OWNER'S GUIDE TO PREFABRICATION

(rev. 12.10.20)

This guide is designed to provide owners and facility managers with the information needed to help them make more informed decisions on the use of Prefabricated Cold Formed Metal Stud Wall and Floor System technology. Please feel free to contact Klover directly for project specific guidance or to schedule a continuing education program.

1. What is Prefabrication?

The National Institute of Building Sciences defines prefabrication as the "Planning, design, fabrication and assembly of building elements at a location other than their final installed location to support the rapid and efficient construction of a permanent structure". It is also referred to as offsite construction, industrialized construction, modern methods of construction or "design for manufacture and assembly".

Prefabrication is unique in that it helps solve the traditional construction paradigm of time vs. money vs. quality vs. scope. Time is reduced due to the ability of prefabrication to allow concurrent construction activities. For example, wall assemblies can be fabricated while concrete footings are being poured. Money is typically saved due to productivity gains due to fabricating in a controlled environment vs. in the field. Quality is improved due to factory precise fabrication and oversight. Scope can be expanded while minimizing overall cost impacts because of the improvements made with time, money, and quality.

2. What size and type of projects are best suited for Prefabrication?

In general, almost all projects are candidates for prefabrication to some degree. Factors to consider include project delivery method, size, location, time of year, schedule, budget, contractor preferences and labor requirements (Union/Open Shop/Prevailing Wage).

Facilities with repetitive walls make ideal prefabrication projects using cold formed metal framing. Examples include hospitals, healthcare facilities, hotels, dormitories, condominiums, mixed use, apartments, office buildings/towers and casinos. Projects with compressed schedules, site restrictions, limitations on work schedules/hours can be ideally suited to prefabrication. For example, college dormitories that need to open in time for the fall semester are excellent candidates for prefabrication. City center projects where space for construction activities is extremely limited benefit by just-in-time delivery of wall sections, minimizing the need for onsite material storage and laydown areas. Projects in neighborhoods where work hours are limited by local regulations benefit by having much of the construction activity take place in offsite factories.

Another advantage to using prefabricated wall assemblies is that there is *virtually no limit* regarding façade choices. Brick, synthetic stucco, stone veneer, metal panels, ceramic tile, and insulated metal panels are all easily adapted to prefabricated walls due to the cold formed metal stud framing used for these systems.

3. <u>What are the Project Delivery implications when using Prefabrication?</u>

Project delivery is the term used to indicate how roles, responsibilities, risks, and rewards are assigned among the parties involved in the design, document preparation, construction, and management of a project. In other words, project delivery defines the relationships between each of the main parties involved in the project. Design/Bid/Build, Design/Build, Design/Negotiate/Build, Integrated Project Delivery, Construction Management (fast track) and Owner/Build are all terms used to describe different forms of project delivery.

Prefabrication is possible with all delivery methods, but those that allow early communication and collaboration between the stakeholders are the best candidates. Owners, architects, engineers, contractors, and fabricators all need to be communicating *early and often* for the benefits of prefabrication to be fully realized. This is because prefabrication requires some engineering and design decisions be made *earlier* in the process which then allows improved project scheduling, sequencing, cost certainty and risk management. For example, walls can be fabricated while the foundation is being poured, something that is not possible with the traditional design/bid/build project delivery process where all construction activity takes place on the jobsite and is sequential. Due to the change's prefabrication has on individual trades regarding scope and sequencing, the decision to use this process is best made *prior to finalizing construction documents* and *before the bidding process*. Project funding is

not a consideration as prefabrication has a successful track record with both public and private sector projects.

Design/Bid/Build is the most traditional project delivery method where the design and construction documents are completed prior to bidding and construction, and the contractor is selected based on bid results. This method is the *least favorable* to prefabrication because there is limited communication between the owner, architect, and general contractor prior to bidding. Prefabrication can work with design/bid/build projects but is less common, and the process is referred to as "conversion". Challenges with conversion include scopes that change *after* the bid which affect scheduling, material procurement, trade coordination, budgets/credits etc. Examples of scope change might include materials and labor for structural steel supports, floor decking closures, pour stops, brick shelves, bracing etc. Flexibility and cooperation between the general contractor, subcontractor and material suppliers are necessary to minimize disruption due to post-bid scope changes. Specifically, the ability to fabricate wall and floor assemblies earlier in the process while foundation work is being done is lost when the project is "*converted"*. *However, some projects still find enough efficiencies with conversion to overcome these initial challenges.*

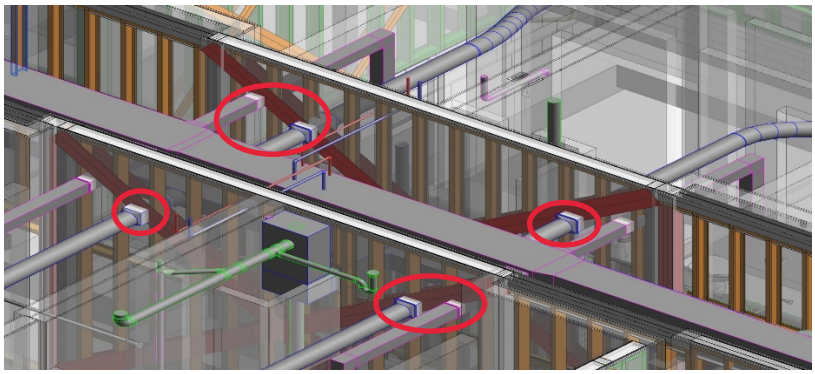
4. <u>What differences are there with the design process when using Prefabrication?</u>

The biggest differences from a design viewpoint involve the use of significant amounts of design assist and delegated design supplied by the prefabricator. Per the American Institute of Architects (AIA), "Design assist describes a form of collaboration where a *contractor provides information to assist a design professional* usually before pricing for the work has been agreed upon or before the work has been awarded…".

