how maritime trade transformed the architectural design of the port through modernization.

Before the modernization, The Hooghly River had a narrow channel, the banks were too shallow to dock, and ships had to anchor their ships in the middle of the river, therefore labours had to sail out with small vessels and then load and unload mid-stream (Figure 2.1)⁶, which is dangerous and difficult, boatman often crashes into other vessels, unfortunately, it was the only solution at the time. To solve this problem modernization began with the idea of the construction of a few jetties, jetties were wooden platforms on the river, therefore labours could load/unload general goods on the jetty. In total the construction of 4 jetties with cranes and sheds was completed by October 1869, which soon made the unloading process safer and more efficient,⁷ traders started using the jetties as soon as they were installed (Figure 2.2)8.



(Figure 2.1) Traders loading and unloading cargoes mid stream.



(Figure 2.2) Left, A view of newly built jetties

As a direct result of modernization, according to the Calcutta Port Trust's records, the total quantity of maritime trade had quadrable from 52 ships with 48000 tons to 143 ships with 222000 tons between <u>1871 – 1872.</u>⁹ The traffic had greatly improved compared to before, the modernization process hasn't finished yet at this point, new sheds were constructed, and the T-shaped jetty was extended with plans for the eventual construction of a single jetty extending through the port's length 4 more jetties were constructed, more advanced machinery was equipped, for example, oldsteam powered cranes were replaced by hydraulic crane, in at least 3 jetties, shippers are capable or move cargoes directly from the vessel into the sheds without it touching the ground, for loading/ unloading, all of this constituted a significant change from the old cumbersome method.¹⁰ Over the course of the 1870s, maritime trade expanded at a steady pace, for example, during the phase between 1879 – 1880, a total of 192 ships used the jetties compared to 143 ships in 1872. The impact of the modernization of port Calcutta can also be seen in the amount of labour employed, according to the <u>Calcutta port commissioners' proceedings in 1871.¹¹</u> which suggest that the Calcutta port trust employers brought additional labourer to help the regular workload, which indicates the increase in maritime trade as more work needed to be done.

Under the supervision and <u>management of port commissioners</u>¹², for the reasoning of the improvement of the port and advancement of trade, various works were taken between 1870 and 1900. 8 jetties were built, 27 hydraulic cranes and 34 mechanical cranes were installed, a few specialized structures were constructed in Calcutta for the service of trading; a Petroleum Wharf was built at Budge Budge, which was established in 1886 for storage of all petroleum; A tea warehouse was built near the port in 1887, it affords accommodation for the storage, sampling, and sale of tea before it is shipped out. One of the most important constructions was the new coal yard at Shalimar which provides space to bunker coal, coal business was a big part of trading in Calcutta with the shipment of about <u>1.5 million tons per year.</u>¹³ Another important project was a specific export focus dockyard, Kidderpore dock was built corresponding to the increase of export as the increase of maritime business kept booming. The dock is in the Kidderpore district, (Figure 2.3) construction finished in 1892 and began providing facilities for general exports and coal.



Port of Calcutta

^{12:} Calcutta Port commissioner originally consisted with 12 commissioners (including a chairman and a vice-chairman), who were appointed by the provincial government.

Corresponding to the increase of maritime trade, the indirect effect of demanding better provision of infrastructure to support logistics grew into an issue, railway connection was a good solution to this problem, so in 1876, referencing to the map above (Figure 2.3), a line of railway was constructed connecting jetties at Calcutta port to the Easter Bengal state railway at Chitpore, the Howrah-Shalimar branch was constructed in 1883, enabling goods to be delivered from railway into boats at any point on the wharf on the Howrah foreshore. In 1885 the main line between Chitpore and jetties was extended south to the kidderpore docks to shorten the time transferring goods between different ports.¹⁴



(Figure 2.4)1903, Hooghly River, Port of Calcutta¹⁵

A brief summary, driven by the huge trading need, the modernization improved maritime efficiency by changing the architectural design of the Calcutta port, mainly in the way of construction of jetties, cranes, specialized facilities, and new docks. A huge infrastructure investment was also needed to accommodate logistic needs from the enormous expansion of trading.

