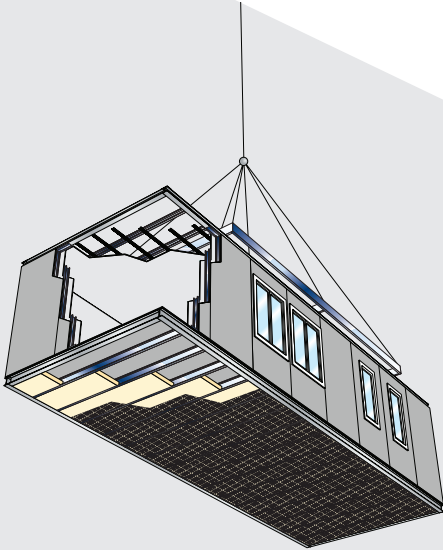


THE RISE OF MODULAR CONSTRUCTION AND ITS EFFECT ON DESIGN



ENSURING EFFICIENCY

Modular construction, sometimes referred to as off-site construction, is transforming the construction industry. Though it started out as a way to create temporary buildings, it has transformed into a common way of building permanent structures.¹ Its promise of efficiencies makes it enticing to architects, specifiers and builders alike.

Permanent modular construction is the process of building a module within a controlled setting and transporting it to a job site for assembly into a complete structure.² This type of construction has changed the way architects and specifiers plan and design. With modular construction, integrated design is critically important because it forces designers to build more efficiently. It encourages them to see buildings as a series of interconnected components and to compartmentalize mechanical, electrical and structural systems, which can lead to more efficient, lower-cost buildings. Since decisions on materials and systems must be made and finalized as the modules are designed and before construction begins, this process enables architects and specifiers to work hand in hand and ensures the best results for the completed structure.

There are many additional benefits to modular construction, including:

- Ensuring efficiency
- Better construction quality management
- Reducing delays
- Sustainability

UNIFORMITY OF MODULES

Design flexibility is a benefit of modular construction—there is no project too big or too small. It can be used for a single component in a building, such as a modular partition for hospital walls or a bathroom pod, or extended into the framing of an entire structure, such as a hospital, hotel or multifamily housing unit. For designers, seeing the repetitive components in a building helps them build more efficiently, significantly reducing costs over stick-built buildings. The more components that are copied and used again, the lower the building cost.

REDUCING DELAYS

Modular construction ensures a superior quality of construction. Modules are manufactured in a factory, where job-site risks of inclement weather and human error are minimized. Quality-control programs and procedures are implemented in the manufacturing facility, ensuring a higher quality building. Once complete, the modules are transported to a permanent location, where they're stacked and secured much like building blocks. The materials used to build modules are the same as those used on construction sites, so there's no compromise on the quality of the unit.

Reducing job-site delays is another benefit of modular construction. Weather is often a major factor when jobs get pushed off schedule, as rain, strong winds and freezing temperatures impact installation time. With modular construction, since a majority of the construction process takes place in a factory, weather is no longer a risk factor.

Another job-site concern is a potential lack of on-site storage. Oftentimes, the footprint of the structure is equal to the footprint of the land. This does not allow for storage of materials on site, making modular construction the only solution for the job. This quickens installation time, as the modules are shipped to the site and installed into their final position right off the truck.

It's also possible to condense overall construction schedules with modular construction. Depending on the modular builder, modules can arrive on a job site up to 95% completed, ready for installation and final finishing. This is advantageous to construction crews, as it lessens the amount of work that takes place on the job site.

SUSTAINABILITY

DESIGNING WITH MODULAR IN MIND

PRODUCT INFORMATION

See usg.com for the most up-to-date product information.

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SCP69-USA-ENG/rev. 2-19
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According to the Environmental Protection Agency, 534 million tons of construction and demolition debris were generated in the United States in 2014.³ Modular construction can greatly reduce construction waste because of the efficiencies involved in the construction process.

USG has a portfolio of products designed for use in modular construction: USG Structural Solutions. The panels in this portfolio have great structural characteristics, but are light relative to other noncombustible construction materials. USG Structural Panels, also known as USG Structo-Crete™, are cured and subject to a rigorous manufacturing quality-control program. There is no site mixing of construction components; the panels are shipped ready for installation. After fastening, electrical and mechanical services can be installed immediately—there's no time spent waiting for the panels to cure.

Since modular buildings are manufactured away from the final job site, these building components need to be transported over roads and highways. Oftentimes, the stresses on the structure while traveling 60 miles per hour down roads filled with potholes can be greater than the stresses in the final resting position. Furthermore, the cost of transport is directly proportional to the weight of the building component; a strong, lightweight noncombustible panel, when incorporated properly into a structural design, can provide great benefits to a modular builder.

Specifically, USG Structural Panel Concrete Subfloor and USG Structural Panel Concrete Roof Deck are ideal for modular construction. These products are high-strength reinforced concrete panels for use in noncombustible construction, and are lighter than precast or poured concrete. Though they're lightweight, they do not compromise on fire resistance or life safety. The panels install like wood sheathing and provide a new, faster, easier and more efficient way to build floors, roofs and walls.

Additionally, these two products now carry the thinnest and one of the lightest UL-certified assemblies available for modular construction, making them a premier choice among building professionals. The UL-certified fire design H501™ is a two-hour rated floor/ceiling assembly that makes the overall height of modular buildings competitive or lower than traditional stick-built buildings. It requires only a single layer of drywall as the ceiling without any required floor coverings or underlayments on top.

In the UL-certified fire design H501™, each structural member in the system—USG Structural Panel Concrete Subfloor, the floor joists and the structural steel beams—was loaded to its respective maximum allowable load for the duration of the fire test, eliminating load restrictions on the structural components in the final published design. In fact, even the ceiling was loaded to simulate the weight of the sprinkler piping, ductwork and lighting.

Since module framing and floor joists were incorporated into the fire test, the assembly affords modular professionals the flexibility to create open floor areas with multiple, adjacent modules without walls for open dining rooms, lobbies or common areas, while still maintaining the two-hour floor/ceiling rating.

USG Structural Solutions offer a multitude of benefits, including:

- Noncombustibility
- Nonrotting
- Moisture, mold and termite resistance
- Dimensional stability
- Fast installation in three easy steps: lay, fasten, finish
- No pouring, setting or curing
- An alternative to poured, precast or CMU block

USG Structural Panels deliver the requirements for a compressed schedule, allowing for design flexibility without compromising on life safety. For modular construction, these panels are an ideal solution that is advantageous to all involved in the design and construction process—architects, specifiers, designers, builders, owners and tenants. The demand for modular construction has increased in recent years, and is expected to rise in the years to come.

Notes:

- 1 Information courtesy of Design of Modular Construction
- 2 Information courtesy of the Modular Building Institute
- 3 Information courtesy of the Environmental Protection Agency