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CONTAINER HOUSES

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ABSTRACT

The concept of reusing and recycling materials has long been recognized as an important value in sustainable design and architecture. From reusing stone, wood, and marble columns in historical buildings to the more recent reuse of paper and steel shipping containers, there have been various attempts to explore the possibilities and opportunities of creating functional spaces while reducing waste and environmental impact.

One specific example of this trend is container architecture, which repurposes shipping containers that would otherwise be left unused or require costly and energy-intensive recycling processes. Container architecture aims to create architectural spaces that can host different functions and human activities, both at the scale of individual buildings and on a larger scale that can help provide quick or temporary solutions for structurally stable and safe environments that are also environmentally friendly.

In this study, we will explore and analyze container architecture projects and case studies from various perspectives, including geometry, architecture, structure, finance, and the environment. While container architecture provides benefits such as speed of construction and lower costs, it also presents challenges such as limited interior space and the need for additional insulation and ventilation in certain climates and weather conditions.

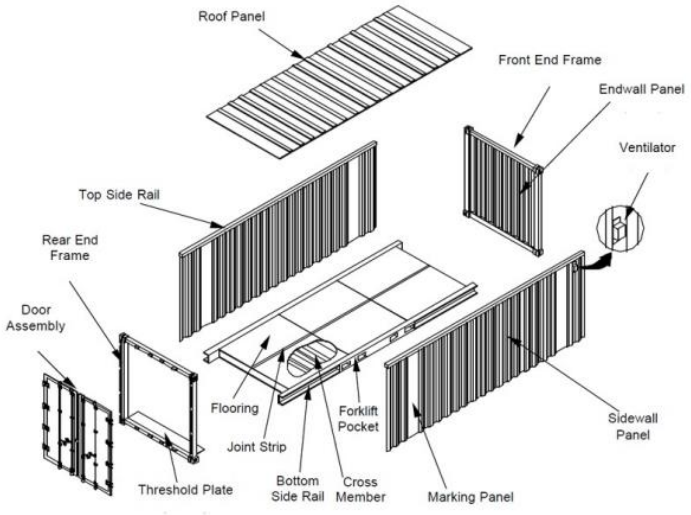
Overall, container architecture is an intriguing and important development in sustainable design and architecture, and its continued evolution will likely contribute to more innovative and environmentally conscious building practices in the future

INTRODUCTION

Shipping container architecture is a form of architecture that involves the reuse of steel shipping containers as a structural element and architectural envelope to accommodate various functions and human activities. It is often referred to as "cargotecture," a fusion of traditional architecture and container construction. The popularity of cargotecture has significantly grown in recent times due to the durability, affordability, and accessibility of shipping containers.

Many people are now choosing to build their homes using shipping containers because they have a lower environmental impact than traditional homes made with brick and reinforced concrete structures. Building with shipping containers also requires less time compared to traditional construction methods, and offers the flexibility of moving the structure to a different location or adding additional spaces or volumes in the future.

Overall, the use of shipping containers in architecture provides a sustainable and cost-effective solution for creating functional spaces that meet the needs of modern living.



WHAT IS A SHIPPING CONTAINER?

A shipping container is a strong steel frame, usually in the shape of a cube, designed to transport and store large cargo. There are different types of containers available, ranging from refillable to standardized. For global trade, the term "container" typically refers to a standard shipping container that can be easily loaded onto various modes of transportation without requiring the contents to be unpacked.

While shipping containers are intended to be reusable, many end up being neglected or abandoned due to surplus supply or economic factors. This has resulted in a significant number of containers sitting idle in ports around the world. Research indicates that approximately 20 million containers are currently abandoned worldwide, with over 1 million of these having no practical use and taking up valuable space.

EXPECTED LIFETIME OF A SHIPPING CONTAINER.

Shipping containers are designed to have a lifespan of at least a decade, with a target lifespan of three decades, to meet the demands of their intended use. They are constructed to be highly durable and secure, ensuring the safe transportation of cargo over long distances. Many of the containers currently in use have already surpassed the 10-year lifespan threshold. With proper maintenance and upkeep, it is possible for containers to exceed their anticipated lifespan by a considerable amount.

USING SHIPPING CONTAINERS IN CREATING VARIOUS ARCHITECTURAL SPACES.

