

NATIONAL PRACTICE GUIDELINES FOR SPECIALTY STRUCTURAL ENGINEERS

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IMPORTANT INFORMATION ABOUT THIS DOCUMENT

The material in this document is for information purposes only and is not to be regarded as legal advice. If legal advice is required, it is recommended that the reader consult an attorney.

This document is intended to be educational in nature, and is presented as a guideline only. It has been developed to provide a general framework and sets forth guideline practices for situations where specialty structural engineers are involved in the project. Guideline practices are to be distinguished from a standard of care in professional practice. The definition, application and measurement of a professional standard of care necessarily depends upon a complete and conscientious evaluation of all of the relevant project-specific factors and circumstances regarding the structural engineer's engagement and performance, including scope of services and other contract terms, the project delivery approach (e.g. fast track), time constraints affecting service delivery, complex or innovative nature of the project, and others.

The guideline practices described in this document, by definition, do not take into consideration such factors and circumstances and, as such, should not be used as a substitute for a properly and professionally conducted professional standard of care evaluation. In other words, failure to comply with these guideline practices does not necessarily equate with a departure from the professional standard of care, and compliance with these practices does not necessarily constitute adherence to that standard. They are also not meant to prohibit alternative approaches to a firm's efforts to assess and improve its management practices.

In a number of respects, these guideline practices define roles and responsibilities of structural engineers. Any such definitions assume, of course, that the structural engineer has been retained to provide a scope of services adequate to assume and undertake such roles and responsibilities. This qualification is especially important in the instance of structural engineers engaged by contractors on design-build projects.

This document was derived as a general consensus from a group of authors. The views presented in this document may not necessarily exactly represent the views of any one author or other members of their respective firms.

NATIONAL PRACTICE GUIDELINES FOR SPECIALTY STRUCTURAL ENGINEERS

Purpose and Goals

This document has been prepared to supplement CASE's *National Practice Guidelines for the Structural Engineer of Record* by introducing the concept of a specialty structural engineer (SSE) and the interrelation between the SSE and the Structural Engineer of Record (SER).

CASE encourages the concept of one SER for an entire project. However, for many, if not most projects, there may be portions of the project that will be designed by SSEs. Those portions may be part of the primary structural system, secondary structural systems, or non-structural systems or even areas that are not part of the final structure, such as formwork or shoring. Those tasks are usually designated to be performed by an SSE, because that portion may have been specified as a performance specification to be provided by the Contractor, or perhaps to avail the particular expertise of an SSE, or for a variety of other reasons.

While careful attention to contractual scope of services and well-prepared project specifications can clearly define areas of responsibilities and avoid many potential problems, there is still the need for coordination and cooperation among all members of the design team. It should be recognized that the SSE is a member of the design team, although the SSE may actually be working for the contractor or a sub-contractor. Close coordination between the SER and the SSE (or the PDP and the SSE) will be instrumental in making the project flow smoothly, with minimum difficulties.

The primary purpose of this document is to better define the relationships between the SER and the SSE and to outline the usual duties and responsibilities related to specific trades. This is done for the benefit of the owners, the PDP, the SER, the SSE and the other members of the construction team. The goal is to help create positive coordination and cooperation among the various parties.

NATIONAL PRACTICE GUIDELINES FOR SPECIALTY STRUCTURAL ENGINEERS

I. INTRODUCTION

A. GENERAL

In 1989, the Council of American Structural Engineers (CASE) published the *National Practice Guidelines for the Structural Engineer of Record (Guidelines)*. This document was last revised in 2000, with the publication of the fourth edition. The *Guidelines* provide a guide for consulting structural engineers and their clients regarding the function of the Structural Engineer of Record (SER) and relationships with the other members of the construction team. While various aspects of design and construction administration are defined in the contract documents, the division of responsibilities within the design team may not be clearly defined. A detailed scope of service section is necessary in the design agreement between the SER and the client.

The *Guidelines* are intended to facilitate the development of such a detailed scope of service section. In doing so, they clearly identify that the SER should be responsible for the design of the primary structural system and identify the basic services that are normally included under that definition. Further, they identify those additional services (special services or extra services) that are normally excluded from the basic services, unless agreed upon by the client and the SER. The *Guidelines* briefly discuss relationships with a SSE, but without specifics. This document, the *National Practice Guideline for Specialty Structural Engineers*, is intended to fill that void and provide guidance to both the SER and the SSE in the conduct of their practices. This 2006 publication is the third edition of this document. The original publication in 1994 was based on and borrowed from a similar document prepared by the Virginia Section of the Coalition of American Structural Engineers, and from the Florida Minimum Standards of Responsibility for Structural Engineering.

