

Comparison between shipping container homes and regular stick-built homes in California.

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The Research that was conducted was to examine the differences and similarities between shipping container construction and stick-built construction within residential homes in California. Shipping Container construction has grown in popularity and has continued to make its way into many different construction industries. I wanted to find the reasoning behind why this has continued to grow and if it could be a future way to construct Californian homes. This information could change how future homebuilders construct homes in California. This information could also provide a home that has a different cost, schedule, and features that could benefit the owner. After conducting my research I have found that shipping container homes do not have the potential at this point in time to replace stick built homes in California. Shipping container homes provide a simple design, affordability, a short construction schedule, and the ability to be relocated easily. While these benefits apply to smaller simple homes and ADUs when constructing mid-size to large custom homes the affordability, schedule, and flexibility of design are diminished when constructing with shipping containers. Shipping container construction has a niche for the future of construction although, it will not overcome stick-built construction in typical Californian home building.

Key Words: Californian Housing, Shipping Container, Affordable Housing, Alternate Homes, Home Owners.

Introduction

My enthusiasm for this research subject first came when I was 17 years old heading to Waterpolo practice after school. I remember passing a new house in our small town that looked very different than anything I had ever seen. It gave off a modern look but was simple with a clean design. It was a shipping container home. I thought to myself, one day I would live in a building like this. Ever since that day I have been interested in these types of homes.

The first home that was constructed with shipping containers was designed by an architect named Peter DeMaria. He constructed a home with eight shipping containers that he turned into a beach house that had four bedrooms, three and a half bathrooms, and twenty-foot ceilings. After Demaria's creation of what is now known as "The Redondo Beach House" people from all over the world started constructing homes using shipping containers. Today, there are companies that specialize in shipping container homes and this style of construction is growing. The purpose of this research is to find what the benefits and hindrances of constructing homes with shipping containers are compared to stick-built construction. These details could help determine if shipping container home construction could save people money and be a growing niche in the construction industry.

California Home Building

In California, there are many different construction methods, although there is one construction type that is the most popular for residential construction. This type of construction is known as typical stick-built construction. This consists of a concrete foundation with timber studs and framing. There

are many benefits to this type of construction and is always being improved over time. Some of these benefits include the ability to be altered easily, lightweight, good weathering abilities, cheap, and a quick construction time. A typical stick-built home can last anywhere from eighty to one hundred fifty years. If shipping container homes can improve on any of these aspects of construction it could change the way homes are built in future California.

Shipping Container Construction

Since the creation of *The Redondo Beach House* by Peter DeMaria, shipping containers of different sizes have been converted to what once was to ship goods into homes, stables, hotels, apartments, bars, and much more. The shipping containers used in construction are typically 20 feet or 40 feet long, although everything as short as a 10-foot container or as long as a 53 feet container has been used as part of a structure. The design of homes made from shipping containers varies. Some leave the ridged container exterior as the outside walls while others have the same facade as a regular home.



Figure 1: Homes Beautiful- Multi container custom shipping container home



Figure 2: Homes Beautiful- Single 20-foot prefabricated shipping container home

The same goes for size. Some homes are constructed with a single 20' container while others are multiple stories with thousands of square feet, as seen above in figure 1 & 2. These container homes have a faster construction timeline than stick-built construction and can either be built on-site or can be prefabricated off-site and assembled on a foundation. What has originally made shipping container homes stick out to their customers is the interesting new look of these buildings, the simple designs, and the affordability. In the instance of building a 20' shipping container home, the price of this small home could be at low as a third of what constructing a 20' home at the same dimensions would be. Due to the possibility of using this modern look at a cheaper cost, many businesses have started to incorporate shipping containers in construction. An example of this is at Geneseo Inn at Cass Winery located in Paso Robles California. This is a collection of an eight-unit bed-and-breakfast Inn right along The Cass winery vineyard. The Units are constructed of two containers with the interior constructed with local sustainable materials.