CONTAINERIZATION OF THE PORT OF LOS ANGELES



(Figure 3.1) Photo of The port of Los Angeles.¹⁸

By the end of the 1980s, with the increase in demand for global trade, people started to revolutionize the method of trading, an efficient method of transportation has been developed, Intermodelism, it comprises the different means of transportation, including air, road, sea, rail and pipelines,16 in maritime trade, general cargoes were loaded/unloaded individually, but during this process involves series of unnecessary movement, which makes the process costly to transfer goods parcel-by-parcel, but with the introduction of containerization, it has greatly reduced cost by putting numerous parcels into one unit, a container, moreover, the containerization can be integrated into the intermodal transportation system, as they can be loaded on trains or trucks from the ship seamlessly.17

Before the containerization, <u>break-bulk vessels</u>¹⁹ used to dock at jetties, and general cargo was loaded and unloaded from the ship with the cargoes on the pier, then cargo was stored in warehouses. Since containerships have no cranes aboard, ports aspiring to become container ports had to become more capital intensive, which means that not only need to invest in dockyards, but also in other types of mobile and infrastructure. Few changes in container ports can be found, jetties were eliminated, and berths were redesigned so containerships can be docked parallel to berth for easier loading/unloading by dockside cranes. Warehouses were removed, containers stacked upon each other, and stored in the open air, <u>some containers were stored directly onto the</u> truck chassis or trains to optimize efficiency.²⁰

^{19:} A Break Bulk Vessel is a ship that transports goods in packaged form. These goods are not containerized and are not carried in bulk.

Containerization has greatly improved maritime trading efficiency, resulted in a massive expansion of containerized seaborne trading, for the 1980-96 period, international containerized seaborne trade increased 433%, from 36.4 million TEUs²¹ in 1980 to 157.6 million in 1996 TEUs²². In 2021 an estimated 90% of the world trade moves in containers.²³

Many ports foresee the trend of containerization in maritime trade around the end of 1980, port design looks up to facilitate container ships and infrastructure installation. Constructions of container ports started at different places across the world, one of the examples is the port of Los Angeles, the development of Seaside container terminal was one of the USA's largest and most modern container handling facilities when completed in 1981, this 21 million \$ project include 129 acres (522044 m²) with 4,000 feet (1219.2m) of concrete wharf served with 6 container cranes, to accommodate bigger and heavier ships, the water depth at the Seaside container terminal were much deeper compared to the old port, 51 feet (12.8m) and 35 feet (10.6m) relatively speaking.²⁴ It was the largest single contiguous container terminal on the pacific coast, within the terminal it has over 87 acres (352076m²) of container storage area, which can hold 18,000 containers and would be able to facilitate an average of 2.5 million tons of cargo annually.²⁵



year	container counts (TEUs)	growth compare to previous year	
1981	476,249	N/A	
1982	606,189	27%	
1983	733,979	21%	
1984	908,417	24%	
1985	1103722	21%	
1986	1,329,649	20%	
1987	1,579,629	19%	
1988	1,652,066	5%	
1989	2,056,626	24%	
1990	2,116,410	3%	
1991	2,039,165	-4%	
1992	2,289,271	12%	
1993	2,318,920	1%	
1994	2,518,619	9%	
1995	2,555,206	1%	
1996	2,683,026	5%	
total increase in growth in 15 years		463%	

(Figure 3.2) Port of Los Angeles 2009 September 26

Ever since the construction of Seaside container terminals in 1981, the capacity of facilitating containerships has increased significantly, 463% in 15 years, an average of impressively 11% growth per year. (Figure 3.3)

(Figure 3.3)Those data were collected from official releases²⁷ of the port of Los Angeles, and were calculated and processed on Microsoft Excel,