One of the key questions that arises in container architecture is how a steel shipping container can be repurposed into a livable space. Any space can be defined geometrically by different planes, both horizontal and vertical, which create a spatial relationship that organizes and defines the space, and represents the human function for which it was intended. By considering the scale and dimensions of the space, additional value can be added to enhance its performance in its intended function, or even add a new function altogether.

When looking at a steel shipping container, the basic conditions for a space already exist, and with some modifications, it can be transformed to host various human activities or functions. This creates not only functional spaces, but also interesting and unique spaces for people to live in, use, and enjoy.

WHY COULD A SHIPPING CONTAINER BE USED ASA SPACE UNIT THAT CAN CREATE A BUILDING OR A GROUP OF BUILDINGS?

1.The composition of a shipping container:

A shipping container is constructed using six planes: a floor, a top, and four sides made of steel with regular corrugations that enhance their strength to withstand loads or pressures during transportation. It also has steel posts and reinforcements at the corners, intersections of the sides, below the floor, and above the top. As a structure, it is designed to resist forces that exceed those typically encountered in many architectural spaces such as residences, offices, dormitories, etc.

2.Storage order:

Shipping containers are designed to be stacked in a standardized manner globally. It is not possible to stack containers in any other manner than the standard arrangement since the frames are designed to stack in a universal alignment with no additional locks available to facilitate a different configuration.

THE BUILDING FUNCTIONS THAT SHIPPING CONTAINERS CAN HOST.

Due to its unique structural composition, uniform cuboid shape, and modular size, shipping containers can be repurposed for various building functions. Examples of buildings constructed using shipping containers can be found all over the world. These containers can be utilized to construct buildings for housing, emergency crisis shelters, emergency natural disaster shelters, school buildings, residential and commercial structures, studios, shops, mobile museums, bank branches, pharmacies, sleeping rooms, malls, and public restrooms.

Numerous real-life projects worldwide have utilized shipping containers in various scales and functions. The following case studies provide examples of projects that have been explored and analyzed, ranging from a simple residence to large-scale developments.

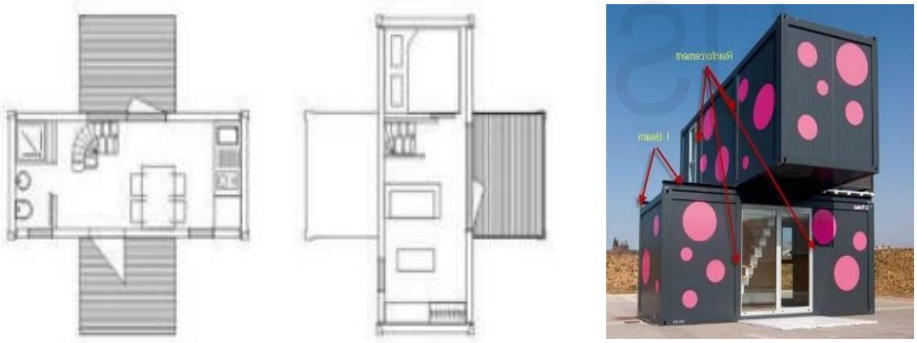
1. Small Size Residence

The Small Shipping Container Cabin is a project that was constructed in 2008 using two twenty-feet standardized shipping containers. The containers were stacked on top of each other in an intertwined manner, utilizing crisscross stacking to create a non-traditional box shape. To support the added weight and create a structurally sound building, modifications and reinforcements were necessary, including the addition of supports and beams.

Both the upper and lower containers required reinforcing, and the borders of the containers were utilized to facilitate placement of another container that was straying from its corners. This allowed for the upper container to be balanced. To create an aesthetically pleasing appearance, a specific color theme was applied to the exterior.

Modifications were made to connect the two containers vertically, creating a staircase that connects the two levels. The crisscross stacking also created a shaded area on both sides of the lower container, and two terraces were added to both sides of the upper container.

In case additional space was needed, there was a possibility of adding a third container on top of the second one. Overall, this project demonstrated the adaptability and versatility of shipping containers in constructing functional and visually appealing buildings.



