

# Container Housing as Green Building Concept for Ews Housing Scheme in Context of India (Literature Review)

Atul Dubey<sup>1</sup>, Vikash<sup>2</sup>, Ashish Juneja<sup>3</sup>

<sup>1</sup>Interarch Building Solutions Ltd. Noida, India

<sup>2</sup>M. Tech Ganga Institute Of Technology And Management Bhadurgarh, India

<sup>3</sup>Assistant Professor, Dr. Akhilesh Das Gupta Institute Of Professional Studies, New Delhi.

**Abstract-** The paper is a study on the use of ISO shipping containers to build sustainable Urban Economical weaker section housing society for Slum living in Metropolitan cities in India. As per world bank report nearly 35.2 % of urban population of India living in Slums (2018). In Japan, China and Vietnam the use of container housing solved their housing problems. Shigeru Ban , a house hold name in architecture in Japan has designed high end homes, biennials and museums by using containers. Room heating is a primary concern of using container as housing material because steel boxes are good heat conductors. But by using passive or active cooling technology we provide insulation. Also it leaves a low carbon foot print too. As per right to shelter in U. P. Avas Vikas Parishad v. friends coop. Housing society limited, the right to shelter has been fundamental right to residence secured under article 19(1)e and the right to life guaranteed under article 21.The state has to provide facilities and opportunities to build houses to standardize life of poor people. Container housing is a new trend of green construction technology, also it is made up of a heavy, good engineering property steel which is corrosion free and has adequate life to use as shelter. Average cost of shipping container houses are ranging from 5-15 lakh INR. India uses about 4 to 5 % of total shipping containers used in the world. This paper covers the literature review, methodology adopted for research, challenges and opportunity to use container as housing material.

**Keywords:** Include at least 4 keywords or phrases, must be separated by commas to distinguish them.

## I. INTRODUCTION

India is world's 2nd most Populous nation after China. It is also a fast developing country in the world. Due to rapid urbanization in India there is a great shortage in quality of economic house building, which leads to search for new ways to build economic sustainable houses. As per the latest data Urban housing shortage across India was at 18.78 million houses for the period of 2012-2017, 95 % of the gap was for low income households. As per the 2011 census, there are approximately 108000 such slums in the country which is a home to 13 million households of which 3.6 million are renters. Such household constitute 17% of the total urban population. In India, the right to housing & adequate shelter is guaranteed in the directive principle of state policy. India's net average salary as per the average salary survey 2022 is between 5,50,000 -14,00,000 INR. The average house cost in India is shown below in the Survey by Statista Research Department 5, Oct, 2022.

In this research paper we have studied regarding the usage of old shipping container to build sustainable houses for low income group people, in today's world many countries are using shipping container to build economic buildings. It creates sustainable, economic and quality of life uses in India. India is

surrounded by ocean on three sides. There are 213 ports in India in total out of 13 are major ports . The dock yards are full of empty cargo container that are ready to sale. If not reused, these containers will pose environmental issues of recycling them. ( et al Agarwal .V. Container Housing- Challenges and Opportunities).

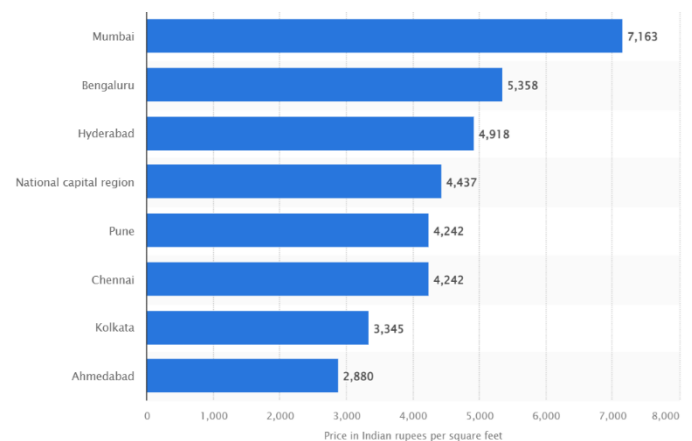


Fig. 1.1 Price of Residential Properties across India in H1 2022, by city

**Source:** Published by Statista Research Department 5, Oct, 2022

Table No. 1.1 House condition of urban slum

Housing Structure	% of slums	Housing condition	% of slums
Pucca house	59.6	Good condition	58.4
Semi-pucca house	25	Livable condition	37
Kutchra house	15.4	Dilapidated condition	4

Source: Ministry of Housing and Urban Poverty Alleviation (MoHUPA)

This paper includes literature review of research paper regarding usage of shipping container as building material in Green Construction technology all around the world. There are only few studies which has been done in India regarding the usage of shipping container as building material for economic weaker section group housing.

