



Date: August 2, 2017
To: Patrick H. West, City Manager *T.H.W.*
From: Amy J. Bodek, Director of Development Services *A.J.B.*
For: Mayor and Members of the City Council
Subject: **Shipping Container Construction**

In May 2017, the City Council adopted 29 recommendations to support the production and preservation of affordable and workforce housing. Please consider this memorandum as a response to Recommendation 3.10: *Encourage the adoption of regulations to allow and incentivize the use of shipping container construction for housing.*

The shortage of housing, coupled with escalating home prices and a lack of affordable rental inventory, has resulted in the consideration of alternative housing solutions, including the use of intermodal shipping containers (containers) for housing development. Containers (a.k.a., transport, freight, portable, dry cargo, or box) are commonly used on oceangoing vessels for the transportation of goods and commodities, as well as storage. Although a fairly new phenomenon, the repurposing of containers as building modules is viewed as a practical solution due to their environmental friendliness, strength, availability, speed of construction, and relatively low expense. However, the use of containers for housing is not a simple matter of placing them on a site and hooking up utilities. The advantages and requirements associated with containers as housing units are addressed below.

Environmental Suitability

It is believed that the use of containers is more eco-friendly than conventional construction. According to the Environmental Protection Agency, traditional building methods account for 60 percent of raw material use and non-industrial waste in the United States. Most agree that the repurposing of containers would save on the energy consumption required to melt them down, as well as limit the use of traditional building materials such as bricks and cement. Other collateral benefits include improved fire resistance, and resistance to termite damage, dry rot, and other fungus related infections.

However, since containers are constructed for transporting goods and were not intended for human habitation, they may contain potentially hazardous elements like chromate, phosphorous, lead-based paints used on the walls to provide rust protections for ocean crossings, arsenic, and chromium used to infuse the wooden floors of the container to deter pest infestation. Therefore, before containers can be made habitable, certain improvements to offset the CO₂ carbon savings would be needed, such as sandblasting the walls and roof and replacing or sealing the wood flooring.

Lastly, containers absorb and transmit heat and cold very well. As such, the temperature within containers can be controlled with passive cooling and heating designs by using appropriate insulation and paint; however, it can also be addressed by non-environmentally friendly solutions like energy-consuming air conditioning systems.

Structural Requirements

In many ways, containers are the ideal building material because they are strong, durable, stackable, and modular. Containers can easily be stacked one on top of the other to create multi-story and multi-family dwellings. Due to their robustness, container dwellings can be earthquake resistant if properly designed by a licensed professional. Designs that result in non-traditional stacking (not aligned on four corners) will need additional structural support. Opening for windows, doors, skylights and decks will result in structural deflection or reduced earthquake resistance that will need to be reinforced. The engineering design, coupled with the engineered reinforcements, will add additional expense to the housing development.

Shipping Containers versus Manufactured Buildings

Container construction, like any other method of construction, is required to comply with the California Building Standards Code and receive local permits. The use of manufactured buildings (manufactured or prefabricated) is another non-traditional method of providing housing resources. Manufactured buildings are permitted through the California Housing and Community Development Department (HCD). This allows a manufacturer to receive certification from HCD and use their manufactured buildings Statewide. It provides a faster permitting mechanism for the production of affordable housing units, but may not provide the same aesthetic as shipping containers. Staff has been researching the use of manufactured units and recently received a presentation on the MicroPAD, developed by Panoramic Interests. While not yet certified by the State (permitting is underway and expected shortly), the MicroPAD is a 160-square-foot, self-contained dwelling pod that is easily stacked to create a multi-family building. The pods can be stacked within a matter of weeks and provides turnkey housing for areas in need. The developer requires that the City enter into a long-term lease, provide free land, and eventually purchase the units. While it is currently financially infeasible, it is yet another example of an alternative housing solution.

