# Pre-Manufactured Wood Trusses

*The Impact of Deferred Submissions and Cost Silos*

*By Kirk Grundahl, P.E.*

**2018 IBC Chapter 1**

[A] 107.3.4.1 Deferred submittals

Deferral of any submittal items shall have the prior approval of the building official. The registered design professional in responsible charge shall list the deferred submittals on the construction documents for review by the building official.

Documents for deferred submittal items shall be submitted to the registered design professional in responsible charge who shall review them and forward them to the building official with a notation indicating that the deferred submittal documents have been reviewed and found to be in general conformance to the design of the building. The deferred submittal items shall not be installed until the deferred submittal documents have been approved by the building official.

Component Manufacturers (CMs) are often a misunderstood business in the construction industry, specifically by the structural engineering community. CMs are a key supplier of load path resisting structural elements. Premanufactured roof trusses are one such element. Typically, the process of developing both the architectural and structural plans for a building designates "trusses by others." By definition, trusses then become a deferred submittal. Given that trusses are the primary structural framework that provide resistance to the load path as load flows from the roof to the walls and floors to the walls and foundation, the concept of trusses being a deferred submittal presents both engineering and communication challenges.

Given these challenges, why is this the preferred method in the market? Generally, cost; much of the root cause of the problems we all face in the construction industry can be traced to a singular focus on lowest cost. The engineer's silo of work is bid out. This used to be illegal, due to concerns over cutting corners given that structural design should place life-safety above cost. Engineering service fees used to be one to two-and-a-half percent of the project value. From personal experience, fees can now be one-half percent or less. Each silo of work has essentially become a commodity. That cost squeeze has had a significant impact on the ability of the supply chain to collaborate and communicate well.

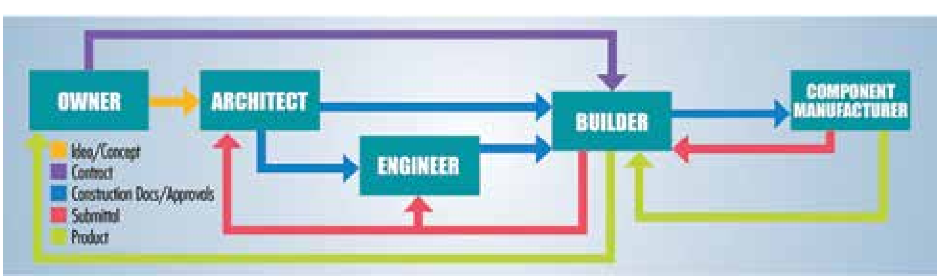
## ANSI/TPI 1 Scopes of Work

CMs utilize engineering in their value proposition because they supply the primary load path resisting elements. As mentioned above, the building owner or the Building Designer/Structural Engineer does not contract with the truss manufacturer to provide their engineering and manufacturing expertise at the design development stage of the project. Thus, the designation "trusses by others."

To help navigate the potential for misunderstandings and misperceptions, and also for contract relationships, CMs rely on the scopes of work (SOW) outlined in ANSI/TPI-1 (TPI) Chapter 2, *Standard Responsibilities in the Design and Application of Metal-Plate-Connected Wood Trusses*. This standard, as Brent Maxfield outlined in his STRUCTURE magazine articles (March and April, 2019) regarding wood trusses, works incredibly well. There are, however, instances where SOWs are exceeded due mainly to a breakdown in execution.

As the Structural Building Component Association's (SBCA) Executive Director since 1992 and a P.E., the author is in a unique position to regularly see interactions between Building Designers and CMs. He has witnessed countless successful applications of trusses inside a properly functioning supply chain. Just think about the billions of dollars of structural framing that are installed each year that utilize trusses. If truss use presented a systemic problem to the construction industry, SBCA would hear about it daily.

In instances where the SOW breaks down, it is due primarily to a failure in some form of communication. Communication, specifically between Building Designers/Engineers and CMs, can be improved and can provide solutions to many of the problems that arise in the implementation of deferred submissions and review processes. For example, one solution that works well is Building Designers and General Contractors (GCs) who commit to work with a specific CM early in the project life cycle. Communication and collaboration at the design development stage of any project solve many of the problems that typically present themselves during a deferred submission review and revision process. Those problems typically result in costly rework by the Building Designer and CM. When communication starts early in a project, it is more likely to continue throughout that project to everyone's benefit!




