ARCHITECT'S GUIDE TO PREFABRICATION

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This guide is designed to provide architects 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, client 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.

One of the main aesthetic advantages of wall prefabrication is that although it is most cost effective with repetitive designs (wall sections with similar widths, heights and framed opening locations – see figure 1), there is *virtually no limit* regarding façade choices (figures 2-4). ACM/MCM, brick, stone veneer, metal, 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>

Prefabrication is possible with all delivery methods, but those that allow earlier coordination between the parties are the best candidates. Design/Build, Design/Negotiate/Build, Integrated Project Delivery, Construction Management (fast track) and Owner/Build are all excellent choices for prefabrication. The architect, engineer, contractor, and fabricator all need to be communicating early and often for the benefits of prefabrication to be fully realized. This is because prefabrication requires *earlier engineering and design decisions* to improve the project schedule and sequencing. The best way to think of it is that certain decisions need to be made earlier in the project so that *concurrent activities* can happen. For example, the walls can be fabricated while the foundation is being poured, not afterward like traditional construction. Due to the change's prefabrication has on individual trades regarding scope, the decision to use this process is best made *prior to finalizing construction documents* and before the bidding process. Prefabrication works well with both public and private sector projects.

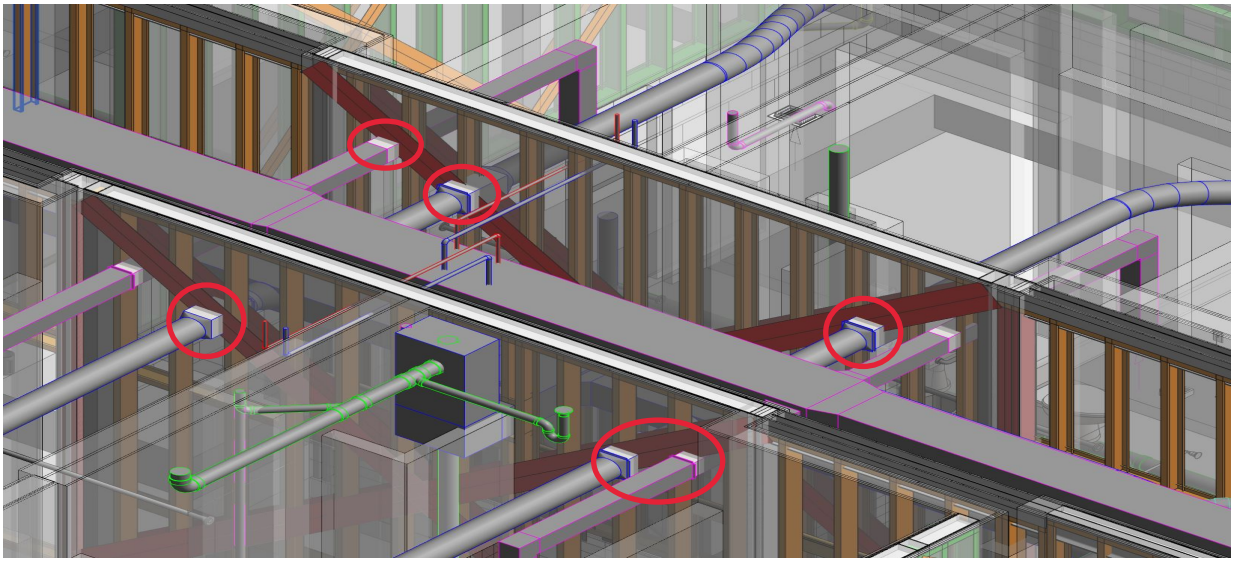
Prefabrication can also work with Design/Bid/Build projects but is less common. This process is referred to as "conversion". Challenges include scopes that change after the project bids, which affect scheduling, material procurement, trade coordination, budgets/credits etc. Examples of scope change might 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 after bidding*. *However, some projects still find enough efficiencies with conversion to overcome these initial challenges.*

In most instances, the previously mentioned project delivery methods will dictate that the general contractor or owner makes the final decision on who is the prefabricator due to the means and methods nature of this process. However, the architect should have considerable say in the process because of the delegated design and design assist support that *must be provided by the prefabricator.* Forming solid working relationships with prefabricators *before* you need them is always good policy.

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 delegated design and design assist supplied by the prefabricator. They need to work closely with the project architect for cladding attachment details and air/water/vapor/thermal control layers. 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 for clash detection, especially at corridors (figure 3). Mechanical, electrical and plumbing components are all located within these areas. The ability to identify and locate these components digitally before they are physically constructed eliminates a multitude of design issues common to site-built assemblies. Firewalls can also be incorporated into prefabricated corridor racks greatly simplifying detailing and construction.



Good prefabricators also use BIM as manufacturing equipment inputs, greatly improving quality and precision of the wall assemblies. It is common for more advanced prefabricators to use a minimum "400 level" of BIM design which includes complete fabrication, assembly and detailing information.

5. <u>What are the cost implications of Prefabrication?</u>

When speaking about cost the conversation often revolves around square foot or initial cost. However, the cost benefit of prefabrication is a much larger subject and has many components. Not only does prefabrication often lead to lower initial costs, but also reduces financing costs, general conditions, opportunity costs, environmental costs and most importantly to owners, speed to revenue. Compressing the construction schedule and utilizing offsite fabrication help improve *cost certainty* and reduce the risk of cost overruns.

6. How does Prefabrication affect Project Specifications?

In most instances, the previously mentioned project delivery methods will dictate that the general contractor or owner makes the final decision on who is the prefabricator due to the means and methods nature of this process. However, the architect should have considerable say in the selection process because of the delegated design and design assist support that *must be provided by the prefabricator.* Forming solid working relationships with prefabricators in your area *before* you need them is always good policy.

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, minimum 400 level of design
- Experience with projects of similar size and scope
- Masterformat specifications
- Geographically located to support the project

Prefabricators need to qualify and understand the same issues that Architects do when evaluating an opportunity. Reach out to them early in the process for assistance, and to gauge their level of interest in the project as well as their capabilities. *Companies who can provide prefabrication, installation and traditional carpentry services are usually preferred due to their ability to provide a single source solution.*

7. 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. MEP coordination between units and across corridors was performed by the panel system prefabricator.

8. What are the environmental benefits to Prefabrication?

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.

9. Where can I get more information about Prefabricated Cold Formed Metal Solutions?

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