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STUDY ON REUSE OF SHIPPING CONTAINER AS RESIDENTIAL HOUSE IN NAGPUR

Prof. Kunal D.Thanekar, Abhishek B. Sahu, Bhushan S. Bhalerao, Arjun J. Dharmik, Rajat S. Sharma, Bhavin H. Patel

Department of Civil Engineering, Priyadarshini J L College Of Engineering, Nagpur, India.

Abstract: The idea of container Housing is new, with Cheap and Good appearance, this can be benefit for lower class people in country like India. The retired cargo shipping container can be Recycled and Reused for making houses with architectural appearances and modern techniques. The city like Nagpur, occupies of high cost for constructing a residential small house as compared to container housing which are good in strength and low in cost.

In this paper, we have studied and discussed the use of shipping container as residential house in City like Nagpur. It also explains literature reviews on other papers and the methodology included while making out. The comparison between Normal houses to container houses. Designing the 3D model and CAD drawings and some structural calculations along with it. It is also recommended the future with shipping container homes.

Keywords :- Container Housing, appearances, techniques etc.

1. Introduction

As the world is moving towards new challenges and development, the construction industry is also reaching to its advanced growth stage. So, the construction industry i.e., Civil engineering industry heading towards new ideas and new researches. The demand of shelters to everyone is increasing day by day which results high wealth investments in construction industry, so ultimately demand of construction materials such as cement, sand, aggregate will also increase the energy consumed in a production of such material, like cement is comparatively costlier. There is a need to find and alternative which will benefits in cost cuttings to end users and also be environment friendly.

Cement is also Comparatively costlier and also increases CO_2 gas while producing. and brick is also made by natural clay where they can be excavated the earth surface. It is to be said that both industries consume more natural substances and Energy.

So, we can use a shipping container as a replacement in least count of cement and brick.The shipping containers are made by Corten steel, Galvanized steel, aluminium etc. elements. Basically, they are used for import and export of materials and things.While designing these are designed that they can suffer Harsh climatic conditions and rough seas. With this condition, shipping containers suffers a shipping span of 8-10 years. Recycling and reused them with a span of 15-20 years after retirement.

The shipping containers are eco-friendly as compared to concrete made structures.

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2.Comparing container homes to traditional homes

While constructing a residential house, the first thought in mind is What will cost going for construction? Due to the increase rates of materials, it is to be ready to perusing the materials. For small type of residential house construction like 300sq.ft to 600sq.ft plots, it is to be beneficial use a shipping container as replacement of concrete-based houses in least count.

Some points to be consider while comparing

2.1 Cost of construction

Comparing key point, The land purchasing for construction of house in city like Nagpur, The area like Pardi or Bhandewadi a plot rate of Rs.1000sq.ft. This will cost up to Rs.3 lacks for the area of 300sq.ft. If we built a foundation i.e. (300 X 500= 1,50,000) and along with it if we construct RCC structure and Brickwork Etc. it will cost approx. 300 X 1200 i.e., Rs3,60,000. So, the complete construction costing will go approximately around (Rs.3,00,000+Rs.1,50,000+Rs.3,60,000) Rs.8,50,000. This can be constructed economically in shipping container around Rs.2,00,000- Rs.3,00,000 only.

2.2 Strengthening

The RCC work, the strengthening will be more than shipping container. But Corten steel which are use in shipping container Are also good in bearing heavy loads. These are also called as Atmospheric Corrosion Resistant.

2.3 Maintenance

Maintenance will be less for shipping container while comparing with RCC works. Corrosion is the reason to maintenance of containers which can be solved by applying paints and solvents etc.

2.4 Architectural purpose

It is to be easy to give an architectural shape to containers homes compare to Traditional houses. And can be change its over view.

2.5 Transportation

Basic and easy way to transport the container houses to one place to another.

3.Literature review

During the study of various literatures, we have come to know about Grey Water Treatment, Reuse, Recycle, Hydroponic Farming Methods, Uses, Benefits, Design Composition, etc.

3.1 "Containers Architecture Reusing Shipping Container in Making Creative Architecture Spaces."

3.1.1 Expectation Of life of Shipping Container: Most of Containers are made to fulfil at least one decade lifespan. These are made extremely resilient and secure to travel long distance. The Containers are designed at that time which runs 2 decades.

3.1.2 Shipping Containers creates various Architectural Spaces: Due to Reuse of Container not only creating functional spaces but also geometrically durable interesting and joy able spaces. The renovation of Container taken a little time there have been reports that container being have successfully renovated for personal living in 72 hrs.

In this study, Containers are standardized with identical design and can be modified.Durable against temperature and pest.