*SBCA's Construction Industry Work Flow Initiative looks to map the way information, products and services flow throughout the construcution industry in a series of articles and graphical models.*

## Scope of Work Creep

In recent years, commoditization of the construction supply chain has led to the need to do more with a smaller budget. This drives SOW creep down the supply chain. A good illustration is provided through the many plans CMs receive today that need to be fixed, whether it be dimensions that do not close or load path details that do not work. To manufacture the trusses that will create the proper load path, CMs help by providing solutions (usually under a very tight timeline) to keep the project moving.

Unfortunately, the SOW creep starts with the Architect, who often designs structures without full consideration of the load resisting elements. From there, in a cost-cutting effort, Building Designers/Engineers are bid out and forced to abandon their traditional SOWs in hopes of maintaining profitability through streamlining the engineering process. Digging into the dimensional weeds and providing specific load path details is very time-consuming. Consequently, many have created processes like "standard details" to speed up project completion. It is not out of the ordinary to see a partially complete detail on a set of "for construction" plans.

As a result, CMs are forced to exceed their defined SOW in hopes of pleasing their customer, typically the GC. Often, information is wrong or missing from the design documents as provided to the GC. The GC delegates problems to the CM to interpret or, in many cases, fix. These "fixes" need to be done before the CMs can perform necessary tasks to model the project and ultimately deliver their product. The goal is to fix what needs to be fixed, given that project time pressure generally does not allow a lengthy review and approval process. This is exacerbated by the fact that the Architect and Building Designer/Engineer generally are not in a position where their original fees will tolerate additional costs.

**ANSI/TPI 1 SOW**

**2.3.6 Requirements of the Truss Manufacturer.**

**2.3.6.1 Truss Design Criteria and Requirements.**

The Truss Manufacturer shall obtain the Truss design criteria and requirements from the Construction Documents.

**2.3.6.8 Reliance on Construction Documents.**

The Truss Manufacturer shall be permitted to rely on the accuracy and completeness of information furnished in the Construction Documents or otherwise furnished in writing by the Building Designer and/or Contractor.

**2.3.6.5 Required Documents.**

The Truss Manufacturer shall supply to the Contractor the Truss Submittal Package, including the Truss Design Drawing, a Truss Placement Diagram, if required by the Construction Documents or Contract, and the required Permanent Individual Truss Member Restraint location and the method to be used per Section 2.3.3.

**ANSI/TPI 1 SOW**

**2.3.6.2 Communication to Truss Designer.**

The Truss Manufacturer shall communicate the Truss design criteria and requirements to the Truss Designer.

**2.3.5 Requirements of the Truss Designer.**

**2.3.5.1 Preparation of Truss Design Drawings.**

The Truss Designer is responsible for the preparation of the Truss Design Drawings based on the Truss design criteria and requirements set forth in the Construction Documents or as otherwise set forth in writing by the Building Designer as supplied to the Truss Designer by the Contractor through the Truss Manufacturer.

**2.3.5.2 Single Truss Component Design.**

The Truss Designer shall be responsible for the design, in accordance with this Standard, of each singular Truss depicted on each Truss Design Drawing.

## Why the Truss Industry Functions as it Does

CMs are compensated based on the volume of product delivered and not the engineering value they provide to the structure. Many Building Designers/Engineers know that CMs provide fixes "for free." Getting the party that needs to fix the plans to get truss designs to work, so that they can be manufactured and out the door, can leave more money in the building design/engineering budget. Hence, it is useful if the fix work can be done where it does not negatively affect the construction budget.

Behind the CM is the Truss Design Engineer (Truss Designer), who designs and seals individual trusses based on input parameter files that are interpreted by the CM's Truss Technician. Like the CM, the Truss Designer relies on a defined SOW to perform his or her duties. The Truss Designer is a delegated engineer, removed from the specifics of the project and not as intimately knowledgeable about the project as the Building Designer/Engineer. The key to a successful project for both the CM and the Truss Designer is that they "shall be permitted to rely on the accuracy and completeness of information furnished in the Construction Documents or otherwise furnished in writing by the Building Designer and/or Contractor."