Figure 3: Ecotechdesign- The Geneseo Inn features at Cass Winery, Paso Robles CA.

These units were designed by Ecotechdesign a company with experience in building with shipping containers with a movement to use recycled materials in construction as seen above in Figure 3. If this construction is faster, cheaper, and more sustainable, why would we not transition toward this type of construction? This is what I wanted to find out, weighing the positive and negative traits of building with shipping containers compared to regular stick-built structures.

Methodology

My approach to data collection is passive, I simply want to gather information from both surveys as well as interviews and firsthand experiences. This will be exploratory research that compares two different methods of residential construction. I have contacted a local residential company O'SHEA construction which has agreed to interviews. Shean Oshea has agreed to help me gather the information that will help me with this research. This information I will be gathering will consist of specific project costs, regulations, timelines, zoning requirements, and post-occupancy factors. My data collection will come from different case studies that are built by these companies for typical stick-built homes in California. I have also contacted companies that specialize in building homes with shipping containers. These companies are Cahill construction Stack Homes and Ecotechdesign. I chose these container home companies because they offer custom home options and perform work in California. I will gather the same information from the following companies for container home data. This will make it more of an analytical case study trying to find similarities and differences between regular homes and shipping container homes. For the specific techniques, I will use for data collection I will conduct interviews in which I will compare the pros and cons of each method of construction within home building. The Following 32 questions helped me get to the answers of whether Shipping container homes were cheap and sustainable alternatives to stick-built homes.

Interview Questions

- What are the costs of materials compared to stick-built construction?
- Can you incorporate used shipping containers into new construction?
- What is the cost of labor compared to Stick Built Construction?
- Do you need special equipment or tools to construct these buildings?
- Are there different Permits that are required to build a shipping container structure?
- Does the precon planning and design take the same time as traditional construction?
- Does the precon planning and design cost the same as traditional construction?
- What is the procurement time for shipping containers?
- Have shipping containers gone through similar inflation as other building materials?
- Does the price of containers fluctuate often?
- Is there always a steady inventory of materials for these containers and building materials?
- Are there specific regulations with shipping containers that are not required from other methods of building strategies?
- Is it hard to find laborers that efficient with this type of construction?
- What are the most challenging aspects of building structures with containers?
- What are the benefits of building with containers?
- Do you see this method of construction expanding in the future?
- Do shipping container homes have an easier or harder time with natural weathering?
- Is there a specific climate or environment in that you could not construct this type of building?
- Is there a most favorable climate for these structures? If so what is it and why?
- Can a lot of the construction of these containers be constructed off-site like a prefabricated home?
- How are containers joined to each other or outside construction material?
- Do these homes last as long as other homes?
- Is it harder to control the temperature of the home due to the mass amounts of metal?
- How does the building's structural integrity compare to stick-built construction?

- What is the difference in timelines of container projects vs. stick built in each aspect of construction (precon/con)?
- Is the construction sequence of events different than other construction methods?
- Is there a more or less unknown risk with container construction than traditional?
- Is there a difference in the profit margins in this type of construction?
- Is there a demand for this construction? Is it hard to find jobs?
- Is this niche in construction competitive?
- What projects is container construction best suited for?
- Are there regulations on what can be built with shipping containers such as residential/commercial?

Results

Cahill Construction Jason Sommers Senior Project Manager: Jason Sommers, being a senior project manager at Cahill construction, has seen all different types of methods and materials within the construction industry. Sommers also has had experience with modular home construction. Sommers believes that shipping container homes have a specific place in the construction world and this type of construction will not be the complete future of cost-effective homes. “Shipping Container homes can be practical for an ADU unit or small prefabricated homes although with larger family homes the use of shipping containers can become impractical and might lead to less space for similar or more costly than a traditional stick-built home. The problem is when you cut containers and stack them onto each other the structural integrality of the roof is at risk. This being said the roof will have to be reinforced.” Sommers Nov. 3, 2022. The reason why this is such a cost impact is the reason why people use shipping containers in construction in the first place to provide an exterior for the home, but if you have to build reinforcements to the roof then what is the point of the container? Sommers goes on to say “Shipping container homes are also not exempt from California Code. This means insulation and fireproofing will still need to be installed. This cuts down space in an already crowded container.” For custom large homes, Jason Sommers suggests there are better solutions if cost is the main concern. There are prefabricated homes that have a fast schedule and low cost that are more suited for larger homes.