Cost Comparison

Building with containers may be faster than conventional construction if properly designed by a licensed professional engineer and architect, and site construction constraints and logistics are accounted for by an experienced contractor. Depending on the method of construction, container home construction can be done in a matter of weeks to a few months, whereas conventional home construction could take four to seven months. As indicated in Table 1, containers are cheaper than conventional building construction in most cases. The cost can be further reduced with the mass production of prefabricated containers built off-site at a factory in sections and delivered to a construction site for final

assembly. Another benefit of prefabricated construction is a reduction of time and expense associated with the City's permitting and inspection agencies if HCD is the lead agency that approves the manufactured units built off-site. Notwithstanding HCD's approval, containers used as building modules or structural building components, just like any other conventional development, will need the necessary construction permits from the City.

TABLE 1: ESTIMATED AVERAGE COST OF CONSTRUCTION PER SQUARE FEET ¹

	Conventional ²	Container	Modular/Prefab ³
Single-Family	\$170	\$145	\$135
Multi-Family	\$200	\$240	\$230
Commercial	\$180	\$180	\$160

1. Estimated cost can vary depending on the specific materials used to complete the building, the amount or type of structural system designed for the building, the amount of modification made to the containers, and other external factors such as utilities, transportation, etc.
2. Assumed conventional wood-framed construction.
3. Assumed the modular/prefab's design is approved and inspected through HCD.

Both State and local agencies are now reacting to the growing trend of repurposing containers for residential and nonresidential uses. A patchwork of regulations has emerged, creating potentially conflicting and duplicative requirements from State agencies to local jurisdictions. To provide a clear path for compliance, and to help establish guidelines for future projects, the Development Services Department is engaging in and working with other local, State, and national agencies and organizations to help shape the regulations and codes that will encourage and facilitate the repurposing of containers and their safe and efficient use.

Use of Shipping Containers in Long Beach

In 2012, a residential addition at 2175 San Francisco Avenue was the first project in the City to use two containers in a residential construction. The design called for the containers to be placed on a traditional foundation, secured the containers to the rear of the main house, and added additional structural reinforcements to accommodate cutting openings into the containers for windows and doors.

More recently, a commercial project named "SteelCraft," located at 3768 Long Beach Boulevard, used ten containers of varying sizes to create both retail and restaurant spaces. The containers were placed directly on the ground and supported on the four corners by concrete pad footings. The wood flooring was removed in order to provide access to trench and install utilities under the containers and eventually reinstalled and sealed. Ramps and other site improvements were made to comply with the State's accessibility requirements. The design also called for additional structural reinforcement to accommodate the window and door openings in the containers. The developer stated that the overall cost of the project was similar to traditional wood-framed construction methods; however, the aesthetic appeal of the containers outweighed the additional costs necessary to meet building codes.

Additionally, a small office project is proposed on Artesia Boulevard, which would utilize ten shipping containers (five containers wide and two containers high) to create a two-story infill development. This project is in the conceptual stage.

The City's existing zoning and building codes already accommodate the use of shipping containers or manufactured units for housing projects. Since the City does not develop affordable housing on its own, it relies on the development community to propose the use of these alternative methods and materials. Through its experience in permitting the above mentioned projects, other local governments, including the City and County of Los Angeles, have sought out staff for advice on how to permit their own projects.

Site Plan Review / Shipping Container Aesthetics

As revealed in public comments during recent public hearings on Accessory Dwelling Units, there may be a community perception that the aesthetic quality of shipping containers is incompatible in residential neighborhoods. Homes in Long Beach neighborhoods, with the exception of designated historic districts, exhibit a myriad of building designs and have allowed for architectural creativity over time. The completed shipping container projects in Long Beach are examples that shipping containers can co-exist in many different environments. However, in a 2011 determination allowing shipping containers to be used for residential structures, the Planning Commission deemed that Site Plan Review would be required to ensure that the building design complied with neighborhood aesthetics. This will ensure that shipping containers are used in a contextually-sensitive manner.

Development Services will continue to engage in, and work with, local, State and national agencies and organizations to shape the regulations and code, to facilitate, and thus incentivize, the use of shipping containers in accordance with Item No. 3.10 of the Revenue Tools and Incentives for the Production of Affordable and Workforce Housing.

If you have questions regarding this matter, please contact Oscar W. Orci, Deputy Director, at (562) 570-6369 or oscar.orci@longbeach.gov, or Truong Huynh, General Superintendent, at (562) 570-6921 or truong.huynh@longbeach.gov.

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