^{21:} TEU or a Twenty-Foot Equivalent Unit is a widely used unit of measurement in the shipping business. (1 TEU=20ft x 8 ft x 8 ft volume of goods, roughly 36m³)

Modern container ports require enormous transportation infrastructure investments, as containerships grow larger and larger, fewer and fewer ports can facilitate large containership, railroads are being heavily relied on to distribute containers inland, and sometimes logistic issues may occur to ports. In 1997, the state of California had a backlog of 3,000 containers, in the port of Los Angeles, the containers experienced delays of up to days to weeks, the shortage of rail capacity also affected port productivity and expenditure, it caused the port using 30-35% more labour forces for stacking excessive containers.²⁸ Between the 1996-2000 period, US ports planned more than \$6 Billion in capital spending, 80% of which goes to the 10 largest ports in the US at the time. The port of Los Angeles plans to spend \$1.33 Billion, as an indirect result of expansion in maritime trade, more than \$200 million was spent on basic highway-rail grade separations.²⁹ like freight rail line (Alameda corridor³⁰)³¹,(Figure 3.4) which connects the port of Los Angeles and Long-Beach.



(Figure 3.4) Alameda corridor³²

To wrap up this chapter, with the help of technology development and a new mode of trading intermodalism being practiced, containerization rise to the global stage and led to the change in architecture design of ports, in ways where the dimension of ports needs to increase ever than before, different facilities for functioning and maintenance of ports, it also requires a strong logistic system to support the efficiency of ports.

CONCLUSION

In conclusion, based on the research around the question of how maritime trade transformed the architecture design of ports, with assistance from case studies to support my argument, that the research question has been answered, the architecture design of ports was changed in ways of expanding dimensions of ports to generate more capacities serving more maritime trade; as works of loading and unloading cargoes getting more and more complicated and technical orientated, installation of advanced machinery and structures was necessary to facilitate the functionality of ports, and finally the indirect improvements on infrastructure investment were made to support the need to handle more logistic services. It is important to address that changes in port design couldn't be made if there wasn't any economic benefit, as quoted in a study: "but the e East India Company, a trading concern whose motive was profit rather than glory, was extremely parsimonious and discouraged any expense that did not bring immediate dividends."³³

The essence of my study towards wider width in the topic of port design and trade, so it does not support deep analysis of relationships between port designs with a specific maritime trading strategy, my research question answer can only briefly be used to give a general explanation of how maritime trade affected port design, but it cannot be used as a theory to predict port designs under influences of maritime trade, as the following reasoning stands: The unpredictable technological advancement may change port completely, ports might not even exist in the future; regional and geographical differences are huge; additionally speaking, geopolitical changes also play a vital role on global trade strategy.



⁽Figure 3.5) Exponential Moving Average (EMA)³⁴

Therefore, suggestions of future researches on the topic of trade and port design are given, as technological advancement grew exponentially as it comes to the 21st century, its impact on business mode and trading strategies is vital, so how technology affects port design might be a great topic; this topic can go deeper into specific port, for example, the port of Amsterdam have experienced diverse trading strategies and technological improvements, specific studies on one port will give more context, and usefully toward future researches; we can also look at trade and port designs in other perspectives, like political changes, business strategies, and strategic materials (rare earth, petroleum, and LNG).

BIBLIOGRAPHY

1: Pinterest. (2019). Pinterest. [online] Available at: https://cz.pinterest.com/.

2: www.archisoup.com. (2022). Understanding Building Typology - archisoup | Architecture Guides & Resources. [online] Available at: https://www.archisoup.com/understanding-building-typology.

3: Bansar China. (2021). What is the Difference Between Vessel and Ship? The Ultimate FAQ Guide. [online] Available at: https://www.bansarchina.com/what-is-the-difference-between-vessel-and-ship/.www.archisoup. com. (2022). Understanding Building Typology - archisoup | Architecture Guides & Resources. [online] Available at: https://www.archisoup.com/understanding-building-typology.

