



# The Safety Advantages of Prefabrication and Modular Construction

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Chubb Global Risk Advisors

## Are You Aware of the Safety-Related Benefits Associated with Prefabricated and Modular Construction?

Modular construction, prefabrication, and offsite construction are terms which are often used interchangeably, although they have subtle differences. All three are types of construction in which techniques from manufacturing are being utilized to improve the construction process. They also reflect the industrialization of construction.

In prefabrication, a building or building components are made in a more controlled environment than is offered at a traditional construction site. Prefabrication has been defined as “a manufacturing process, generally taking place at a specialized facility, in which various materials are joined to form a component part of a final installation.”<sup>1</sup> This approach typically involves a single trade, such as electrical, piping, or rebar. Prefabricated or modular construction allow various building components such as bathrooms to have pre-wired light fixtures and exterior walls built in a factory setting, and then transported to a construction site.

In terms of safety, think of modular or prefabricated construction as a construction process rather than a specific type of building. The key is how the building was constructed, not what the building is.

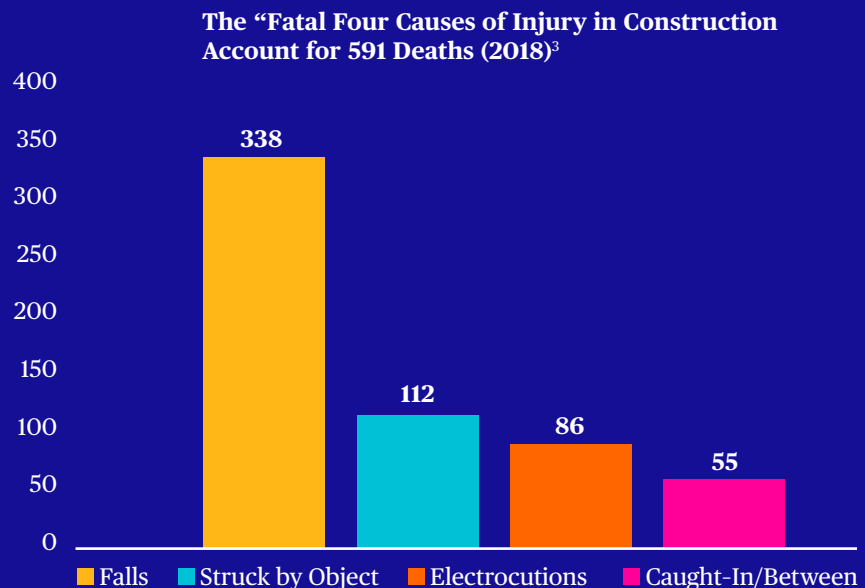
The construction industry is one of the most dangerous fields to work in. Out of every 5,000 private-industry worker fatalities, 20 percent are in construction. That means one out of every five worker deaths is construction-related. According to the Department of Labor (DOL), Construction workers accounted for 1,008 (47 percent) of all fatal work injuries in 2018. Utilizing modular or prefabricated construction should be considered as an approach that can reduce the likelihood of fatalities and injuries on the traditional construction sites.

## Construction's “Fatal Four”

1. Falls
2. Struck by object
3. Electrocution
4. Caught-in/between

According to the Bureau of Labor Statistics (BLS),<sup>2</sup> in calendar year 2018 there were 4,779 worker fatalities in private industry; of those 1,008 or 21.1% were in construction. This equates to one in five worker deaths last year occurring in the construction industry. The leading causes of private sector worker deaths in the construction industry (excluding highway collisions) were falls, followed by struck by object, electrocution, and caught-in/between. These “Fatal Four” were responsible for more than half (58.6%) the construction worker deaths in 2018, BLS reports. **Eliminating the Fatal Four would save 591 workers’ lives in America every year.**<sup>3</sup>

Falls are the number one cause of construction worker fatalities, accounting for one-third of all on-the-job deaths in the industry. In 2017, there were 366 fall fatalities out of 971 total fatalities in construction.<sup>2</sup> Falls are a hazard found in many work settings, but construction has the most fatal falls out of all industries and represents 51% of all falls nationally.<sup>4</sup>





### **How Modular Construction Can Reduce Construction Risks**

With modular and prefabricated construction, much of the work being performed occurs in a manufacturing setting, where the likelihood of fatality and serious injury is lower than in on-site construction. Incorporating modular and prefabricated components into a construction project can help to reduce the top causes of construction site injuries and fatalities.<sup>5</sup>

#### **Reduced Risk of Fall-Related Injuries**

Performing much of the work offsite allows for the reduction of risky construction site elements such as scaffolding, ladders and working at heights. With falls as the number one cause of workplace fatalities in construction, maximizing the work done at ground level can have a big impact. According to the Center for Construction Research and Training, ladders accounted for 24% of fatal falls in construction with scaffolding involved in an additional 15% of fall-related fatalities.

