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Modular Warehouses – A Growing Trend in Mumbai's Supply Chain Storage

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***Abstract* – Warehousing has been growing at the fastest rate in Mumbai compared to any other city in India as per KnightFrank Research report published in 2018. This growth is anticipated by the growth in gross domestic product of the country. Mumbai, being the financial capital of India, has been vigilant in recording this fastest growth in warehousing, even with faster rate. Yes! The modular construction way. Modular construction is 50 per cent faster compared to the traditional construction and is 20 per cent cheaper with the right trade-offs, says McKinsey & Company. Due to these reasons, modular construction has gained much traction in Mumbai's warehousing segment. This paper elaborates on various popular modular warehouses used across warehousing vertical and the momentum of cross-linked segments associated with them.**

***Index Terms* –India, Logistics, Supply chain, Materials handling, Modular construction, Mumbai, Storage and Warehousing**

I. INTRODUCTION

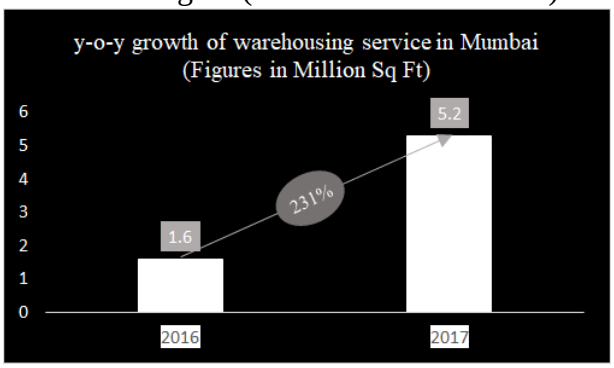
Warehouses in Mumbai region are one of the fastest growing services in the country. The current y-o-y with which warehousing is growing in Mumbai is close to 231%, which is clearly a leader compared to other metropolitan cities across the country, according to Knight Frank Research report published under the flagship of 2018 India warehousing market report. Mumbai has been considered as financial capital of the country with major tax contribution from within the region.

With such a huge growth in the warehousing segment within a year, there is vital need of faster infrastructure in order to meet the

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raising demands. There are 2 major warehousing clusters within the Mumbai region viz. Bhiwandi cluster and Panvel cluster. Both of these clusters have their own set of advantages associated with the regional presence. Considering volume of transaction Bhiwandi cluster dominates the regional revenue. However, Panvel cluster has its own advantage of being closer to one of the busiest sea port of the country i.e. Jawaharlal Nehru Port Trust (popularly known as JNPT). In fact, Panvel cluster has developed as one of the major warehousing hub because of its surrounding to JNPT. Many a times, warehousing experts separate out JNPT from Panvel cluster due to two third of warehouses located around JNPT and remaining in rest of the Panvel cluster.

Fig1: y-o-y growth of warehousing services in Mumbai region (inclusive of all clusters)



Source: 2018 India Warehousing market report, KnightFrank Research

It has to be noted that 70 per cent of warehouses are located in Bhiwandi cluster and rest in Panvel cluster of Mumbai region.

The Bhiwandi cluster is situated in strategic location which signifies its presence closer to point of consumption of goods. Industrial zones are closer by located to Bhiwandi cluster and processed goods can be transported easily from this location to point of consumption.

II. REGIONAL DEMOGRAPHY

The Bhiwandi cluster is nearly in the outskirts of Thane district which is adjacent to Nashik, Aurangabad and allied consumption points of Maharashtra state. Major e-commerce players like Amazon, Flipkart, etc. have presence in the cluster since many years. Players involved in consumer packaged goods are also having widespread existence in the cluster.

Panvel cluster, on the other hand, has presence of companies involved in the international trade of bulk commodities and specialty products. Due to its presence closer to strategic JNPT port, many chemical tank-farms are also visible from the far. Below image shows the location of each warehousing cluster in the Google maps image of Mumbai region.