4: The Editors of Encyclopaedia Britannica (2019). East India Company | Definition, History, & Facts. In: Encyclopædia Britannica. [online] Available at: https://www.britannica.com/topic/East-India-Company.

5: Jstor (2000). JSTOR. [online] Jstor.org. Available at: https://www.jstor.org/.

6: Photos, O.I. (n.d.). 03/01/2016 - 04/01/2016. [online] Available at: https://www.oldindianphotos. in/2016/03/.

7: Haughey, P. (2018). A History of Architecture and Trade. Routledge.

8: Haughey, P. (2018). A History of Architecture and Trade. Routledge.

9:en.banglapedia.org. (n.d.). Calcutta Port - Banglapedia. [online] Available at: https://en.banglapedia.org/index.php?title=Calcutta_Port#:~:text=Calcutta%20Port%20one%20of%20the%20oldest%20modern%20ports [Accessed 14 Jan. 2023].

10: Haughey, P. (2018). A History of Architecture and Trade. Routledge.

11: Haughey, P. (2018). A History of Architecture and Trade. Routledge.

12: Ray, A.K. (1902). Census of India 1901. Vol. 7, Calcutta : town and suburbs. Pt. 1, A short history of Calcutta: Census Reports - 1901. JSTOR, [online] 1. Available at: https://www.jstor.org/stable/saoa. crl.25363717#metadata_info_tab_contents [Accessed 14 Jan. 2023].

13: ay, A.K. (1902). Census of India 1901. Vol. 7, Calcutta : town and suburbs. Pt. 1, A short history of Calcutta: Census Reports - 1901. JSTOR, [online] 1. Available at: https://www.jstor.org/stable/saoa. crl.25363717#metadata_info_tab_contents [Accessed 14 Jan. 2023].

14: Stuart-Williams, S.C. (1928). THE PORT OF CALCUTTA AND ITS POST-WAR DEVELOPMENT. Journal of the Royal Society of Arts, [online] 76(3948), pp.890–906. Available at: https://www.jstor.org/ stable/41358033?searchText=41358033&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3D4135803 3&ab_segments=0%2FSYC-6744_basic_search%2Ftest-1&refreqid=fastly-default%3A48613eee29e42f67cf42a4df5e7635a8#metadata_info_tab_contents [Accessed 14 Jan. 2023]. 15: Photos, O.I. (n.d.). Vintage Photographs of Calcutta (Kolkata) 1903 - Part 7. [online] Available at: https://www.oldindianphotos.in/2008/12/calcutta-kolkata-1903-part-vi_21.html?m=1 [Accessed 15 Jan. 2023].

16: webmaster (2013). The Benefits Of Intermodalism - Dovetail. [online] https://dovetail.co.za/. Available at: https://dovetail.co.za/benefits-of-intermodalism/ [Accessed 14 Jan. 2023].

17: Selna, J.V. (1969). Containerization and Intermodal Service in Ocean Shipping. Stanford Law Review, 21(5), p.1077. doi:10.2307/1227465.

18: Instagram. (n.d.). Daily Overview on Instagram: 'Cargo ships dock at one of the many shipping container terminals in the Port of Los Angeles, California. Also known as "America's Port," it has been the busiest container port in the United States for at least 20 consecutive years, handling 9.2 million twenty-foot equivalent units (TEUs) of cargo in 2020. The port handles 20% of all incoming cargo for the USA. — Created by @ dailyoverview Source imagery: @nearmap'. [online] Available at: https://www.instagram.com/p/Ci-1L_5O-JtI/?igshid=MDJmNzVkMjY%3D&epik=dj0yJnU9Qi1GS1c1TTBVVGlCaFlmdFUtazl0RzNTY09pc3hVN-HAmcD0wJm49cS1RMUJQRmhZdjlHT09RNlhuVUlLZyZ0PUFBQUFBR1BFWWFn [Accessed 15 Jan. 2023].