B. CONTRACTS/AGREEMENTS-RESPONSIBILITIES

Responsibilities for all elements of a project design are specifically identified in the design agreements for the Prime Design Professional (PDP) and subconsultants, including the SER. This could include provisions for an SSE, although if it does at this point, the SSE is another subconsultant for a specific portion of the project.

It is more likely that a requirement for an SSE is specified in the contract documents as being a service that is required of a contractor, subcontractor or supplier, with specific instruction that the design of that element is to be performed by a professional engineer, licensed to practice in the state where the project is located. This is often referred to as a “delegation” of services.

It is important to note that although the design responsibility has been delegated, there is no contractual relationship between the PDP/SER and the SSE. It is essential that the design responsibilities be clearly assigned and that the scope of services is carefully defined for all parties:

- Contract between the PDP and the SER. The contract should specifically define the elements of the structural design for which the SER is to be responsible. If certain elements of the structural system are to be designed by an SSE, the contract should identify what items the SER will review and to what degree that review will be performed. Care should be taken here; for example, if the stairs or the cladding are going to be designed by an SSE, the SER would be well advised to be sure that they are not included in the SER’s contract. Those elements would normally be delegated by the PDP through the PDP’s portion of the specifications.

- Contract documents. Wherever a system or element is to be designed by an SSE, it must be clearly identified in the contract documents, indicating licensing requirements, experience qualifications, performance specifications, submittal requirements, and calculation requirements.
- The SSE contract. The SSE must be equally careful in having a detailed scope of work. The SSE should be cautious in providing designs for projects on which there is no SER responsible for the primary structural system. In such a case, the SSE might be perceived to be the SER for the project. CASE Document 8 *An Agreement Between Client and Specialty Structural Engineer for Professional Services*, a CASE standard agreement, is a good example of a contract form for an SSE.

The SER is responsible for the design of those elements included in the SER's contract. The design of some elements may be "delegated" to an SSE. The SER should review the SSE's work associated with those elements to the degree necessary to support the SER's contractual responsibilities.

While the determination of issues of design liability is beyond the scope of this document, the SER should be aware that even though the design of certain elements has been delegated to an SSE, liability for that design might still rest with the SER. The issue of design liability could ultimately be determined by the court system, but is best established by the written contract and the contract documents. The SER (or the PDP) should consider requiring the SSE to provide indemnification to the SER (or the PDP) for injury, property damages, or other damages to the extent caused by the negligence of the SSE.

C. TYPES OF SSE SERVICES

The *Guidelines* provide a framework for the scope of services that the SER may provide, including identification of those elements that are normally considered Additional Services (special services or extra services). The *Guidelines* do not address the idea of an SSE or describe the responsibilities or interaction between the PDP/SER and the SSE. The following describe those services that an SSE may perform.

1. Structural design of elements of the Primary structural System

SSE services may include structural steel connections, precast, prestressed concrete components and connections, post-tensioned members and connections, timber trusses, pre-engineered metal buildings, metal plate connected wood trusses, open web steel joists. In these cases, the SER may require that the SSE seal work resulting from the design of these items. In any case, these designs should be reviewed by the SER, since primary structural systems are usually included in the basic services of the SER, unless specifically exempt by contract.

2. Structural design of Secondary structural and Non-structural Elements

Examples may include stairs and railings, architectural cladding, roof-mounted flagpoles or retaining walls not connected to the building. The *Guidelines* describe the SER's basic services as reviewing these elements to assess their implications for the primary structural system and designing the primary structure to accept and support such items. The responsibility for design of secondary structural and non-structural elements rests with the PDP, generally an architect.

The *Guidelines* make this assignment to establish a clear-cut scope of services for the SER. Two important factors in this assignment are as follows:

- The PDP may not be prepared to deal with the issues of secondary structural elements or structural aspects of non-structural elements. In which case, the SER should have a frank discussion with the PDP regarding these responsibilities and the SER's scope of services and fee should be amended to include the structural design of these items as Additional Services.
- SSEs may be involved in the structural design of secondary structural and non-structural elements.

3. Construction related items

Construction related items that might require the services of an SSE are generally those items that are not part of the completed building.

