

STRUCTURAL FORUM

Specialty Structural Engineers

The Role and Responsibilities of "Specialty" Engineers

By Wesley G. Britson, P.E., S.E., and Emile W.J. Troup, P.E.

Spring 2003 has finally arrived! Unfortunately, it was preceded with the kind of winter in the Mid-Atlantic and Northeast when roof systems were once again challenged by heavy and persistent snow falls. During this same period, a nightclub fire tragedy in West Warwick, RI occurred. Searching for spokespersons on the causes of roof collapses and inadequate fire safety, a few national media outlets (Wall Street Journal, Associated Press) contacted NCSEA.

These inquiries prompted a flurry of email chatter (i.e., an "internet forum") among NCSEA Board members and others about the role and responsibilities of "Specialty Structural Engineers" (SSE) in design of fabricated Engineered Products furnished by manufacturers. (Authors' note: Depending on region and industry, the term "Delegated Engineer", or DE, is also common. For purposes of this article, we will use "Specialty Structural Engineers".)

The discussion occurred over a week spanning from late February to early March, and participants represented SEA's in 14 states: Alabama, California, Connecticut, Florida, Illinois, Kansas, Massachusetts, Michigan, Minnesota, New York, Oklahoma, Tennessee, Texas and Washington.

The following discussion, in a Q&A format, was gleaned from the many emails; the conclusions or recommendations presented are not necessarily those of all of the participants.

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Photos: New England Winter Roof Failures; courtesy of David Grandpre, Tom Grafe and Michael Grafe of C.A. Pretzer Associates, Cranston, RI

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Q What changes do you feel will occur as a result of the night club fires?

Most respondents agreed that the fires were most unfortunate, but completely preventable. Several felt that some code changes might result from a "knee-jerk" reaction (not unlike some of the suggestions following the WTC collapses). Apparent failure by the owners, inspectors (fire and building), promoters, and performers to recognize a potential fire hazard is reprehensible. Equally unfortunate, there is little NCSEA and structural engineers can do to keep people from using a building in a manner that could cause a catastrophe.

The discussion involving the tragic losses caused many of the respondents to comment on the way Engineered Products are specified. Certain structural products, due to the manufacturing processes, do not lend themselves to being designed by the Structural Engineer of Record (SER). Thus, a Specialty Structural Engineer (SSE), employed by the supplier, is needed to design a product for those specific circumstances outlined in the contract, or its plans and specifications.

It seems that there are no standard ways of dealing with this practice. However, Florida has provided rules in their licensing act as an example of how to approach the issue. Many jurisdictions will not allow the use of the manufacturer's specialty product, as designed by its SSE, without the SER approving the erection plans that are submitted to the building official before construction begins. But, there exists no uniform way in which 'delegated engineering' is practiced outside of Florida. This leaves the SER to make the rules or submit to the whims of others.

The vexing issue is what the roles of the SER and the SSE should be. Conflict has been encountered on some typical Engineered Products designed by SSE's. The more typical products, in which design is delegated to a supplier, include: Plated Wood Trusses (PWT); Metal Building Systems (MBS), and Precast Concrete (PC). Each of these products is supplied routinely using differing methods. In instances other than the Florida model, each material is supplied in accordance with an industry's standard practice and can vary widely with the type of material.

Q In recent snow storms, what types of construction seem to have suffered the most distress?

The vast majority of responses pointed to plated wood truss roof structures and low-rise metal building systems. Several respondents noted that cold-formed light gauge steel trusses also have some of the same issues.

Q Were the snow loads in excess of the code snow and drifting design loads?

With the exception of new building additions adjacent to existing buildings of different roof heights, most felt that the actual loads were consistent with code-mandated design loads and acceptable safety factors.

Q What were the most common causes of failures?

The plated wood trusses generally failed by the buckling of compression members due to improper bracing, design, or detailing. The metal building system failures were observed to be due to improper installation, improper detailing, inadequate bracing, web-buckling, lack of roll over prevention at supports, and not accounting for unbalanced loads on continuous members. Additionally, not accounting for high bay additions to existing buildings, causing drifting onto a low roof structure not designed for drifting, was a frequent response.

Q Who is responsible for specifying performance criteria for Engineered Products?

In a perfect world, a Structural Engineer of Record (SER) would be consulted in the beginning of a project to set the design criteria (plans and specifications), in an effort to get each manufacturer to provide equivalent products, to let the product supplier know what the serviceability requirements are, and to assure that the owner's needs are met. The SER would continue to coordinate the design intent throughout the construction process.

Often, there is no SER on a project. The Architect delegates design of structural elements to a Specialty Structural Engineer. Also, there is no SER in the case where a Structural Engineer (SE) is not engaged to establish the criteria for the Engineered Product, review the product, and approve the product. The Structural Engineer assumes the role of a Specialty Structural Engineer (SSE) for the foundation only. This can be a legal nightmare, since the product supplier will not accept the SER's role and responsibilities. You (the SSE) must have clearly defined contracts limiting your scope of work and responsibilities.

When there is no SER responsibility for an Engineered Product, a new role must be established; that of the Designer of Record (DR). The DR, either the Architect or Design/Builder, must assume the responsibility for the Engineered Product and the entire system of which it is a part. You must be sure that DR is aware of their role and responsibilities! (*Authors' note: the role of Designer of Record is equally important on any project on which there is no SER.*)

In the case of Design-Builders becoming the DR, they (and you) must make sure that they are licensed and insured for this responsibility. Typical construction policies do not cover the Design-Builder for professional liability, which can result in unintended liability for the SE. Additionally, if the DR is not licensed, all of the licensed parties may find state professional registration boards interested in why they were involved working under the supervision of an unlicensed DR.