To the extent possible, eliminating or reducing the use of ladders can significantly reduce the risks in construction. Approximately 65% of all construction workers perform work on scaffolds, exposing workers to the risk of falls, electrocutions, and falling objects. With prefabricated or modular construction, more work is performed at the ground level, and the need for working at heights is reduced in general. Additionally, the prefabricated/modular construction process reduces the need for climbing to potentially dangerous heights to build each module. The typical height of a prefabricated modular unit ranges from 8 to 10 feet tall. This reduction in height alone can prevent a significant number of accidents that occur due to falls.

#### **Reduced Risk of Struck by and Caught-In/Between Injuries**

One of the most significant differences between traditional and prefabricated/modular construction is that the latter takes place away from the construction site in a controlled factory environment. An assembly-line-like work process is set up for the manufacturing of the building components. Team members know their work area well, understand the areas of caution, and are specialized in their tasks. Because of this well-organized workflow and process, there is a significantly reduced chance of being struck by machinery, equipment, or other objects – frequent occurrences on traditional construction sites. Manufacturing construction components away from the jobsite can reduce the amount of foot traffic occurring at the job site. This simple change means fewer workers onsite and fewer workers who can potentially be injured, killed, or otherwise involved in a caught-in/between or struck by an object accident.

#### **Reduced Risk of Weather-Related Injuries**

The controlled environment of an indoor manufacturing setting keeps out any weather hazards that may present themselves in a traditional construction environment. When the process takes place indoors no rain delays or slippery surfaces should occur due to weather. The likelihood of slips, trips and falls is reduced inside indoor environments. Hazards such as temperature extremes and high winds can be eliminated when building components are prefabricated indoors at an off-site location.

#### **Reduced Risk of Inattention**

Since the prefabricated component or structure is a module, workers have one large object to focus solely on rather than many moving parts. With employees' attention centered on the modular structure, workers can focus on one thing at a time during the installation of the module and not be distracted



by multi-tasking. Overall, these pre-assembled structures make the construction process more efficient and reduce site disruption and wasted time.

### **Reduced Time on Site Due to Improved Efficiency**

In addition, with modular/prefabricated components, the overall construction process can often be quicker than traditional, onsite construction. By finishing the project roughly 30% to 50% faster, construction workers will be spending far less time in a potentially hazardous situation, reducing the chance of all potential injuries.<sup>6</sup>

### **Increased Quality Control/ Reduced Exposure to Construction Defect Claims**

In addition to reducing the potential for workplace injuries, prefabricated/modular construction can also help improve quality and efficiency.

The controlled environment of a manufacturing facility lends itself to more thorough quality control testing and traceability of components that allows the team to identify and correct glitches before the module arrives at the worksite. Additionally, the factory environment allows for more accurate construction, tighter joints and better air filtration, which in turn allows for better wall insulation and an increase in energy efficiency. Getting it right the first time saves all parties time and money and can help reduce exposure to construction defect claims

Overall, modular construction can provide a variety of advantages over traditional construction methods, but perhaps the most essential is the safety it provides the employees working on the project. The prefabricated/modular construction process itself sets up

standardized workflows that encourage specialization and a better understanding of duties and environments, allowing for far fewer accidents to occur in comparison to a typical construction site. Then when the structure is delivered to the project site, all that is left is installation.

### **Managing the Safety Hazards Associated with Modular and Prefabricated Construction**

While modular and prefabricated construction processes can reduce some of the safety risks associated with traditional construction sites, this approach does have its own hazards that must be managed. The Rinker School of Construction Management at the University of Florida, Gainesville, Florida conducted a study that closely examined 125 injuries that occurred on in manufacturing facilities and onsite construction projects that installed or utilized prefabricated/modular building components. Their findings provide a blueprint for safety managers seeking to control hazards associated with prefabricated/modular construction.

#### **Cranes**

Unlike most other traditional construction sites, a job site with prefabricated/modular installation requires a large crane to lift modules (boxes) onto the foundation or structure. An acute focus on crane safety is required on job sites where prefabricated modular units are being installed. Having a clear understanding of the loads involved and the capacity and reach of the site crane will be paramount. Chubb Global Risk Advisors™ suggests only using highly experienced qualified crane and rigging companies to perform these tasks. Pre-planning hoisting operations involving large modular units are essential to avoid significant incidents.

#### **Rigging**

Rigging of each modular component is another area where additional focus is needed. In many cases customized rigging is required when lifting the modular components. Having the correct rigging equipment and trained and qualified personnel is essential for this type of work.

### **Moving Prefabricated Components to and Around the Site**

Based on the accidents found in studies of prefabricated/modular construction sites, precise pre-job planning to properly clear the work area around and under moving components should be a primary concern for contractors. The OSHA standard 1926750(k)(1) states “Requirements for Lift-Slab Operations can be considered as a basic safety practice for moving prefabricated/modular components.” According to this standard “no employee, except those essential to the jacking operation, shall be permitted in the building/structure while any jacking operation is taking place unless the building/structure has been reinforced sufficiently to ensure its integrity during erection.” Ensuring employees do not work under or near a live suspended load is an area that will require additional focus.

Securing modular/prefabricated loads during transportation, lifting and storing, is another area of emphasis. Most modular units are transported on a semi-trailer and are often oversized loads, requiring specialized planning and routing to transport the large components. Chubb Global Risk Advisors suggests only hiring trucking and fleet specialists that have experience in large oversized load transportation.

