SPEIGHT MARSHALL & FRANCIS
A Professional Corporation

# Technical Bulletin

FROM SPEIGHT, MARSHALL & FRANCIS, P.C.

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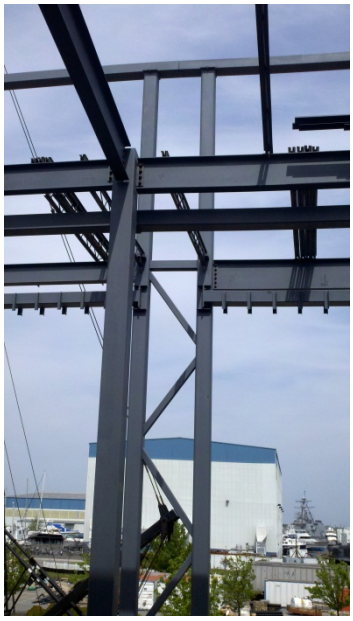
## Introduction

All projects utilizing structural steel will be constructed using steel connections, including a combination of high strength bolts, welds, plates, angles and other connecting parts. Despite being small in size, the proper design and selection of these connections can have a major impact on any structural steel project. In fact, it is estimated that up to 40% to 50% of steel costs are associated with the connections. Overly conservative connection designs can cause major increases in the overall cost of a steel structure. Code clarifications and design guides developed over the past few decades have aided structural engineers in the design of structural steel connections. Despite these advancements, there has never been more confusion between structural engineers, architects, owners and structural steel fabricators over which party is responsible for these connections than ever before. In 2010, the American Institute of Steel Construction (AISC) issued its most current 'Code of Standard Practice For Steel Buildings And Bridges' as part of the 14th edition of the 'Steel Construction Manual' and made significant changes aimed at alleviating some of the confusion. Speight, Marshall, & Francis P.C. has developed a unique expertise in this field as we have served as Structural Engineer of Record (SER) on hundreds of structural steel projects and also served as steel connection designer on hundreds more projects in which we were not the SER. This technical bulletin will address several common issues we have dealt with and clarify the new code requirements.



Additions & Alterations to Port Center 1 for Portsmouth Circuit Court, General District Court and Juvenile & Domestic Relations Court, Portsmouth, VA

## Changes in Delegated Design

Delegated steel connection design is the appropriation of the connection designs by the SER to an outside party, typically a sub-consultant hired by the general contractor or steel fabricator. This can include the design of shear, moment, braced frame and drag strut connections to name a few. There is often confusion as to which party is responsible for these designs as notes and typical details on the contract documents can often be ambiguous. For instance, the SER may provide typical details showing bolt quantities, welds, plate and angle thicknesses (implying that these have already been designed), yet still provide notes requiring these shear connections be designed by the fabricator's engineer. The AISC's most recent code of standard practice has set forth definite criteria for delegated design by requiring the SER to explicitly indicate on the contract documents one of three allowable options, as described below:

Option 1: *"The complete connection design shall be shown in the structural design drawings."* This option means the SER is solely responsible for the complete design and detailing of each connection.

**Option 2:** *"In the structural design drawings or specifications, the connection shall be designated to be selected or completed by an experienced steel detailer."* This option means the SER is not requiring signed and sealed calculations from the fabricator; however, the fabricator is responsible for detailing the connections per design tables, schedules etc. listed on the contract documents.

**Option 3:** *"In the structural design drawings or specifications, the connection shall be designated to be designed by a licensed professional engineer working for the fabricator."* This option means the SER has allocated the design of the connections to the fabricator. Signed/sealed calculations and details will be developed by a professional engineer hired by the fabricator.

Regardless of the option selected, the SER will still have ultimate review of all shop drawings and/or calculations submitted for review.

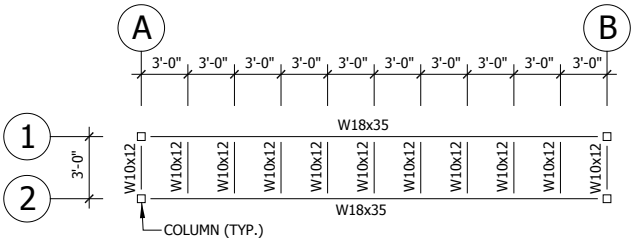
## What to Watch For

Regardless of your role on a project, it is critical to understand what option has been selected and that it has been clearly communicated to both the owner and general contractor, as it can have major time and cost impacts. Here are a few items to look for when reviewing your SER's drawings:

Old Point National Bank,
Ghent Branch, Norfolk, VA

**Notes and Specifications:** Carefully review the notes and specifications on a project, as this is where most of the confusion occurs. Compare what was agreed to in the contract against what is being specified. At the beginning of any structural steel project, discuss and clarify who is designing each connection type. In design/build projects, there can be huge savings with the input of an experienced steel fabricator for the selection and design of steel connections. Substantial costs can accrue with the hiring of a specialty connection engineer. Lead times associated with additional design, which may not have been considered by the general contractor when bidding and/or scheduling a project, may also increase considerably.