Cahill Construction Tony Pellegrini: Tony Pellegrini is an alumni of Cal Poly and was also willing to share his insight on Shipping container homes. He agreed with Jason Sommers that large houses would be hard to accomplish with shipping container construction. He believes that if someone is on a budget they could construct a small simple home with containers at a more affordable price than stick-built construction. Although Tony did not believe that shipping container construction was the best fit for custom homes, he did mention what he thought this type of construction could be perfect for. Tony Pellegrini explained to me the specific niches this type of construction could be used for. “The last project I worked on I was working out of a job site trailer. This trailer was constructed out of a shipping container (See figure 4 below). It had a door, windows, and even AC. For the duration of the project, Cahill had to rent this trailer from a second party. Although if we owned a couple of these shipping container Jobsite offices we could simply reuse them over and over and have them hauled on and off job sites just like our equipment.” Tony Pellegrini Nov. 3 2022. If Cahill owned their own containers they could control the environment that they work in and save rental costs on short-term offices.



Figure 4: A-Verdi- Jobsite Trailer constructed out of shipping containers.

Pelligrini continued to express how shipping container homes could also be used for the military due to the easy transportation and the instant ability to use the homes. He also described how they could be used for sporting events, concerts, and festivals where pop-up construction and temporary construction are found. “Shipping Container construction's best attributes are that it is fast, affordable, and transportable, and that is what shipping containers should be used for in construction.”

Bobs Containers Robert Balerdaz CEO: Robert Balerdaz is the CEO of Bobs Containers started in Austin Texas. They make prefabricated shipping container homes out of 20-40 feet containers. They have single container units starting at \$39,000 to a three-bedroom multi-unit home at \$180,000. “We are affordable and create a great recycled product for our customers.” The Homestead model at a total of 960 square feet costs a total of \$178,447 while a competing modular home company Stack Homes has their 640 square feet model starting price at \$410,000. (See figure 5 & 6 below for models.) Bobs Containers beats a lot of competition with pricing per square foot and transportation services.

"THE HOMESTEAD" FLOORPLAN



Figure 5: Bobscontainers.com- The Homestead shipping container home floorplan.



640 square feet, 1 bed, 1 bath: \$410,000
Model 640 + 3-car garage with external stairs

Figure 6: Stack Homes- 640 square feet modular home design.

O'Shea Construction Shean O'Shea Owner: Shean is the owner and manager of his residential contracting company started in Cayucos California. He has great knowledge of the construction of homes on the California coast. O'Shea is interested in the idea of shipping container homes but had a few areas of concern for the coastal environment of California. "The main areas of concern I have for building shipping container homes are the waterproofing, heating and cooling, and the engineering of the windows and doors. If you could straighten these aspects out I could see how it would be an easy way to construct a fast cheap home." O'Shea Nov.11, 2022.

Interview Question Results Summary

- What are the costs of materials compared to stick-built construction?
Most all shipping container homes material costs are lower than typical home unless elaborate custom homes need reinforcement and modifications to the structure.
- Can you incorporate used shipping containers into new construction?
Yes most shipping container homes are constructed with used containers usually used for a single shipment so they are in good condition but cheaper than a new container.
- What is the cost of labor compared to Stick Built Construction?
Similar labor costs unless extra onsite welding is required.
- Do you need special equipment or tools to construct these buildings?
No irregular onsite tools are necessary.
- Are there different Permits that are required to build a shipping container structure?
Certain neighborhoods require homes to look similar or have extremer criteria, but most can be met with shipping container homes.
- Does the precon planning and design take the same time as traditional construction?
Usually no, since the containers are certain sizes there is only so many variations that the design could undergo. The way that precon could take longer is when building a custom home with stacked containers. This can take engineers more time to figure out how to reinforce the building then it might with stick-built homes.
- Does the precon planning and design cost the same as traditional construction?