### Appropriate Temporary Connections

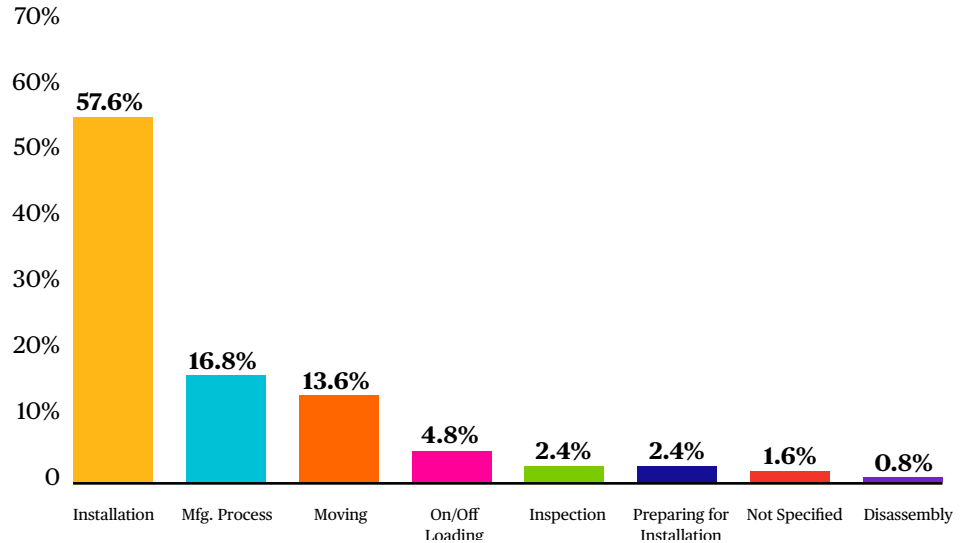
Stabilizing and securing temporary connections of modular/prefabricated structures during their installation is an essential area contractors need to pay attention to. Support connections with this type of construction require special and innovative design, training, and preplanning. The table on the right illustrates accidents related to prefabricated/modular construction. The table focuses on the activities taking place at the time of the incident, showing 57.6% of the accidents associated with prefabricated/modular construction occur during the installation phase on project work sites. Effective and thorough preplanning of the installation process is a critical part of a safety program.

### Manufacturing Hazards

Modular/prefabricated building construction is essentially the fabrication of building components in manufacturing plants. The intent is to improve quality, enhance safety, reduce construction time, minimize waste and improve energy efficiency. The manufacturing process involves risks that must be addressed as well. Keep in mind that work in the facilities fall under the General Industry Standards OSHA 1910, not OSHA 1926 (Construction). It is important to be aware of the potential hazards and different regulations and requirements in manufacturing as opposed to a construction environment.

The Rinker School study demonstrated that there is a significant difference in the nature and severity of onsite and off-site construction accidents. Approximately 62% of the accidents associated with prefabricated/modular construction occurred on construction sites, while only 18% occurred at manufacturing plants. The location was not clearly identified for 20% of the accidents.

### The Majority of Injuries Associated with Modular Construction Occur During Installation



“In general, it can be concluded that on-site working environments pose greater safety risks than off-site construction operations. Safety can be expected to improve by fabricating as many components as possible in manufacturing facilities.”<sup>7</sup>

Although the manufacturing environment is generally a safer and more productive work setting, companies that perform prefabricated/modular construction should be aware of the hazards associated with this unique type of construction. Chubb Global Risk Advisors has experience in both the construction and manufacturing industries assisting our insured in avoiding accidents by providing sound loss control advice.

### Need a hand?

Whether you already utilize prefabricated or modular construction or are thinking of incorporating them into your construction process, it's important to have a robust safety program that helps you address all the exposures associated with your projects. Business as usual can make it hard to identify many exposures that often go unnoticed. New processes bring new hazards.

Risk management specialists can help you assess your workplace and work processes, identify risks to your employees or gaps in your safety program, and create a tailored solution. For example, they can help you explore the following questions:

- What are the specific loss drivers on your projects?
- How does your data on the “Fatal Four” compare to industry averages?
- How might incorporating modular or prefabricated construction make your worksites safer and reduce injuries?
- What types of projects need an onsite safety manager? How many?
- What set-up requirements should be implemented for cranes working on modular installation and other construction site work? What size, capacity and reach are necessary for a crane on your work site?
- How are the modular units transported to the site?
- What process do you follow for modular installation? Can the process be improved to reduce risk?

- What are the risks at the manufacturing facility? This process is often overlooked and should be reviewed to reduce risk

Risk management specialists can also evaluate the effectiveness of management control programs and operational controls in place to reduce or minimize fall exposures and other risks to employees. They can work with you at every phase of the prefabricated/modular construction process from pre-job planning and hazard assessments to Job Safety Task Analysis (JSTA) and fall protection requirements in order to eliminate, prevent, protect, and monitor controls and to identify additional controls needed.

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#### Footnotes

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