3.2 "Use of refurbished Shipping Container for Construction of housing buildings."

The material using for making out is a Corten steel contains most of the components of container. The characteristics of value of yielding stress are 343MPa (Corten A). Geometric of containers are have thick beam of steel which linear each side.

Composition of containers are made to prevent shear stresses, avoid torsional movements. i.e., a hollow rectangular section which size 20x8.5x7.10 feet.

Refurbishment and preparation of containers will be heading to removing of doors as well as replacing original plywood floors. Next shop will be cutting or removal of steel wall by given Architecture design Containers could be loose some strength. Its profile will be used to strengthening elements.

In this study feasibility of this system based on refurbished containers as construction material should be recognised.

3.3 "Use of refurbished Shipping Container for Construction of housing buildings."

In this study, possibilities are extended to comfort liveable urban places. This are highly durable frames.

Shipping Containers homes can be built on sites that may not be suitable for regular houses i.e., Sloped block. Always Shipping Containers allows for creativity and feasibility in your design.

Always possibilities of further expansion. Shipping Containers can be turned into portable or multistorey structure and also convenient homes. Also shipping Containers are most cost effective, durable and customizable.

3.4 "The Orange Box Project."

Renovation of S.C. there are some points that need to be considered before renovating i.e., Shipping Container structure, Law rules and Regulations, Insulations, Plan for Plumbing, Strategy to cope with wind.

In this study Renovation of Containers take maximum 72 hrs and has always possibilities of further expansion.

3.5 "Shipping Containers have Potential to be the Reused as other function"

Standards and regulations of shipping Industry creates a robust, durable and Modular shipping container.

The attempts to reuse these containers not only reduce the pile up in depot and ports, but also reduce energy and resources consumption from construction industry.

In this study it has a big potential to reused as other function but similar projects cannot be done easily in other cities having higher average temperature.

In this study case, Temperature recorded was only for 10 days but a full year observation will be more helpful to see whole condition throughout various season

3.6 "Shipping container Architecture in changing Landscape."

Since the first shipping container was built in 2006 By Peter De Maria, This Architecture style have caused innovative thing to stretch our thinking.

Started with a simple design concept has turned out to be a global movement to bring affordable and efficient housing into our life's.

Although, further research is needed for long term use of this container house like are this container really low-cost model, durable and have low maintenance.

3.7 "The Container Housing."

In this study, using recycled Containers can be explored Practice as viable option in India. The opportunities for Container Architecture in India and the incentives it can bring, there is need to explore this form of architecture in India. Also, a study of post occupancy evaluation of container user is required to be done in Indian context to understand the issues related to the user, comfort and preferences.

In this study it was known that housing per Indian space requirements and typology is possible to be designed using this prefab unit.

3.8 "Design and analysis of Shipping Container using STAD- PRO"

It is observed that any proposed design responds to new challenges such as (low energy use, construction particle etc.) can be analysed.

Containers can be created easily and relatively in too budget within short time in addition to flexibility and possibility on sites.

This paper also shows that calculation of structural projects with construction system by using resources available.

3.9 "Thermal performance assessment of shipping Container."

In this paper to check thermal performance of shipping container, building energy modelling is done. BEM is the branch which examines use of energy and indoor condition of a structure.

In BEM, parameters of interest are physical appearance, metal properties are taken into consideration.

Second thing which can be done for thermal insulation is providing layers of foam insulations on walls and ceilings. Also, it is necessary to check structureorientation and window properties for thermal comfort.it is observed that having glazed windows schedule natural ventilation and increased door temperature and humidity.

3.10 "Shipping Container market – resistance market."

The global shipping container market gives positive response and growth trend since 2012.

Valuation of GSC in 2016was US $ 4600 this could be more than US $ 8N by end of 2025.

20ft segment was mostly used.

Container product type: - Dry, Tank, Offshore, Reefer.

3.11 "Thermal performance assessment of shipping Container in hot and humid climate."

Most of steel containers are made from weathering steel or Corten steel which ensures high corrosion resistance. Using different roofing such as double roofing which can act as thermal insulation or reflective painted shed, hip or gable roofing.

Insulation in roof and wall: - insulating the grass into the roof, double roofing, solar energy panel, straw bale walls.

Internal insulation: - spray foam (Styrofoam), insulation blankets, mud bricks.

3.12 "Refurbished shipping Containers as architectural module in Bandung."

Standards and regulations of shipping industry creates a robust, durable, and modular shipping container. Properties create a big opportunity for adaptive reuse and attempts to reuse those containers, not only reduce the pile- Shipping containers have a big potential to be reused as these containers in terms of heat insulation. Reducing heat gain inside the building. Cover surrounding the building reduce the amount of heat.