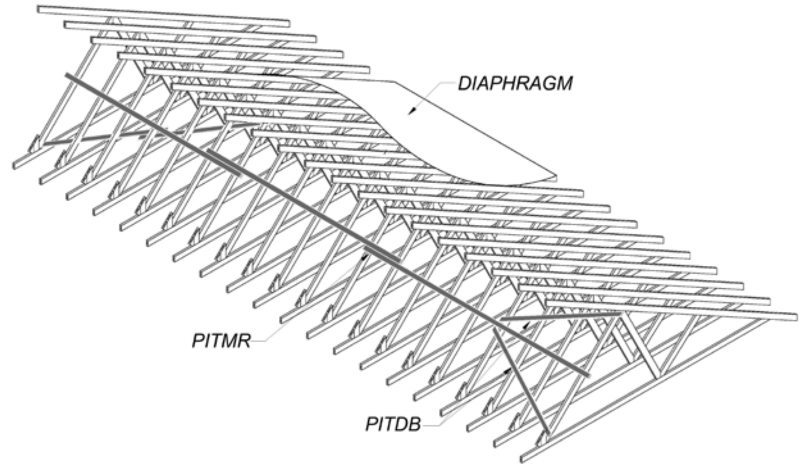
Mr. Maxfield's suggestion of injecting additional engineering services, outside of the traditional SOW of the Building Designer, is a serious transfer of load path responsibility. This also jeopardizes the role and value that Building Designers/Engineers have within the supply chain. Several unintended consequences may occur if the CM takes on additional SOW that should rightfully be performed by the Building Designer/Engineer. If the CM hires or employs a building design engineer to design the roof system as Mr. Maxfield suggests, could they design the rest of the structure, rendering the traditional Building Designer/Engineer obsolete? Savvy Architects and GCs/Project Owners will, in a cost-cutting effort, quickly take advantage of this new load path engineering service and look to replace the Building Designer and use the CM's engineer instead. CMs will be forced to solicit more of this work to cover the costs of Mr. Maxfield's suggestions.

The author has no problem with this strategy as long as CMs are compensated, at competitive engineering service rates, for any expansion of their SOW. However, serious consideration should be given to the unintended consequences of this suggestion for Building Designers and the structural engineering community.

## Serving Best Interests

What is the best path forward to address the engineering and communication challenges outlined above? The Building Designer/Engineer is in the best position to have a full understanding of the intent of the building design in the context of expected load paths and to specify building conditions such as snowdrift, HVAC units, load path to footings, etc. The SOW, as outlined in TPI Chapter 2, should be followed regardless of who is performing the various design duties. It is important to engage the CM as early in the design development process as possible. This will immediately improve communication. Design reviews should be conducted and are necessary if the process is to be successful. Mistakes are occasionally going to be made. These are often due to communication and execution breakdowns because the silos of work are isolated and bid out to obtain the lowest cost.

Several opportunities exist to improve communication between the engineering community and CMs, specifically with regard to using common specifications, contract language, standard details, and so forth. SBCA has a longstanding working relationship with NCSEA, most recently working together on IBC lateral restraint and diagonal bracing related code change proposals. NCSEA's point of view was also instrumental in TPI 1 Chapter 2 and Building Component Safety Information (BCSI).




*An excerpt from the collaborative work of NCSEA and SBCA to bring clarity to the IBC on best methods for installing permanent lateral restraint and diagonal bracing of individual wood truss members.*

Opportunities to collaborate remain. Successful construction projects certainly require that the SOW of the Building Designer/Engineer, GC, CM, Truss Designer, truss installer, and so forth to be appropriately compensated in order to be successful.

CMs are a key supplier of load path resisting structural elements. The Building Designer/Engineer is in the best position to have a full understanding of the intent of the building design in the context of expected load paths. How both groups work together to improve communication and execution, while also being adequately compensated in the process, will lead to both excellent communication and much better construction quality.▪

*URL references for graphics and text are live in the digital version of this article.*

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