

Modular Design

The Advantages for Contractors

By Ryan Cantu



Washington Redskins Public Relations & Marketing Building (Ashburn, VA) © Alan Gilbert Photography

Modular construction or accelerated building methods have been an alternative form of building permanent and relocatable structures for over 40 years. These buildings generally consist of sections (modules) that are first manufactured in a factory then shipped to a build site with all interior plumbing, electric and fit-outs already completed. Once on-site the modules are assembled, additional architectural finishes may be applied and the finished product is nearly indistinguishable from a site-built structure.

Uses

Modular buildings are best utilized for long-term temporary or permanent facilities, including construction camps, laboratories, schools and classrooms, civilian and military housing needs, industrial facilities,

churches, healthcare facilities, sales and retail offices, fast food restaurants and ticket offices.

In addition, modular construction allows for buildings to be increased or reduced in size by adding or removing modules without altering the basic construction. The same process can be utilized to create changes in functionality. So an office building can be built for a company that plans to expand in the future; and as the need arises to add more offices and conference areas, additional modules can be added to the existing building. Access points are created and the expansion becomes seamless with little interruption to the company's operation.

The same can be true for an organization that is downsizing. Modules can be removed, and if designed properly, can be sold off as a separate,



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Maryland Port Administration (Worldwide Headquarters for International Shipping Company)

smaller building. By adding or removing modules or moving the building to another location and altering the architectural design, another user can change the purpose of a building.

Construction Process

Modular components are typically constructed within a large indoor facility on assembly lines that utilize tracks to move the modules from one workstation to the next. Independent building inspectors are on-site to supervise the construction and ensure that all building codes are adhered to during assembly.

The completion of the modules can take between one to three months, while the actual construction on-site can take as little as 10 days once the pieces of the building have been transported. Sometimes a crane is brought in to set the modules, but often they are simply rolled onto the foundation using trans-lifts, a piece of equipment with tracks that a building can actually be set on and moved a short distance. Assembling the modules generally can take several hours or a few days, with the final product being indistinguishable from typical site-built construction.

Advantages

Manufacturers cite the following reasons for the typically higher Return on Investment (ROI) of modular buildings: the speed of construction, indoor construction, favorable pricing from suppliers, the ability to service remote locations, low waste and it's a more environmentally friendly construction process.

Modular buildings are cost-effective to builders and consumers because of their factory construction and because units are constructed in enclosed facilities the weather is not a factor in the construction timeline. In addition, material delivery fees are also out of the equation because ample

amount of material is always available at the facility, nearly eliminating construction delays and theft of building materials from the site.

Green Advantages

The ease of the modular construction process allows for flexible design and reuse and strengthens its position as a resource efficient, inherently greener way to build. Renovated reuse can provide advantages in sustainability and cost savings while still being as architecturally alluring as buildings constructed by more traditional methods.

The main *green* advantages found as a result of building the structure in a factory are:

- Reduced environmental impact
- Less materials waste in landfills
- Labor and resource efficiency

The National Institute of Standards and Technology's (NIST) research project, Advancing the Competitiveness and Efficiency of the U.S. Construction Industry, found that the U.S. construction industry could improve its productivity and efficiency by incorporating a greater use of prefabrication techniques. The study noted that one advantage relating to environmental impacts of off-site construction was "Fewer jobsite environmental impacts because of reductions in material waste, air and water pollution, dust and noise, and overall energy costs."

Because modular manufacturers buy in bulk and can work on multiple projects simultaneously at the same site, there is greater efficiency concerning materials usage. The strategy of ordering five to 10 percent extra material, common for on-site construction, is very uncommon in off-site facilities. On-site builders often have limited storage space at their construction sites and don't necessarily have an exact accounting of all required materials at the start of construction, leading to less efficient procurement.

Construction of modular buildings generally occurs while the site work is underway, significantly compressing the traditional construction schedule and allowing for most projects to be completed 30 to 50 percent earlier.

“The opportunities that accelerated construction brings to the construction industry are limitless and worth noting. Not only are modular buildings inherently green due to their flexibility and reusability factors, making it a good choice for owners; but new techniques and material options are making it a viable choice for contractors wanting to streamline the construction process, minimize safety liability and improve their profit margins by decreasing costs.”

-Michael Wilmot, president, Wilmot Modular Structures, Inc.

The coordination of trades that occurs at the factory also improves efficiency. No longer do electricians and plumbers have to wait until the entire building is framed in to begin work. No longer does the first floor need to be completed before beginning on the second. The streamlined and efficient work process results in fewer labor hours needed per project and thus fewer trips to the site per project.

Standards and Zoning Considerations

Typically, modular buildings are built to local, state or council code, so those built in a given manufacturing facility will have differing construction standards depending on the final destination of the modules and can be customized to meet those specific codes. For example, structures built for final assembly in a hurricane prone area can have additional bracing built-in to meet local building codes.

Surfaces and Finishes

Modular buildings can be assembled on top of multiple foundation surfaces, including a crawl space, stilts (for areas that are prone to flooding), full basements or standard slab at grade. They can also be built to multi-story heights in the form of barracks, dormitories, and motels. The height that a modular structure can reach depends on jurisdiction, but in a number of countries, especially Asia, modular structures are allowed to be built to 24 floors plus.

Exterior wall surfaces can be finalized in the plant production process or in the case of brick/stone veneers field applications may be the builder's choice. Roof systems also can be

a part of, separate from, or applied in the field after the basic installation is complete.

Building Strength

Modular buildings are designed to be initially stronger than traditional homes, with techniques like replacing nails with screws and adding glue to joints to help them maintain their structural integrity during transportation to the construction site. Despite manufacturer claims, it is difficult to predict the final building strength since modular structures endure transportation stresses that traditional homes never experience.

When FEMA studied the destruction wrought by Hurricane Andrew in Dade County, Florida, they concluded that modular and masonry homes fared best compared to other construction.

Limitations

While accelerated building methods can be utilized in a wide spectrum of applications and offer considerable flexibility to its users, there are some things to consider when deciding to implement a modular solution into a construction project that are not factors with traditional construction.

Shipping of Modules

The maximum allowable shipping heights, widths, and lengths for modules will be determined by the location where they are being fabricated and the route to the destination where they are being delivered. Accessibility to the jobsite is another factor that also needs

to be considered when preparing the site for the installation of the modules.

Installation Methods

Project size, scope, site conditions, and schedule requirements will be deciding factors on how the buildings can be ultimately assembled and erected.

It is important to assemble and bring in the team of professionals earlier rather than later in the design phase of the construction project. When this is done, it will allow for better collaboration up front and help shape the most cost effective and efficient available options for the end user's consideration.

The Future of Modular Construction

“The opportunities that accelerated construction brings to the construction industry are limitless and worth noting. Not only are modular buildings inherently green due to their flexibility and reusability factors, making it a good choice for owners; but new techniques and material options are making it a viable choice for contractors wanting to streamline the construction process, minimize safety liability and improve their profit margins by decreasing costs,” states Michael Wilmot, president of Wilmot Modular Structures, Inc.

The Modular Building Institute, an international group of businesses involved in different aspects of modular construction, believes it is not necessary for an entire project to be completed by a modular manufacturer. To capitalize on the advantages of modular construction, architects, general contractors and owners should communicate with modular manufacturers prior to a project to determine if certain components of the project lend themselves to off-site prefabrication and realize efficiencies immediately.

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