Examples are concrete formwork, excavation bracing, and temporary shoring or erection bracing. These items, which necessarily involve “means and methods,” are specifically excluded from the SER's basic services in the *Guidelines*. They are considered additional services and would only be part of the SER's scope of services if they were specifically added to that scope. The Contractor is responsible for any structural engineering tasks that are required for construction related services. It is prudent for contractors to retain SSEs experienced in the design of such items. Often, the PDP or the SER will require the contractor to utilize an SSE, for example for underpinning or excavation shoring. Because the Contractor is solely responsible for this work, and because of liability and insurance issues, most SERs choose not to review such designs.

II. RELATIONSHIP OF THE SPECIALTY STRUCTURAL ENGINEER TO THE STRUCTURAL ENGINEER OF RECORD

A. GENERAL

Except in very unusual cases, which are clearly defined by contract, the SER has overall responsibility for the design of the primary structural system. He may delegate the design of some structural elements, connections or systems to one or more SSE's in the contract documents. In the same manner, the design of secondary structural or non-structural elements may be assigned to an SSE by the PDP.

To realize the maximum potential of using SSEs, full cooperation between all members of the designated design/construction team is required. Direct communication between the SSE and the SER and/or PDP is necessary for efficient and expeditious completion of the SSE's tasks.

The importance of communication within the design team is emphasized in the CASE document 962-D A *Guideline Addressing Coordination and Completeness of Structural Construction Documents*. The design delegated to specialty engineers makes the SSE part of the design team. Communication and coordination must be extended to the SSE for a successful project.

B. ITEMS TO BE PROVIDED BY PDP OR SER

The following items should be provided in the contract documents or be available to the SSE when necessary. To accomplish this, it may be necessary for the PDP or SER to require that the appropriate construction documents be provided to the SSE.

1. Design Criteria

Governing building codes, specific requirements for live and dead loads, site related factors for snow, wind and seismic loads, deflection criteria; and any other performance criteria should be stated. When the design of major structural systems is delegated, the structural contract documents should represent the method conceived for resisting gravity loads, for resisting lateral loads from wind and earthquake, and for accommodating volume change behavior.

2. Dimensions and Details

Dimensions, details, and features shown in the structural contract documents should be sufficiently accurate and reliable to be used for developing the delegated design by a SSE. Provisions for material tolerances, especially at the interface between trades, should be provided. Details of the primary structural system or support for the delegated portion of the structure, where it interfaces with other portions of the structure, should also be provided.

3. Parameters

Parameters or constraints concerning the interface of the delegated design with the remaining portions of the structure should be clearly stated. Parameters prepared by the SER in developing the concept of the structural system should be available to the SSE as they pertain to the structural components, connections or systems which have been delegated to the SSE.

4. Site Conditions

When requested, available geotechnical or other site condition reports should be furnished.

5. Submittals Required

The SER should define the submittals to be provided by the SSE.

C. QUALIFICATIONS OF THE SSE

The SER may specify the minimum qualifications for the SSE as a requirement in the structural contract documents. The SER should be aware that building officials' requirements regarding sealing of work performed by the SSE may vary from state registration laws.

D. SIGNING AND SEALING BY THE SSE

It is the responsibility of the SSE to comply with all state regulations for the practice of engineering and sealing of documents, including those of immediate personal supervision and corporate certificates of authority for suppliers or manufacturers performing engineering "in-house."

The following is a guide to the use of the SSE's seals on structural submittals:

- 1.** Drawings prepared solely to serve as a guide for fabrication and installation and not requiring engineering input do not require the seal of a Licensed Engineer.
- 2.** Drawings introducing engineering input, such as defining the configuration or structural capacity of prefabricated structural components or their assembly into structural systems, require the seal and signature of the SSE.
- 3.** The SER may require in the structural contract documents that any calculations, drawings, or other work product of the SSE be sealed and signed.
- 4.** Computer printouts are an acceptable substitute for manual computations provided they are accompanied by sufficient design criteria and identified input and output information to permit their proper evaluation. Such information should be signed and sealed by the SSE as required by the contract documents.
- 5.** Catalog information on standard products not fabricated for a specific project do not require the seal of a licensed engineer, provided that there is a model code research report and that the SER can size the product for all the loads applied to it by using the standard information provided. If concentrated or other unique loads are applied and are not addressed in standard information, a specific design should be required and the SSE should seal it. Examples of standard products include, but are not limited to, joist and rafters, steel joists, and wood I-joists.
- 6.** The SSE should review and approve the shop drawings prepared by a fabricator and attest to that review with a signed shop drawings stamp, or other means, prior to submittal of the drawings to the SER or PDP. When required by the contract documents, special erection drawings may be requested to be provided by the fabricator and the fabricator shall attest to the review of these erection drawings with a signed shop drawing stamp or other means. As an option, the fabricator may supply standardized erection drawings or installation guidelines to assist in the application of the products. Where standardized erection drawings are supplied, there is no requirement to provide a shop drawing approval stamp.