#### Aim and Objective

The aim of this research is to study the usage of Shipping Container as Sustainable Building material in Indian contexts and identify the Engineering property of Shipping container.

#### The following are the Objective of this research:

1. To review the state-of-the-art of Housing problem for EWS population
2. To study the Engineering property of Shipping Container
3. To study exemplar successful shipping container housing in world
4. To recommend success of container house project

#### Scope of Research

This research concentrate on housing problem in Urban and semi urban area in India due to rapid growth of urban slum population increase in developing cities. Shipping Container house construction takes less time as compared to traditional house.

## II. METHODS AND MATERIAL

The research starts with a comprehensive literature review of the successful container house project across the world. Most of studied literature till now includes published research papers, unpublished papers, books and internet sources relevant to the area of investigation. Literature reviews provides major support to make decisions on selecting shipping container as green

building material. Container homes are generally built using containers of two standard sizes-20x8 ft and 40x8 ft. Across the world, container homes have gained popularity over the years. Such homes have now become one the trendiest spaces when it comes to architecture and design. Though India's first container home was built in Bengaluru five years back, container homes are still a new concept. As per <https://www.squareyards.com/site> used shipping container in India will cost around Rs. 2.7 lakh per piece. The Price may vary from city to city in the country.

## III. RESULTS AND DISCUSSION

#### Structure Property of Shipping Container-

- Steel frames are welded together, corrugated Corten steel is placed on the outside of the frame providing an exterior that can withstand everything thrown at it, wood flooring is than treated and bolted down inside.
- Containers are designed for the corners to bear all loads which allows them to be very strong and have the ability to be stacked up to sometimes 9 containers high.
- High quality steel produced in the factory are of good toughness property.
- They are truly designed for some of the worst-case scenarios imaginable & they are virtually indestructible. While at sea shipping containers can be subjected to 100 miles an hour's wind & 50+ foot waves.
- As per ISO standards containers are designed to be heavily loaded and one individuals container can hold tens of thousands of pounds of material while only being supported at its four corners.
- Longevity is having a long duration of life new containers are generally designed to last 20 to 30 years without much maintenance. If you buy a used container, they are typically sold around the 10-15-year mark.
- Inter-modal shipping containers that confirm to ISO1496-1 are re-purposed for use as building or structure.

#### Architecture Property of Shipping Container-

1. Easy to construct and architecturally modern.
2. Shipping container is a green alternative because old shipping container are being reused as housing, fig. 3.1 shows the sustainable features of shipping container house.
3. Small Foot print and large living area is achieved by using container house.
4. Mix land use is also possible by shipping container

5. Construction time are usually 3 days to 7 days

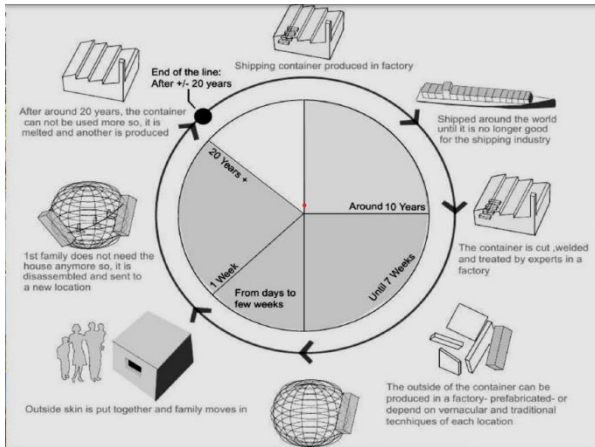


Fig 3.1 Shipping container as recyclable material

Source :Shipping container towards sustainable economic housing et al Madkour M. W. 2019

Table 3.1 Standard Sizes of Shipping container

Standards, measures and capacity : 20 & 40 ft dry standard shipping container						
Length (Exterior)	Width (Exterior)	Height (Exterior)	Length (Interior)	Width (Interior)	Height (Interior)	Capacity (Interior)
20 ft (6.05 m)	8 ft (2.44 m)	8 ft 6 in (2.59 m)	19 ft 4 in (5.90 m)	7ft 8 in (2.35 m)	7 ft 10 in (2.39 m)	1172 cu ft (33.2 m <sup>3</sup> )
40 ft (12.19 m)	8 ft (2.44 m)	8 ft 6 in (2.59 m)	39 ft 5 in (12.04 m)	7ft 8 in (2.35 m)	7 ft 10 in (2.39 m)	2390 cu ft (67.7 m <sup>3</sup> )