**Overly Conservative Design:** If the connections are to be designed by another engineer, watch for notes that require excessively conservative design. A common structural steel note listed on the contract drawings may read "…shear connections shall be designed for ½ of the "Maximum Total Uniform Load" as shown in Part 3 of the "Steel Construction Manual"…" which can often be much too conservative, producing excessively expensive connections. Figures 1 and 2 below illustrate how this note can have huge cost increases:




PLATFORM FRAMING PLAN

PER PART 3 OF THE AISC, EACH W10x12 CONNECTION WOULD NEED TO BE DESIGNED FOR A REACTION OF 37.5 KIPS.

IN REALITY, UTILIZING A DEAD LOAD OF 50 PSF AND A LIVE LOAD OF 100 PSF, THE ACTUAL REACTION OF AN INTERIOR W10x12 WOULD BE:

(150 PSF)(3'-0") x (3'-0" / 2) = 0.675 KIPS

THIS REQUIRES THE FABRICATOR TO PROVIDE A CONNECTION WITH A CAPACITY 56 TIMES LARGER THAN THE ACTUAL LOAD ON THE CONNECTION! ON A LARGE SCALE PROJECT THIS COULD HAVE A MAJOR COST IMPACT.

FIGURE 1

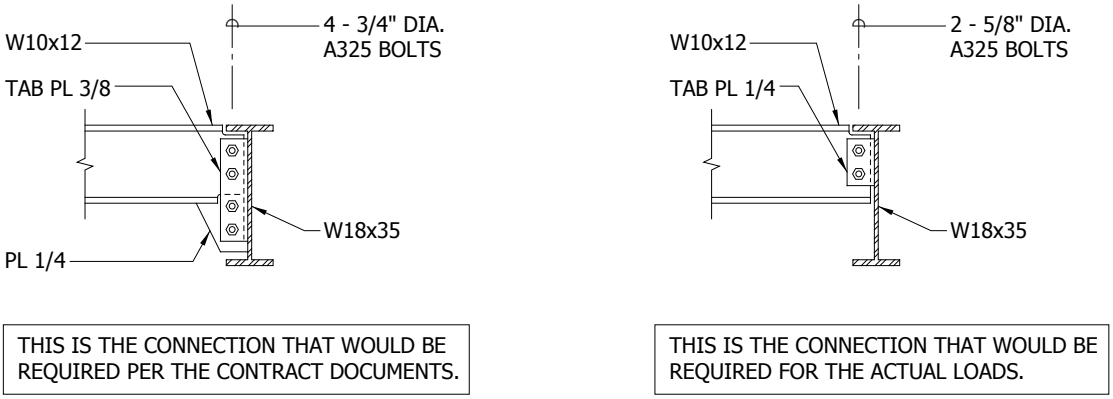



FIGURE 2

The easy solution to ensure an efficient design is to ask the SER to provide loads such as actual beam reactions, moments, transfer forces and braced frame loads on the contract documents.

**Contract Drawing Requirments:** The AISC Code of Standard Practice provides a list of minimum items expected from the SER to be shown on the contract documents. Verify the SER has sufficiently provided these items to avoid confusion and/or change orders. These items include:

- All geometry and work points
- Elevations
- Column centers/offsets
- Camber requirements
- Stiffeners
- Doubler plates
- Bearing stiffeners
- Web reinforcement
- Loads (if delegated design option has been selected)

**Churchland Primary School, Gymnasium Addition, Portsmouth, VA**

The 14th edition of the AISC Steel Construction Manual has not yet been adopted as the referenced steel design code by the International Building Code; however, the new guidelines within can be incorporated into any structural steel project. At Speight, Marshall, & Francis P.C. we have performed the role of SER on hundreds of structural steel projects across the country. We have also served as steel connection engineer for steel fabricators, detailers, and general contractors on hundreds of projects in which we were not the SER. Having extensive experience serving roles on both sides, we have developed a unique expertise in this field understanding what is expected from both parties. We proudly offer these services on any structural steel project you may have. Finally, we urge you to hold accountable your SER for clearly communicated and efficient structural steel projects as it will result in smoother and more cost effective projects.

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## Coming Up...

Our next Technical Bulletin will discuss building expansion joints. Keep a look out for it!

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