2. Shipping Container Guest House

This cabin, designed by renowned architect Jim Poteet, is located in Texas and utilizes a single container. It can function as a garden retreat, studio, or playhouse for both children and adults. The container used for this design is 8x40 ft and features glass doors and windows, a toilet, shower, and sink, and heating and cooling systems. The roof is adorned with a variety of plants.

Due to the boxy nature of the container, decorating possibilities are limited, but Poteet Architects managed to remove two large sections of steel for a sliding doorway and window, and painted the container blue. A patio is featured in both the front and the roof of the cabin, which minimizes the chance of rainwater smashing against the glass. The interior is designed with wood, creating a comfortable and calming atmosphere.

The mixture of materials and colors used gives the cabin a unique standing in the conventional mass of guesthouses. It's worth noting that this isn't the only container-based design from Poteet Architects.

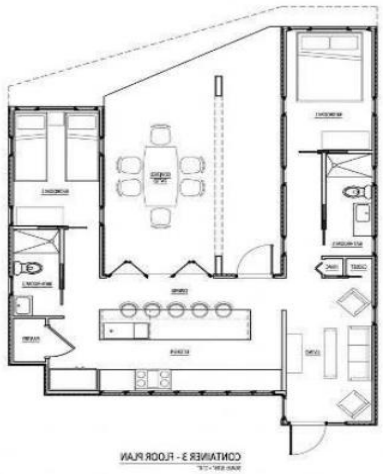
3. Mid-Size Residences

• The ground floor is used for living, dining, and kitchen areas, while the upper floor contains the bedrooms and a home office.

• The exterior of the containers is finished with a stucco-like material, while the interior is insulated and covered with drywall.

• Other features of the house include a rooftop deck with stunning views, a large patio area, and a garage constructed from a fifth container.

• Overall, this house demonstrates the potential for using multiple containers to create a spacious and modern home.



4. Keetwonen in Amsterdam, The Netherlands

Keetwonen in Amsterdam, The Netherlands is the largest container housing project in the world, designed by Tempo Housing. The project gained prominence in the country, particularly among students, and has become the second largest dormitory in Amsterdam. Keetwonen proved that container homes are not too noisy, small, or cold, but are highly cost-efficient, spacious, and insulated against noise and weather effects.

The housing project offers amenities that were missing in other student housing schemes. Each container home comes complete with a kitchen, bathroom, gallery, study, and bedroom, and features upsized glass windows to allow for natural light and ventilation. The project was based on the requirements of students, who wanted a personal space for studying without having to share showers and bathrooms with strangers. Keetwonen also offers convenient facilities such as a cordoned area for bike parking.

Although Keetwonen may appear as though residents are living inside metal boxes, the interiors are actually quite affluent by student standards. Each container home features its own gallery, kitchen, and bathroom, as well as access to fast broadband internet. Initially intended as temporary housing for students, relocation plans have been extended to as far as 2016, allowing students and individuals who purchased their containers to relocate to a new spot.

5. Cite A Docks

Cite A Docks is a dormitory located in Le Havre, France that was constructed in 2010 by Cattani Architects. The architects converted old containers into a four-story building, creating 100 dorms that are each 24 square meters and include a bathroom and a kitchen. While the building's metallic facade may seem dull, it is designed to help identify various rooms and broaden them by using foreign extensions, which are modified into balconies. The sloping architecture of the building provides a mixed feeling of being both filled and hollow, giving it a more scenic view.

The designers had to work against popular sentiment against stacking and create a structure that provides a greater feeling of personal housing independence, as housing demands have changed drastically. Containers provided the best solution, as older models could be renovated and refurbished with interior space, and designed to be stacked on top of each other. The containers' boundaries are easily identified, and terraces are placed to make them aesthetically pleasing. The sloping effect of the structure portrays it as neither too crowded nor empty.

The structure has 100 houses spread over four floor plans, and the first floor was elevated to ensure identical privacy for the ground floor residents as the residents from upper floors receive. Each house faces a garden located within the structure premises, and the abundance of windows and glass walls facilitate consistent penetration of natural light into each house. To minimize noise and temperature, the containers at dividing locations without adjacent containers were coated with 40 centimeters of reinforced concrete, alongside rubber coating to ensure minimal vibrations.