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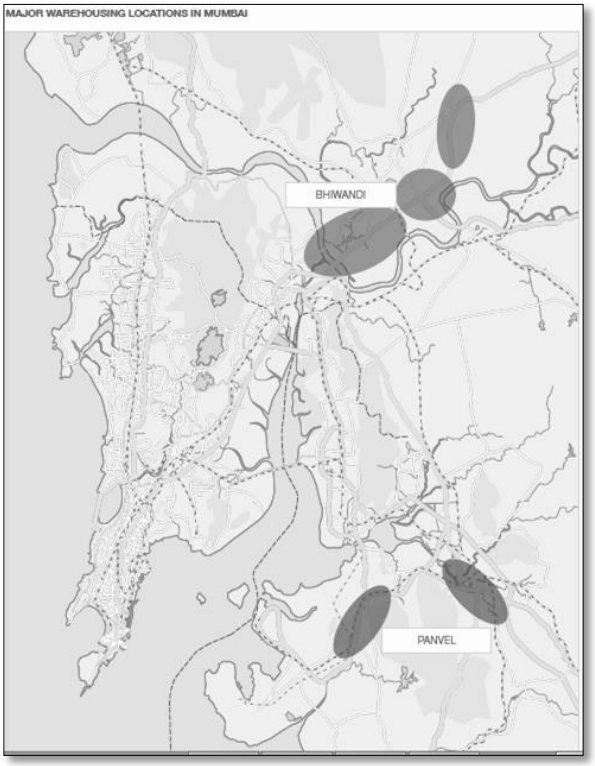
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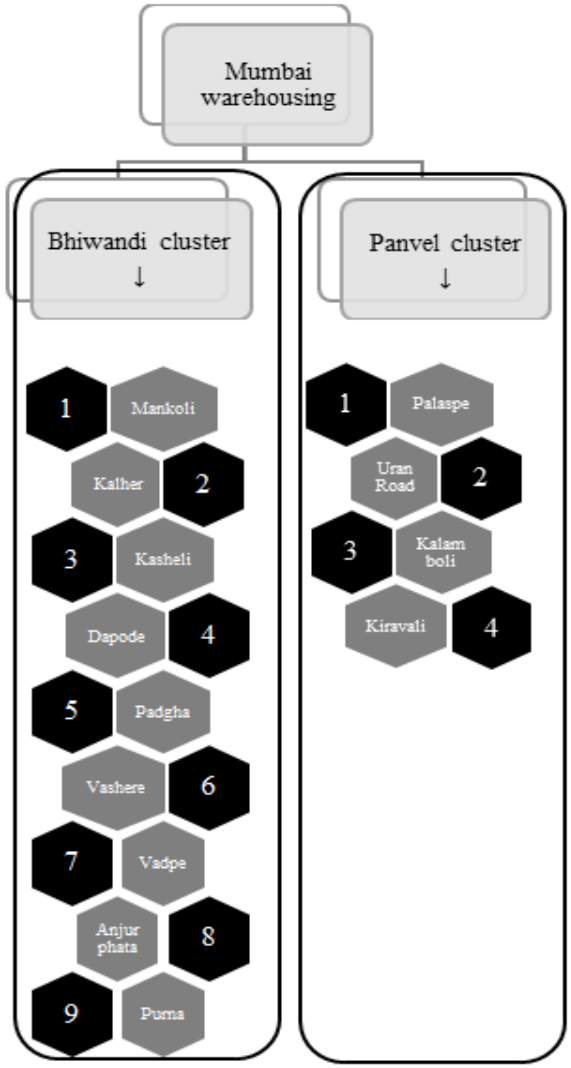
Fig2: Major warehousing clusters in Mumbai region



Source: Google maps (2019), www.google.co.in/maps/

Below image shows bifurcation of warehouses in two clusters. Almost 70 per cent of warehouses are located in Bhiwandi cluster and rest 30 per cent in Panvel cluster. Panvel cluster also has presence of CFS (container freight stations) or ICD (inland container depots). This service is for temporary import export laden as well for the customs clearance purpose. CFS are located closer to ports whereas ICD to railway stations.