The AIA defines delegated design as "a form of collaboration between a design professional and contractor where the *contractor assumes responsibility* for an element or portion of the design…". Delegated design is usually part of a contract awarded for a scope of work, and in the case of prefabrication would involve the responsibility for developing specific design details of the prefabricated wall assemblies.

Both design assist and delegated design are inherent with using prefabrication. The prefabricator needs to work closely with the project architect and general contractor for cladding attachment details and air/water/vapor/thermal control layer design and continuity. Prefabricators and their specialty structural engineers will need to work closely with the structural engineer of record for panel attachments, shear walls, structural vs. non-structural wall/partitions and floor deflection accommodations.

Another area of distinction is the extensive use of building information modeling (BIM) by prefabricators to identify conflicts (clash detection) between various components such as the location of stud walls and structural supports in relationship to mechanical, electrical, and plumbing components. The ability to identify and locate these components digitally before they are physically constructed eliminates a multitude of design and construction issues common to site-built assemblies.



More sophisticated prefabricators also use BIM to help manufacture wall assemblies, greatly improving quality, fit and finish.

5. **What are the cost implications of Prefabrication?**

When speaking about cost the conversation often revolves around square foot or initial cost. It is typical for prefabrication to lower initial cost in many projects. However, there are many other costs that impact project feasibility. Due to the schedule compression that occurs with prefabrication, it reduces the amount of time a construction loan is open, thereby lowering the cost of borrowing. Opportunity costs are also lowered due to the shorter project schedules, making capital and credit available sooner for other projects. General conditions is a term used to describe costs incurred during a construction project that will not form part of the actual product, and may include items such as temporary power, sanitation, jobsite trailers, supervision, material storage and security etc. By compressing the schedule, prefabrication lowers these "overhead" costs vs. traditional site built construction. Owner Controlled Insurance Programs (OCIPs) benefit because work being performed offsite does not need to be covered under the program, resulting in lower premiums. Environmental costs including waste and energy use are lowered due to extremely efficient factory production. The most important cost savings to many owners is *speed to revenue.* The sooner the project can be completed, the sooner it can begin generating revenue for owners/investors.

In summary, prefabrication improves *cost certainty* and reduces the risk of overruns.

5. **What effect does Prefabrication have on quality?**

Prefabrication is more precise than field-built assemblies. Jigs are used to create wall assemblies providing an exact fit and finish. BIM files can be directly imported into the manufacturing equipment, eliminating human error. Working conditions in a factory are controlled to eliminate moisture and temperature issues, and weather no longer plays a role in the quality of fabrication. Many prefabricators undergo rigorous third party inspections and maintain product approval reports with agencies such as the International Code Council – Evaluation Services (ICC-ES) to ensure the products they produce are code compliant and of high quality.

Panels are inspected prior to shipment, loaded onto flatbed trailers and shipped directly to the jobsite. From there they are lifted from the trailer via crane and immediately installed on the structure, greatly reducing the chances for damage on the jobsite.

7. How does Prefabrication affect Project Specifications?

In most instances, the previously mentioned project delivery methods will dictate that the general contractor in conjunction with the owner makes the final decision on who is the prefabricator due to the means and methods nature of prefabrication. The architect should also have considerable say in the selection process because of the delegated design and design assist support that *must be provided by the prefabricator.*

A good starting point for the selection of qualified Prefabricators include the following:

- Evidence of code compliance with ICC-ES Approval Report or similar
- Verifiable quality control processes including third-party plant inspections
- Proven design assist and delegated design capabilities
- Experienced specialty structural engineering support
- BIM modeling capability
- Experience with projects of similar size and scope
- Masterformat specifications
- Geographically located to support the project

Companies who can provide prefabrication, installation and traditional carpentry services are usually preferred due to their ability to provide a *single source solution.* This minimizes conflicts between trades by consolidating much of the work under the prefabricator.

8. Can Prefabrication be used for renovation projects?

Due to the ability to provide load-bearing interior wall panels, prefabrication can be used for extensive remodels. This project located in Trenton, N.J. began as the Clark Street Rope Shop, and was converted into what is now known as the Roebling Lofts Apartments. This project has panelized structural demising walls, which supported the panelized stud joist floor of each unit's sleeping space. Interior walls and partitions were also panelized. The 135,400 SF 4-story building was given new life through efficient BIM modeling that expedited design and layout.

9. <u>What are the environmental benefits to Prefabrication?</u>

Prefabrication has many environmental benefits due to a far lower scrap rate than site-built assemblies, use of recycled steel components, extensive recycling of scrap materials and economical freight from manufacturing plants to jobsites due to the flat configuration of most wall assemblies. Standard 48' long flatbed trailers regularly accommodate 5,000 sf or more of wall panels per load. In addition, some prefabrication factories are powered by green energy, further reducing their environmental footprint. Industry Environmental Product Declarations are available through the Steel Framing Industry Association.

10. <u>Where can I get more information about Prefabricated Cold Formed Metal Solutions?</u>

- *<u>SFIA (Steel Frame Industry Association)</u>: <u>https://sfia.memberclicks.net</u>*
- *Cold-Formed Steel Framing Resource Center for Building Professionals:* <u>https://www.buildsteel.org</u>
- *Steel Framing Alliance:* <u>www.steelframingalliance.com</u>
- *Klover Inc. & Contracting:* <u>www.kloverinc.com</u>

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