19: Anon, (2019). What is Break Bulk Vessel in Logistics? - SCM EDU. [online] Available at: https://scmedu. org/breakbulkvessel/#:~:text=A%20Break%20Bulk%20Vessel%20is%20a%20ship%20that [Accessed 15 Jan. 2023].

20: Talley, W.K. (2000a). Ocean Container Shipping: Impacts of a Technological Improvement. Journal of Economic Issues, [online] 34(4), pp.933–948. Available at: https://www.jstor.org/stable/pdf/4227617.pdf?re-freqid=excelsior%3A6c1e85efff1374ecea32870e5256c5c8&ab_segments=0%2FSYC-6744_basic_search%2Ft-est-1&origin=&acceptTC=1 [Accessed 14 Jan. 2023].

21: www.dripcapital.com. (n.d.). TEUs [Twenty Foot Equivalent] Containers in Shipping & Logistics. [online] Available at: https://www.dripcapital.com/en-us/resources/blog/teu-container-meaning-in-shipping.

22: Talley, W.K. (2000a). Ocean Container Shipping: Impacts of a Technological Improvement. Journal of Economic Issues, [online] 34(4), pp.933–948. Available at: https://www.jstor.org/stable/pdf/4227617.pdf?re-freqid=excelsior%3A6c1e85efff1374ecea32870e5256c5c8&ab_segments=0%2FSYC-6744_basic_search%2Ft-est-1&origin=&acceptTC=1 [Accessed 14 Jan. 2023].

23: Nagurney, A. (2021). Our economy relies on shipping containers. This is what happens when they're 'stuck in the mud'. [online] World Economic Forum. Available at: https://www.weforum.org/agenda/2021/10/global-shortagof-shipping-containers/.

24: MILLER, W.H. (1983). The Port of Los Angeles-Long Beach in 1929 and 1979: A Comparative Study. Southern California Quarterly, 65(4), pp.341–378. doi:10.2307/41171064.

25: THE PORT OF LOS ANGELES. (1979). Defense Transportation Journal, [online] 35(2), pp.22–24. Available at: http://www.jstor.org/stable/44118065 [Accessed 14 Jan. 2023].

26: Murphy, J. (2009). Port. [online] Flickr. Available at: https://www.flickr.com/photos/kin-gair42/3901392426/in/photostream/ [Accessed 15 Jan. 2023].

27: www.portoflosangeles.org. (n.d.). Container Statistics | Port of Los Angeles. [online] Available at: https://www.portoflosangeles.org/business/statistics/container-statistics.

28: Talley, W.K. (2000b). Ocean Container Shipping: Impacts of a Technological Improvement. Journal of Economic Issues, [online] 34(4), pp.933–948. Available at: https://www.jstor.org/stable/pdf/4227617 [Accessed 14 Jan. 2023].

29: Anon, (n.d.). Grade separation – BayRail Alliance. [online] Available at: https://www.bayrailalliance.org/grade_separation/ [Accessed 15 Jan. 2023].

30: Alameda Corridor Transportation Authority. (n.d.). Alameda Corridor Transportation Authority (ACTA). [online] Available at: https://www.acta.org/ [Accessed 15 Jan. 2023].

31: Talley, W.K. (2000b). Ocean Container Shipping: Impacts of a Technological Improvement. Journal of Economic Issues, [online] 34(4), pp.933–948. Available at: https://www.jstor.org/stable/pdf/4227617 [Accessed 14 Jan. 2023].

32: www.tutorperini.com. (n.d.). Alameda Corridor. [online] Available at: https://www.tutorperini.com/pro-jects/rail-mass-transit/alameda-corridor/ [Accessed 15 Jan. 2023].

33: Mitter, P. (1986). The Early British Port Cities of India: Their Planning and Architecture Circa 1640-1757. Journal of the Society of Architectural Historians, 45(2), pp.95–114. doi:10.2307/990090.

34: Walsh, D. (2015). Quick Fix Forex Free Strategy. [online] Forexobroker. Available at: https://forexobroker. com/quick-fix-forex/ [Accessed 15 Jan. 2023].