Fig3: Sub-clusters within major 2 warehousing clusters of Mumbai



Source: Primary research

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III. MODULAR CONSTRUCTION

A. Overview

Modular construction is the modern architectural technology where every part of the building (called module) are prefabricated in a factory and joined them at place of requirement/consumption. The modular buildings take less time to construct, compared to the traditional RCC buildings. Plus, manpower resources required in constructing the building are much less compared to the traditional architecture. Hence this technology is strengthening its roots in the countries where labor force is a challenge for example Australia, United States, Canada, etc.

Modular construction utilizes variety of materials for construction ranging from metals like steel, iron or its alloys to the wooden and synthetic materials like plywood, natural wood, etc. The material used predominantly depends on the application. Modular construction market across the globe for 2018 stands at over 100 billion US$ which is anticipated to grow at the cumulative average growth rate of around 6 per cent in the coming half decade.

B. Modular construction for warehouse

Warehousing segment falls under the category of 'commercial construction' for modular buildings. Modular construction in warehousing segment is predominantly made through the steel way. The main reason behind it, is the requirement of strength for the warehouse structure. Below are few types of modular construction techniques that are popular across the industries

Table1: Types of modular constructions for warehouses

Types of modular constructions for warehouse construction	Prefabricated buildings
	Portable buidings
	Refrigerated storage
	Preengineered buildings
	Cold store panels
	Partitions & cubicles

Source: Primary research

C. Real life applications in the study geography

Warehouses in the modern times demands far greater need of modular buildings compared to a decade ago. There is increasing number of mega logistics parks that are gearing its root in the vicinity inside Bhiwandi & Panvel clusters. Few real-time examples of usage of modular construction in Mumbai's warehousing hubs are as below.

1. Pre-Engineering buildings (popularly known as PEBs)

PEBs are composed of various types of materials including steel; fiber reinforced

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plastic (FRP) as well as concrete. Most of these buildings are also pre-constructed at other location than actual place of use.

Fig4: PEB warehousing structures in Mumbai



Source: Arham group

2. Dome structures (Hybrid structures)

Dome structures are constructed at the factory as well as at location of requirement. And various modern materials like FRP are utilized for its construction. Relatively they are lightweight and resistance to corrosion along with the desired strength required for warehousing operations. Hybrid structures with combination of RCC & modern FRP are very common across region, where time and cost of construction are optimized to obtain best possible results.

Fig5: Dome shaped hybrid warehouse structures in Mumbai



Source: Arham group

Apart from these working applications, there are numerous other hybrid combinations that are used dominantly in the warehousing segment at Bhiwandi & Panvel clusters.

IV. RESEARCH METHODOLOGY

In order to determine the extent of usage of modular construction by warehouses in Mumbai region (Bhiwandi as well as Panvel cluster) following research methodology is adopted. According to India warehousing market report 2018 by Knight Frank Research, total warehousing market transaction volume in Mumbai has been recorded as 5.15 million square feet. Hence,

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considered 70 per cent volume in Bhiwandi cluster and remaining in Panvel cluster, based on the number of warehousing hubs in each cluster.

The sample size chosen for the research is 10 per cent of the total warehousing market transaction size in 2018. The sampling method used for the research is proportionate stratified random cluster sampling. Hence, out of 5.15 million square feet space in Mumbai region, 5,15,000 square feet space is considered for sampling. Following bifurcation is considered before doing proportionate stratified random cluster sampling.

