

Code Compliance and the Modular Construction Trend

What Manufacturers Need to Know to Comply with Building Codes



ANDY COUGHLIN, PE, SE
 ✉ acoughlin@structint.com

The modular construction industry is projected to grow globally at an annual rate of 6.9%, outpacing the growth of traditional construction.¹ Modular construction has many advantages over traditional building methods, including improved quality control and shorter project durations. Factory-built systems are constructed in controlled environments with equipment and materials that are not feasible at congested job sites, and project schedules can be shortened when factory work and field work are performed in parallel.

However, modular projects may stumble without proper forethought: when fabrication takes place in a factory away from the jobsite, the building officials, inspectors, and engineers can have less oversight and less recourse to implement changes if issues are discovered in the field. Code compliance may also be an issue when systems are designed by factory engineers rather than the engineer of record. To mitigate these potential pitfalls, careful planning is required at the start of the project.

SAME INSPECTIONS, DIFFERENT LOCALE



FIGURE 1. Lifting of Modular Central utility plant at Scripps Green Hospital, San Diego, California

Unlike field-built systems, where the structural system is designed ‘from scratch’ for each project and the materials selected for the project are dependent on local availability, in a modular system the manufacturer already has a carefully configured structural system designed to optimize the performance of the system on a variety of factors including space efficiency, fabrication cost, and constructability.

Rather than selecting the structural system, the structural engineer qualifying the modular system starts by checking the existing system for the required loads and detailing requirements of the local building code, recommending strengthening wherever necessary. Drawings documenting the construction can be produced by the manufacturer or by the structural engineer, or in some cases both. These drawings serve the dual purpose of communicating to factory personnel the construction methods and required details to meet local requirements, and to summarize mandated inspections and observations. Inspection and observation requirements of the International Building Code apply even if the construction is completed thousands of miles from the jobsite.

To ensure the construction is following applicable codes, the eventual owner will select a licensed building inspector qualified to oversee the fabrication at the factory. Typically, this professional will live in the region near the factory and will visit the factory at periodic intervals as key components are fabricated. Similarly, the structural engineer will visit the factory to perform construction observations, as required by code, or designate a qualified alternate to complete the required observations.

By the time the fabrication is ready to be shipped, a majority of the required inspections and observations will have been completed at the factory and only a few remaining checks will be required at the project site. These final inspections are typically related to



FIGURE 2. Modular air handling unit undergoing seismic testing

connections, e.g., where the modular components are connected to one another in the field, or anchorage, e.g., where the modular components are anchored to the site foundation.

PROJECT SPECIFIC DESIGN OR CERTIFICATE OF COMPLIANCE?

For modular systems, the International Building Code allows a manufacturer to either procure engineering services from a licensed structural engineer, as described above, or to issue a Certificate of Compliance for seismic compliance. The certification is analogous to those issued for electrical safety, mechanical performance, fire safety, and other disciplines as well as other structural performance such as wind. The certificate must be based on a products certification from an “Approved Agency” accepted by the building official.

Since 2019, SI’s in-house product certification agency TRU Compliance (www.trucompliance.com) has been IAS Accredited to the international standard for certification bodies, ISO/IEC 17065, and has been accepted as an Approved Agency by building officials nationwide. Certification engineers at TRU complete engineering analysis and testing on a variety of modular systems

and provide certifications documenting seismic accelerations and wind pressures the product can withstand. In some cases, TRU engineers work with manufacturers to assess strengthening options so products can withstand higher loads and achieve higher levels of load certification. Customizable product lines require certification documents with restrictions clearly outlined, restrictions which are necessary for the products targeted performance level to be met. After issuance of the certification document, the manufacturer can fabricate and install the certified product at unlimited locations as long as they follow the guidelines, label the product as TRU Certified with traceable reference numbers, and submit all documents to the project team at each site. They must also submit to regular surveillance by TRU inspectors and are subject to periodic renewal of their certification after TRU confirms the product, process, and management system are still in compliance. In following this process, the building officials are effectively delegating the code compliance checks to Approved Agencies like TRU.



FIGURE 3. Modular bathroom being installed at Wilshire Grand Hotel, Los Angeles²

Clearly, the certification approach has many advantages to manufacturers, but it is limited to products with set designs and configurations. Often a design of a modular system is very unique to a specific project and it is not feasible to find a certification method that encompasses all possible designs. In such cases, engineering and inspection specific to a site are required.

WHAT'S NEXT

With modular construction projected to grow faster than traditional construction, the scope of its adoption appears to be constrained only by the size of modules that can be shipped on our highways. Beyond central utility plants, the modular construction is being applied to bathrooms, apartments, office pods, and even high-rise towers. Recently, the Wilshire Grand Hotel in Los Angeles was completed using premanufactured bathrooms constructed in a factory in

Florida. This approach allowed the tallest building west of the Mississippi River to be constructed faster than what traditional methods would permit, and to the high quality standard expected of a luxury hotel.

As the world's construction methods change, codes will eventually evolve too. In the meantime, a proven method to allow modular systems to comply with existing codes needs to be followed to help deliver the speed, efficiency, and quality promised by modular construction.

SI EXPERIENCE

Structural Integrity Associates (SI) has successfully designed modular central utility plants in restrictive jurisdictions like the California Office of Statewide Health Planning and Development (OSHPD), which serves as a de facto building department for all acute care hospitals in California. In the early 2010's, SI's legacy company completed

FIGURE 4. RIGHT Modular Apartment High-Rise in Brooklyn³

the structural design and oversaw installation of the first modular central utility plant at a California hospital, Tahoe Forest Hospital. The plant was fabricated offsite and assembled in pieces at the final location in Truckee, California. Since then, SI has designed and overseen the design of numerous modular central utility plants across California at locations such as Scripps Green Hospital in San Diego, Lucile Packard Children's Hospital in Palo Alto, and Los Angeles Mission College.

Footnotes

- ⁽¹⁾ Modular Construction - Global Market Trajectory & Analytics. ResearchandMarkets.com. September 2020.
- ⁽²⁾ Ufberg, Ross. "Plug, Play and Flush: Why modular bathrooms are gaining in popularity." Built, The Bluebeam Blog. October 11, 2017. <https://blog.bluebeam.com/plug-play-flush/>
- ⁽³⁾ Photo by SHoP Architects. Obtained via dezeen magazine <https://www.dezeen.com/2016/11/18/worlds-tallest-modular-prefabricated-apartment-tower-shop-architects-brooklyn-new-york/>