Source :Shipping container towards sustainable economic housing et al Madkour M. W. 2019

**Case Study**

Amsterdam Village in China (2006)-Dutch architect Julius Taminiau uses concept of container housing by up-cycling a series of shipping containers in the start-up villages. It is a low cost office space for start-ups in Amsterdam Science Park. The 155 sq ft containers are completely insulated, airtight and heated with low energy, infrared heating.



Fig. 3.2 Amsterdam Village in China

ii. Tempo Housing Nigeria-Tempo housing Nigeria can build a house with 2 million Naira using Shipping Containers. It is based on a technology pioneered in Amsterdam and tailor the solution to the housing crisis in Nigeria and west Africa. It includes provision of residential building, offices , residential and commercial housing, clinics, convenience , parks etc.



Fig. 3.3 Tempohousing Nigeria source: <https://www.livinspace.net/>

iii. Green Technology Showroom- It is constructed in 2008 , Beijing China by Vector Architects that inhabits the central lawn of a residential compound in the Guanganmen district of Beijing , China. It is made of steel, covered in grasses, and elevated structure.

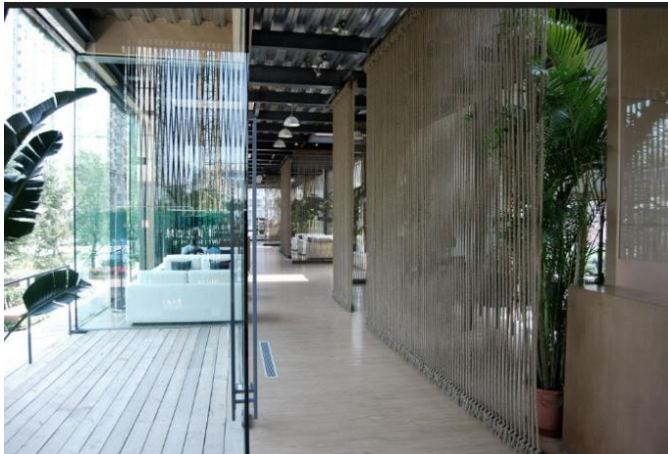


Fig. 3.4 Green Technology Showroom , Beijing China

#### IV. CONCLUSION

There are very limited research which has been done in the field of Container housing in India. Also there are major housing challenges in Urban housing in India due to rapid industrialization. Housing cost and construction cost of housings are very high due to which it is very difficult to purchase own house by EWS society people. By studies and various literature review we conclude that in India there is a good scope of container housing for EWS Housing scheme due to its low cost between 3-6 lakh INR . The time for construction shipping container house is maximum three weeks. It is also one of the good example for green construction technology because they are using shipping containers.

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#### REFERENCES

1. A. T., A. T., & M. B. (2018). Assessing the airtightness performance of container houses in relation to its effect on energy efficiency. Elsevier. Retrieved April 05, 2019.
2. G. Z., & S. S. (2016). Life cycle assessment of shipping container home: A sustainable construction. Elsevier. Retrieved April 08, 2019.
3. D. C. Cameron ( 2019). A case study on the feasibility of shipping container homes as housing for disaster victims Retrieved April 05, 2019.
4. JTW Consulting, Onesan Container Housing Project, Report, Prepared for: Atira Women's Resource Society, March 16, 2014
5. Cargo Container Conversion To Modular School Building, Division of the State Architect (DSA), California, US, Issued 04-15-16.
6. V. Anagal (2017), Container Houses- Challenges and Opportunities P-175-181, 4/3/2017.
7. Prof M. W. M. Madkour (2019), Shipping Containers Towards Sustainable Economic Housing, 17/04/2019
8. O. U. J ( 2020) , Study of Shipping Container Housing as an Alternative to Sandcrete Block and Reinforced Concrete in Lagos, January 2020.
9. Greene, D. and Williams, P. C. (1997). Linear Accelerators for Radiation Therapy, Second Edition. IOP Publishing Ltd., Bristol and Philadelphia.
10. Edric King Hui Wong, Cher Siang Tan and Philip Chie Hui Ling, (2018). Feasibility of using ISO shipping container to Build Low Cost House in Malaysia.