Q What are the responsibilities of the Designer of Record?

In cases like those cited in the previous question, the DR becomes the SER for the Engineered Product and the entire structural system. The DR has the responsibility to review and approve the shop drawings. (Be aware that manufacturers are sometimes reluctant to release their shop drawings). In that review, the DR is responsible for coordinating all disciplines, to show the loads that are to be placed on the Engineered Product, and for correctly interpreting the design intent of the plans and specifications. The DR must also define the loads that are imposed on that portion of the structure that is supported by the Engineered Product. The responsibility of the DR must be fulfilled by a licensed design professional (architect or engineer), in accordance with the licensing laws of the jurisdiction in which the project is located.

Q Who is responsible for designing temporary and permanent bracing of plated wood trusses?

If the Engineered Product is an independent structural assembly of plated wood trusses imposed upon the total structural system, all permanent bracing must be part of the Specialty Structural Engineer's responsibility. When the Engineered Product is a component or assembly within the structural system, the SSE is the only person in a position to determine temporary bracing requirements, and is the only

one who knows the basis for the parameters for which each member was designed. Thus, it is recommended that the required temporary and permanent bracing also be included in the sealed set of shop drawings received from the SSE. Who actually supplies the bracing material is between the GC and the supplier of the Engineered Product.

The SER [or DR] should be responsible for locating and sizing the lateral bracing to be used to transfer wall and diaphragm forces through the trusses into shear walls or braced frames. Additionally, the SER [or DR] should supply special loading criteria to the SSE for things such as chord forces, drag strut forces, and collector forces that is expected to be used in the design of the Engineered Products.

Q In general, who is responsible for adequacy of temporary bracing of structural framing during construction?

Notwithstanding recent publications by ASCE and AISC on stability of structures during construction, OSHA makes it very clear in the recent revision of the standard for safety of structural steel, steel joist and metal building system erection that the Erector is responsible for maintaining stability of the framing at all times during its construction. Generally, the SER is not involved in designing temporary bracing of steel framing, but AISC notes exceptions in its 2000 Code of Standard Practice when the SER must provide certain information to the erector so that the framing can be erected safely.

For plated wood trusses and cold-formed light gauge steel trusses, it would seem that bracing of these components should be designed by the manufacturer's Specialty Structural Engineer, and the installation thereof should be done by competent persons employed by the on-site erector.

Q Do Specialty Structural Engineers have the responsibility to follow the contract documents?

NO, on a contractual basis, and YES, on an ethical basis if they know there is a set of contract documents! Only the General Contractor (GC) has the contractual responsibility to follow the plans and specifications. Suppliers are only responsible for supplying a product that has been agreed to in their subcontract. Thus, if the GC does not include the manufacturer's responsibility to meet the plans and specifications in the sub-contract, it can be difficult to convince the manufacturer to comply with the plans and specifications.

The Designer of Record can only protect the owner by including language into the plans and specifications that force compliance and eliminate the loopholes. Here is a suggestion that one engineer has begun using:

It is suggested that no submittals be accepted without the following certification included adjacent to the Specialty Structural Engineer's Seal.

"I, _____, a licensed engineer in the state of _____, do hereby certify that I have reviewed the contract documents, plans and specifications, prepared by the Structural Engineer of Record (SER) [or the Designer of Record, DR] and have to the best of my knowledge incorporated all of the special criteria contained therein. When conflicts occur, I have contacted the SER [or DR] and we have agreed to any modifications. I understand that any deviation is grounds for rejection."

Q What about Hold-Harmless, Additional Insured and Indemnification Clauses in Sub-Contracts?

As litigation continues to be a major concern of all parties, we see everyone trying to avoid lawsuits. Sometimes in the haste to avoid liability, some subcontracts and supplier agreements commit the owner to things that are uninsurable and, worse, unknown. The only contract that is known to the responsible Design Professionals is between the owner and

the GC. At times, the owner does not wish to share the terms of the contract with the Design Professionals. Thus, the Design Professionals need to include language in the plans and/or specifications to prevent any unwanted liability on themselves and the owner. One engineer suggested the following addition to the specifications;

"The General Contractor shall accept no subcontracts or material orders by sub-contractors that require the Owner to name anyone or company as an additional insured to any insurance policy that the Owner maintains without the expressed written consent of the Owner. Further the General Contractor shall accept no sub-contracts or material orders by sub-contractors that requires the Owner to indemnify or hold-harmless any individual or company without the expressed written consent of the Owner."

Q Who ties all the loose ends together?

The Structural Engineer of Record or the Designer of Record is the only one in responsible charge for this duty!

Q How do the opinions expressed in the above discussion apply to selection and design of structural steel building connections?

The role of connections in a structural steel frame designed by the SER differs somewhat from the role of wood truss roof assemblies, precast concrete systems, and metal building systems. This issue was not discussed by participants and perhaps should be a topic for another Internet Forum.

Conclusion

Recent tragedies have made many Structural Engineers question the processes in which they incorporate engineered products into the overall design. The use of more specialized engineered products is making this issue more of a challenge with every new product being perfected. This ultimately will influence how Structural Engineers produce plans and specifications on future projects.



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