This cost is based on time allocated to precon, the rates of the engineers, architects, and construction managers will be the same. Although the time could be shorter making precon cheaper.

- What is the procurement time for shipping containers?
Depending on time of ordering usually three to five months.
- Have shipping containers gone through similar inflation as other building materials?
Yes, inflation effects shipping containers.
- Does the price of containers fluctuate often?
Not as often as other building materials.
- Is it hard to find laborers that efficient with this type of construction?
No most parts of the construction process are similar to stick-built construction.
- What are the most challenging aspects of building structures with containers?
Framing walls, insulation and reinforcement of the structure.
- What are the benefits of building with containers?
Cheap, fast, and mobility.
- Do you see this method of construction expanding in the future?
The expansion of this construction method will continue although the use might stary away from residential homes and be used for temporary structures or studios.
- Do shipping container homes have an easier or harder time with natural weathering?
Harder, because they are prone to rusting.
- Is there a specific climate or environment in that you could not construct this type of building?
Climates that are the worst for this construction would be extreme cold or hot. This is because of the conductivity of the metal and will require the home to have a professional heating or cooling system.
- Is there a most favorable climate for these structures? If so what is it and why?
A mild climate that does not change to much. The Californian coastline is ideal because the heating and cooling that will be required is minimal.
- Can a lot of the construction of these containers be constructed off-site like a prefabricated home?
Yes
- How are containers joined to each other or outside construction material?
Welding and framing in between the ridges.
- Do these homes last as long as other homes?
No, these homes if not taken care of can last as short as 40-50 years, although have the potential with proper care to last as long as a regular home.
- Is it harder to control the temperature of the home due to the mass amounts of metal?
Yes, although can be controlled with a heating and cooling system.
- How does the building's structural integrity compare to stick-built construction?
These homes are very strong and have to meet all the same structural integrity requirements as stick-built homes. Shipping container homes that are made up with only a few containers are also very safe during earthquakes.
- What is the difference in timelines of container projects vs. stick built in each aspect of construction (precon/con)?
Usually Shipping container homes are constructed faster due to the easier foundation and structural dynamics of the building.
- Is the construction sequence of events different than other construction methods?
Typically, no.
- Is there more or less unknown risk with container construction than traditional?
More since this construction method in homes is so recent and is less than twenty years old.

- Is there a difference in the profit margins in this type of construction?
Unknown. Overall, it is hard to say because I did not get a broad enough scope on this industry.
- Is there a demand for this construction? Is it hard to find jobs?
The demand for this construction is a lot lower than typical stick-built construction therefore many shipping container home builders work in multiple states, do prefabricated homes, or work in regular stick-built construction as well.
- Is this niche in construction competitive?
Due to the lack of a huge market, it is not as competitive as stick-built construction.
- What projects is container construction best suited for?
Prefabricated homes, ADU's and temporary structures.
- Are there regulations on what can be built with shipping containers such as residential/commercial?
Each State is different as well as county both sticks-built, and shipping containers homes will have to be approved through the city of which the construction will take place. Although through my research I have found no regulations against shipping container construction.

Conclusion

When comparing stick-built homes to shipping container construction neither one is superior in all aspects. Both methods of construction have their benefits and drawbacks. The introduction of shipping container homes to the Californian housing market has saved many people money on small homes and ADUs. While stick-built construction is more practical and cheap when building large custom homes with the ability to easily remodel and last long periods of time. Shipping container homes' biggest benefits are the simple design, affordability, short construction schedule, and the ability to be relocated easily. The future of shipping container homes according to those in the industry and my beliefs could be found in temporary construction, large events, and the military. Shipping container homes and construction has its strong suits but, as of now, there is no great competition to the original stick-built method of building typical homes in California.

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