III. RESPONSIBILITIES OF THE SPECIALTY STRUCTURAL ENGINEER

A. GENERAL

When providing services as a licensed professional engineer, the SSE has obligations to the health and safety of the public, to the SER, and to the SSE's client. These include the following:

1. The SSE should review the contract documents to determine the design criteria, intent, and applicable codes and standards. If the design intent is not understood, the SSE should request definition or clarification of the design intent from the SER or the PDP.
2. If, in the course of the development of the design, the SSE discovers or perceives errors, omissions, ambiguities or potential conflicts in the contract documents, parameters or calculations made available by the SER/PDP, the SSE should apprise the SER/PDP of such errors, omissions, ambiguities or potential conflicts.

B. DESIGN OF STRUCTURAL OR NON-STRUCTURAL ELEMENTS

1. The SSE should design the elements, connections and structural systems as delegated in the contract documents.
2. The SSE should provide designs in accordance with applicable building codes, the structural criteria provided, and reference standards cited by the SER/PDP.

In cases where the SSE exercises professional judgment and takes exception to the specified criteria or reference standards, these exceptions should be fully disclosed in writing. Final authority and responsibility for decisions concerning the structural design criteria usually belongs to the SER/PDP.

When the exceptions are stated as qualifications to a subcontractor's proposal, the general contractor and the PDP are obligated to convey this information to the SER for evaluation and recommendation prior to award.

3. The SSE should consider the effects of the processes of manufacture, handling, storage, shipment and erection of the designed materials. Although the SSE is not usually responsible for the means and methods of construction, the structural submittals should include information on any special requirements for the installation of the designed materials.

C. CONSTRUCTION-RELATED SERVICES

The duties of a SSE retained to provide construction-related services, should include the following:

1. The SSE should design the elements, connections or structural systems as determined by the SSE's contract with the contractor.
2. The SSE should design in conformance with applicable codes, regulations and standards required by the design, whether or not specified in the contract documents. This recognizes that there may be such codes, regulations and standards that apply to construction tasks that are not relevant to the design of the building.

IV. SUBMITTALS BY SPECIALTY STRUCTURAL ENGINEER

A. DELEGATED PORTIONS OF THE DESIGN OF PRIMARY STRUCTURAL SYSTEM-SSE RESPONSIBILITY

When the design of primary structural elements, connections or systems, is delegated to an SSE, the SSE's submittals should include the following items that are common to any project. Additional items are noted for specific trades under Section V:

- 1. Project Identification**
 - a. Project name
 - b. Project location
 - c. Identifying project numbers
 - d. North arrow
 - e. Scale
- 2. Governing Codes**
 - a. Building code and edition
 - b. Referenced codes and standards
 - c. Design method used for the design
 - i. Service Loads
 - ii. Strength loads or factors
- 3. Design Load**
 - a. Dead loads
 - b. Live loads
 - c. Snow loads
 - d. Wind loads
 - e. Seismic loads
- 4. Material Properties**
 - a. Design properties
 - b. ASTM designations

5. Computer Submittals

Documentation of computer programs including the program name and version should be included with any submittal of computer calculations. In the case of custom software or spreadsheet developed in house it may be necessary to provide hand calculation of representative elements to verify the use of the program.

B. DELEGATED PORTIONS OF THE DESIGN OF PRIMARY STRUCTURAL SYSTEM - SER RESPONSIBILITY

When the SER delegates a portion of the design to a SSE, the SER should, in his/her review of the structural submittals, confirm the following:

- 1.** Structural submittals have been furnished as specified.
- 2.** Structural submittals have been prepared in general accordance with the requirements of the contract documents.
- 3.** The SSE understands the intent of the SER and has used the specified criteria. The SER should make a sufficient review of the structural submittals to verify the design criteria and to evaluate the effects of the delegated design on the balance of the primary structural system including the interface.
- 4.** The configuration set forth in the structural submittals is consistent with that on the structural contract documents.