In this study case however, recorded temperature was only helpful to see the whole condition throughout various Energy consumption to transport containers from embodied energy a refurbished container building have.

3.13 "Feasibility of using ISO Shipping Container to build low-cost house in Malaysia."

The research aimed to produce a base point study for using used ISO shipping container as structural building application in Malaysia. There is not much literature publicly discuss on the development of container house as low-cost house in Malaysia.

The development of container house in Malaysia is partially recommended as there are 45% of Malaysian citizen can accept the idea of living inside a container house and all the four companies rated 50% trust in the development of container house in Malaysia. As recommendation, future research should also investigate the perception of government sector about the feasible development of container house in Malaysia.

4. Methodology

The term methodology shows the actual work done during the making these papers. Following points expresses methodology used for making research papers.

4.1 Following literature surveys helps to study shipping containers houses in detail.

4.2 Site visits: Without the Practical Knowledge concept cannot work so for those things we have planned to visit some places where such kind of technologies has already been implemented.

Fig. showing container size of 40 x 8 x 8 hudkeshwar corner (exterior and interior)

We have visited a site at Pipla Fata near Hudkeshwar rd, Nagpur Mr. Rajesh Desai the site engineer told us how they modified the shipping container according to their use for storage room and office cabin.

4.3 Preparation of Model: After site visit, we will be making a model of Container of size 2-6 x 2 ft. In this model we will be using various techniques to reduce the problems that people are facing in Shipping Containers.

4.4 Testing: After preparation of our model we will be testing in various ways. This is because in the place like Nagpur the temperature goes up to 50°C in summer. With the equilibrium condition, we will be going at site and testing on actual temperature in inner and outer of the container.

4.5 Result Analysis: After Experimentation the result we get, we will have to check it and through this we are going to analyse the results accordingly.