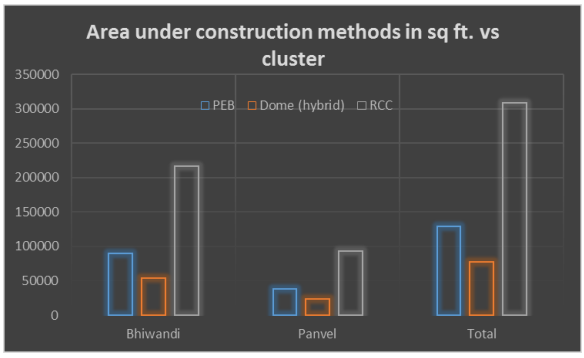
Table2: Sample size in each cluster for proportionate random cluster sampling

Warehouse cluster	% market share in overall market	Sample size %	Actual sample volume (in sq. feet)
Bhiwandi	70%	10%	3,60,500
Panvel	30%	10%	1,54,500

Source: Primary research

Hence, sampling of 3,60,500 sq. ft. is done in Bhiwandi region by selection of various size warehouses totaling the selected transaction volume. Similar exercise is done for the Panvel region and responses of potential respondents were recorded through an online questionnaire prepared on the Google forms. The scope of the study was kept limited to retail warehouses and government grain warehouses are not considered for the study. Similarly, CFS & ICD are not considered for the study due to non-usage of modular construction in their construction. Moreover, legal warehouses are considered for study which is registered with government.

Fig6: Area of warehouse under various construction methods



Source: Primary research

Respondents from both the clusters have responded in terms of volume of warehouse under modular construction vs. traditional construction. It is found that most of the warehouses were categorized as PEB (pre-engineered buildings), Dome shaped hybrid buildings and RCC constructions.

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Fig7: Extent of modular construction in Mumbai warehouses

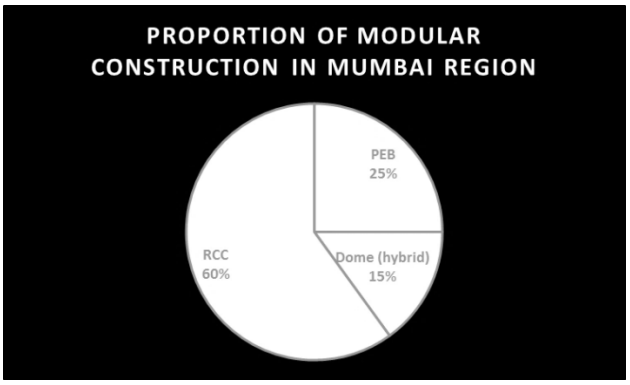


Fig7: Primary research

From the above figure, it is evident that 25 per cent of buildings are reported as pre-engineered buildings in Mumbai region as a whole (inclusive of both Bhiwandi & Panvel clusters).

V. CONCLUSION

Modular construction in the world is a hot topic and growing with the pace due to enormous advantages associated with it. Mumbai warehousing is growing with highest growth rate across India. In order to fulfill the raising demands of consumers, faster construction technology was desired by the warehousing industry. Modular construction is certainly fulfilling the present day needs.

From the survey conducted across two clusters of Mumbai region viz. Bhiwandi and Panvel clusters, it is evident that modular construction is growing with faster rate especially for the newer constructions. 25 per cent of the existing constructions in Mumbai region are found as modular warehouses as against the 60 per cent of traditional RCC construction. Proportion of hybrid dome shaped constructions (modular and traditional) is also found to be 15 per cent. Modular construction is rising for the following advantages.

- Speed of construction is higher
- Cuts cost of construction
- Savings on labor cost
- Higher design flexibility
- Ease of logistics
- Rework flexibility

Hence, it is concluded that modular warehouses are gaining good traction in Mumbai region especially in the newer constructions of bigger logiparks, warehousing complexes, etc. This growth is sustainable and will be growing with the growth of warehousing segment. Newer space coming under the purview of warehousing in Bhiwandi and Panvel outskirts are empty space of lands which are sometimes used as open warehouses. However, due to security and product safety concerns quicker ways like modular constructions are looked upon primarily by the warehouse owners. These warehouses

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are mostly rented to the customers from various segments like food & beverages, glass & metals, electronics, apparels, etc.

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