Questions posed by the SSE regarding interpretation of intent, application of the criteria, or the effects of structural behavior or detailing at the interface should be addressed in a timely manner in response to the structural submittals.

If the SSE provides sealed calculations to the SER, the SER may choose to rely upon the calculations without performing a detailed check. However, the SER should perform a review of the SSE's work to the degree necessary to support the SER's contractual responsibilities.

C. SECONDARY STRUCTURAL OR NON-STRUCTURAL ELEMENTS

When there are secondary structural elements or non-structural elements that may affect the primary structural system, the PDP (or the SER if designated by its contract with the client) should evaluate the submittals made to determine the impact on the primary structural system. The PDP should make confirmations similar to those outlined in Section IV (B1, B2, B3, B4, and B5) above.

D. CONSTRUCTION-RELATED SERVICES

For construction related services, the SER or PDP may or may not choose to review the designs prepared by the SSE. If construction-related design (such as underpinning or shoring) becomes a permanent element or where temporary structures are supported by, or could have an effect on the permanent structure (e.g., shoring systems), the SER should review the designs prepared by the SSE as necessary. The documents prepared by the SSE may or may not be signed and sealed, depending on:

- 1.** Specification or contractual requirements.
- 2.** Code requirements or local building authority regulations. In some cases, SSE prepared construction related items may be required for building permits, e.g. demolition plans or bracing for excavation that may affect adjacent property.
- 3.** State licensure requirements.

V. OUTLINE OF FUNCTIONS OF THE SER/PDP AND SSE RELATED TO SPECIFIC TRADES

The following subsections outline requirements for specific trades, in addition to those identified previously.

A. PREFABRICATED WOOD COMPONENTS

1. Metal plate connected wood trusses:

The SER may delegate the design of metal plated connected wood trusses to a SSE.

- a. The SER's structural contract documents should also include the general truss layout, roof slopes, support locations, bearing conditions, permanent lateral and cross bracing, and anchorage to resist uplift and lateral forces. (Also see Section IV A)
- b. The SSE should provide the normalized force required to brace component members (typically webs) or, the SSE should design the transverse system bracing within the trussed volume.
- c. Metal plate connected wood trusses should be designed and manufactured in accordance with the latest edition of ANSI/TPI 1 and in conformance with the applicable state laws.
- d. Chapter 2 of ANSI/TPI 1-2002 contains recommended design responsibilities for all parties. The SER should provide any modifications to those responsibilities in the contract documents.
- e. Truss design drawings should be provided to the SER for review and approval.
- f. Truss placement diagrams will be provided to the SER, where required by the contract documents.
- g. Handling and temporary bracing requirements during erection are the responsibility of the contractor and may include the recommendations of the Truss Plate Institute (TPI) and Wood Truss Council of America (WTCA) outlined in the latest edition of BCSI 1.

2. Prefabricated Wood Beams, Joists and Columns and Related Components:

The SER may delegate the design of wood structural members, or structural systems using those members to a SSE, (or) designate member sizes from standard catalog information, where all the design parameters required by the SER are tabulated in the standard catalog.

- a. The SER structural contract documents should also identify the general layout, support locations, bearing conditions, bracing requirements, and anchorage to resist uplift and lateral forces. (Also see Section IV A)
- b. Should the SER require the services of a SSE in the contract documents, the SSE structural submittals should also include system layouts, member sizes, and calculations to substantiate the design. Submittal drawings should identify each member, member sizes, material specifications, connections, stiffening and lateral bracing requirements, load forces at bearing points, and applicable erection requirements.
- c. Handling and temporary bracing requirements during erection should be in accordance with the manufacturer's recommendations, and are the responsibility of the contractor.

B. CAST-IN-PLACE POST-TENSIONED CONCRETE STRUCTURAL FRAMING SYSTEMS

The SER may delegate the design of cast-in place, post-tensioned, concrete structural framing systems to a SSE.

1. The structural contract documents and specifications should indicate, as a minimum, the following items: (Also see Section IV A)
 - a. Design concrete properties and composition.
 - b. Clear indication and definition of all elements that are assumed to be post-tensioned.
 - c. Required mild reinforcing locations and sizes.
 - d. Required "pull" and "dead" end locations.
 - e. Required tendon profile (i.e. center of gravity of the tendons at critical locations).
 - f. Required direction of banded and uniformly distributed tendons.
 - g. Minimum required tendon areas of steel.