The building's external facade is made up of old "boxes" that are undulating and repainted in metallic gray, while the interior features white walls and wooden furniture. Overall, Cite A Docks is an innovative and functional solution to the housing demands of students and demonstrates the potential of transforming old containers into comfortable and aesthetically pleasing living spaces.

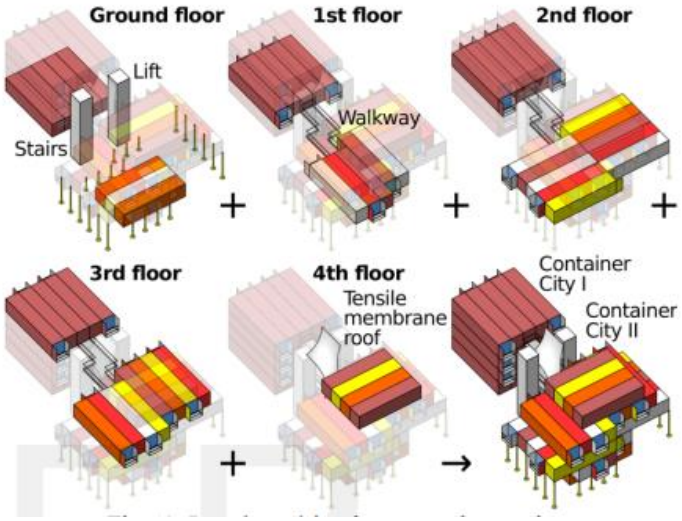
Puma City

Puma City is a unique 11,000-square-foot store located near Boston's Fenway Park. It is constructed using 24 red shipping containers and spans over three levels. The structure serves as both a storage facility and a living space, making it a versatile mobile headquarters for businesses. One of the most interesting features of Puma City is its design, which allows it to be easily dismantled, shipped, and reassembled in any location around the world.

London Container City I, II:

London Container City I and II are innovative and environmentally-friendly workplace structures made entirely of repurposed shipping containers. Constructed in Trinity Buoy Wharf, London, the project began in 2000 and 2002, respectively, and has since received numerous awards for its modern and stylish design.

The primary goal of the Container City project is to provide a modern and affordable workplace in a unique setting. The project has been used by various organizations across different industries such as local government, banking, software development, healthcare, and education. The Riverside building, also known as the first Container City, was completed in 2005 and comprises 73 containers spread across five floors. The project's design is centered around the idea of reusing shipping containers and avoiding the use of conventional building materials, such as bricks, which are more expensive and environmentally damaging. London Container City is among the most significant container-based structures in the world, with the second city built two years after the completion of the original project. The second city features a ziggurat design approach and is painted in vivid colors, providing a source of joy and motivation to its residents. The extensions of the project further highlight its global prominence.



CONCLUSIONS

shipping containers, despite having a very systematic and regular shape, can be reused to create a variety of functional spaces with different configurations of architectural programs or functions. From simple residential units to office buildings, shopping malls, or cultural centers, the possibilities are endless. The text mentions that many attempts have been made globally to create interesting architectural spaces that can be constructed in a relatively short interval of time with reasonable costs.

One of the main advantages of container architecture is that it offers the possibility of creating livable urban spaces that can be constructed quickly and within a low budget. Containers are highly inexpensive compared to conventional building materials, with each individual container ranging from $1,500 to $3,000 United States dollars. In addition, containers are considerably sturdier than wooden or brick structures and last for multiple decades with little decay. They are also highly durable against extreme temperature and pests.

Another benefit of container architecture is that all containers are standardized with identical designs, allowing them to be stacked upon or placed side by side without requiring additional resources or

planning. This makes renovation of containers easy and quick, with reports of a container being successfully renovated for personal living in as little as 72 hours.

Containers are also easily broken down for movement and reassembled with the same structure intact, requiring little expense for transit of a house between locations. The highly durable frame of a container lasts for decades without requiring too expensive or specific maintenance. Containers also offer the possibility for further extensions, as a house can be expanded with more containers to make it larger, with personalized placement of new rooms and utilities.

In summary, container architecture benefits include the renovation of previously utilized containers, low cost, sturdiness, standardization, quick renovation, durability against extreme temperature and pests, ease of movement and reassembly, minimal maintenance, and the possibility of further extensions. These advantages make container architecture an attractive option for creating a variety of functional spaces and livable urban areas with cost and time efficiency.

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