5. Planning of Container Home

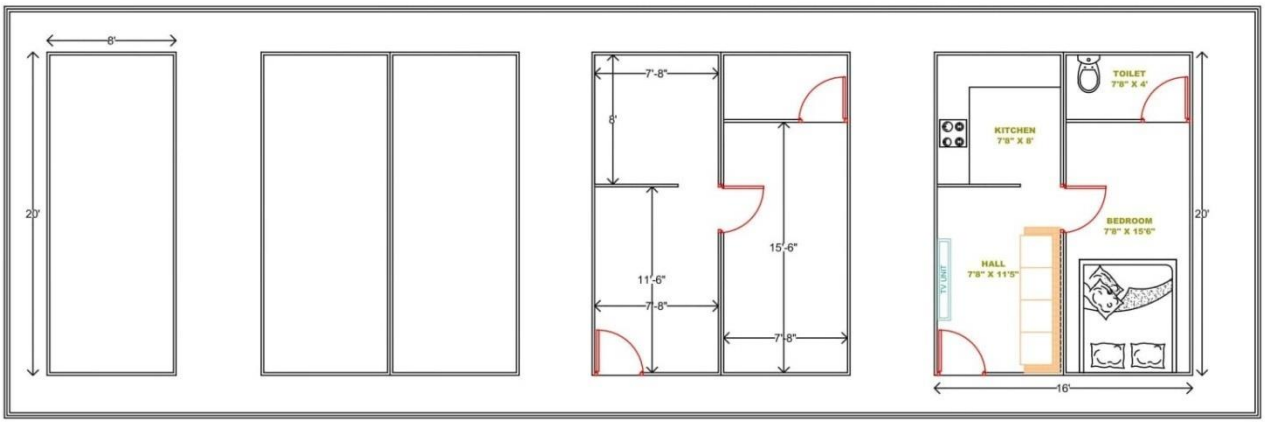

fig. showing container house planning in 2d

6. 3D Overview of Planning

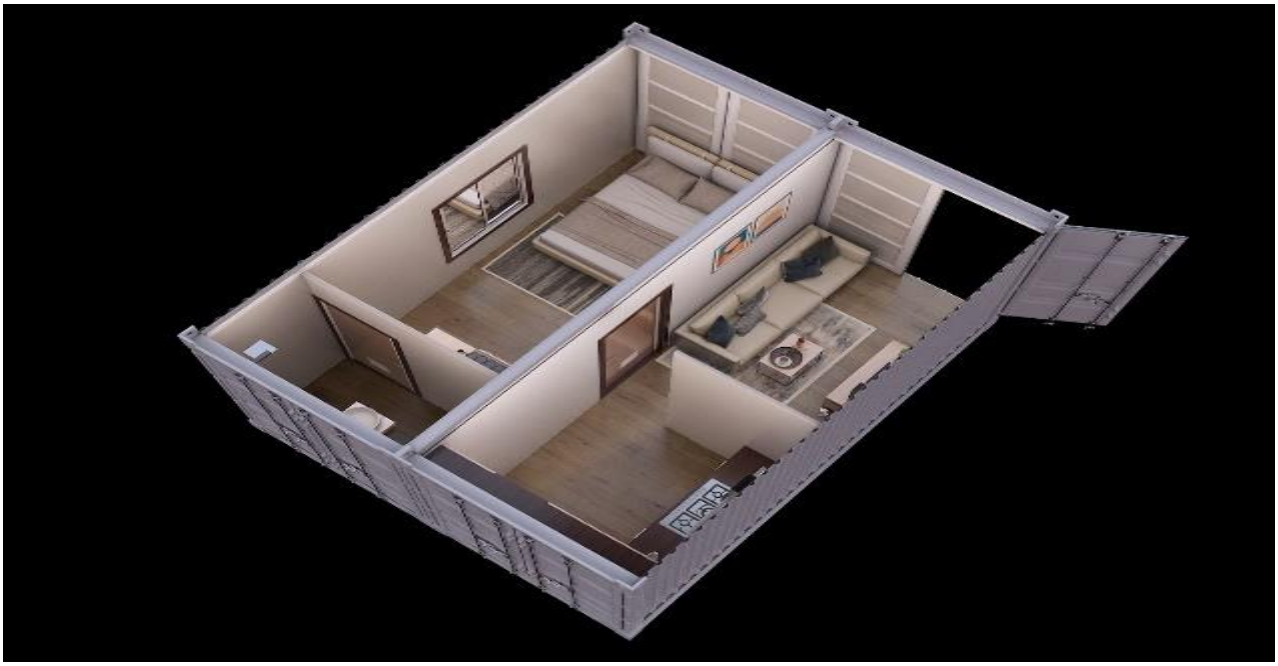

fig. showing 3d design of container

7. Actual Estimation

Shipping Container Homes	
Specification	Rs/pc=total
G.I portable home cabin 20x8x8 2nos (without paneling)	1,55000/- x 2 = 3,10,000/-
Including 1nos Main Door with hydraulic Door closer, 2nos sliding Aluminum window with M.S grill, 4nos cabin Fan, 3nos LED Tube light, Roof outside of G.I sheet, False Ceiling 4mm ACP sheet, Insulation of Glass wool density of 16kg/m3, Wiring of PVC insulated Copper wire, earthing point provided, Legs of 6inch height 4 legs at all four corners, specially formed hooks for easy lifting and shifting, all components paint by 2 coat epoxy after one coat of primer	
Partitions (full)	10,000/-
Inbuilt toilet cum bath 7.8x4	35,000/-
Open pantry L shape 7.8x8	45,000/
Installations	30,000/-

Total	**4,30,000/-**

8. Future with shipping container homes

The overall size of the global container market is supposed to increase by the year 2025. Moreover, the developers are building these homes using various shipping containers, which are all scraped.

Containers triggering ideas and opportunities

8.1 From cargo to classrooms:

A container school in UP's Gorakhpur set up by Project OoSC (Out of School Children). In India, Safeducate, a Delhi-based training firm was among the first to convert in retired shipping containers into classrooms. they have 25 skill development schools across the country, including one in Gurugram, made from shipping containers and trained over 10, 000 youngsters in these container schools

The company's training centre in Binola, Gurugram, which was inaugurated in 2018, has been built with eight containers, and has classrooms, laboratories, and libraries, among other facilities.

8.2 Containers to Mohalla clinics:

The Delhi government recently unveiled two new modular Mohalla clinics made from shipping containers in Shakur Basti in northwest Delhi, the government intends to create many more such clinics in the future.

Due to problems in getting land, the government has been able to set up only 500 of the 1,000 new Mohalla clinics that it announced to build in 2015.

The facilities in the new 350 sq. ft air-conditioned clinic include a doctor's room, waiting area, and pharmacy.

8.3 Containers to a new world:

While the Capital will be using shipping containers on a large scale for a public infrastructure project for the first time, in the past few years they have been used to build portable schools, skill development centres, cafeterias, and even houses across the country. Experts say they are slowly gaining popularity as an eco-friendly, rapidly deployable, scalable, portable plug-and-play building solution.

We need to understand that 50% to 60% of air pollution is caused by construction activities.so todays construction industry needs an alternative to traditional building structure which is flexible, modular, and most important sustainable which can be fulfilled by the use of shipping containers therefore we can conclude that future of containers housing in India contain a whole new world of possibilities.

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