- h. Post-tensioning forces expressed in terms of a “final effective force” in kips per foot for uniformly distributed tendons and in kips for banded tendons.
 - i. Assumed anchorage hardware.
 - j. Required corrosion protection.
 - k. Required fire protection.
2. The SER should require the SSE to submit post-tensioning structural submittals for review as an indication that the design intent has been understood and that the specified criteria have been used.

Post-tensioned structural submittals should as a minimum include installation drawings, tendon calculations, installation requirements (specifications) and calculations for friction and long-term stress losses.

The installation drawings should include as a minimum the following items:

- a. The number of tendons being used and their cross-sectional areas.
 - b. A layout of the tendons being used.
 - c. The sequence for tensioning and the expected elongations.
 - d. An indication of the tendon profile being used.
3. The calculations should include as a minimum the following items:
- a. Calculations confirming that the number and size of tendons provided are adequate to provide the final effective prestressing forces and minimum area of steel shown in the contract documents.
 - b. Calculations confirming that the expected friction and long term losses for the number of tendons being used is adequate to provide the final effective prestressing forces shown in the contract documents.
4. When a complete system is provided, the calculations should also include design for the behavior of the system, for its connections and for its components.

C. PRECAST CONCRETE COMPONENTS

The SER may delegate the design of precast concrete components and their connections or systems utilizing those components to a SSE.

1. The structural contract documents and specifications should indicate, as a minimum, the following items: (Also see Section IV A)
- a. All precast elements clearly indicated and defined. Where dimensions, thickness, depths, bearing lengths etc. are required to be exactly as shown they should be clearly noted as such. Other dimensions should be noted as “minimum” or “maximum” to allow the SSE to determine the required dimensions that fall in the specified parameters.
 - b. Configurations or precast components.
 - c. List of assumed or maximum precast weights.
 - d. Location of precast connections. In lieu of designating specific connection locations, the SER should designate acceptable and unacceptable locations of precast connections.
 - e. Schematic representations of precast connections and/or supporting conditions.
 - f. Component bracing to the main structure to be designed by the precast SSE based on specific precast connection design.
 - g. Required design loads for items to be supported by precast elements and a clear statement as to what if any load factors have been applied to the given loads.
 - h. For precast systems acting as shear walls or diaphragms, the loadings imposed on the systems.
 - i. Corrosion protection requirements.
 - j. Fire protection requirements.
2. The SER should require the SSE to submit precast structural submittals for review as an indication that the design intent has been understood and that the specified criteria have been used.

Precast structural submittals should, as a minimum, include fabrication and erection drawings, calculations, and concrete mix designs indicating compliance with the required concrete properties and composition.

The fabrication and erection drawings should include, as a minimum, the following items:

- a. Reinforcing for all precast elements.
 - b. Sequencing, required handling, permanent and temporary bracing locations and their details.
 - c. Fully detailed and dimensioned connection details for all connection cases.
 - d. Indication of the loading superimposed by the system or components on the supporting structure.
 - e. If applicable, indications of the location and magnitude of the building reactions on the foundation under all design conditions.
- 3.** The calculations should include as a minimum the following items:
- a. An indication of the design methodology used (i.e. ASD or ultimate strength).
 - b. Design of the precast elements including design for their shipping, handling, and erection.
 - c. Design of all connections. The connection designs should be cross-referenced to the erection drawing connection details.
 - d. Design of temporary and permanent bracing.
 - e. When a complete system is provided, the calculations should include design for the behavior of the system, its connections and for the components.

D. OPEN WEB STEEL JOISTS

The SER normally will indicate on the structural drawings bar joists, joists girders and accessories selected from the latest edition of the Steel Joist Institutes specifications and load tables. When the design of the joists involves special loading or non-standard conditions the SER may delegate the design of the joist components to a SSE.

- 1.** Structural contract documents should designate, as a minimum, the following items: (Also see Section IV A)
- a. Joists Layout
 - b. Member sizes.
 - c. End anchorage.
 - d. Concentrated loads.
 - e. Moving loads.
 - f. Uplift loads.
 - g. Temperature loads.
 - h. Lateral loads.
 - i. Applied moments.
 - j. Horizontal or torsional load, such as screen walls, moveable sports equipment or reciprocating equipment.
 - k. All loading indicated on the drawings should be shown without load factors applied.
 - l. Special camber requirements.
 - m. Special bridging requirements. If the joists are not to be erected in a vertical plane, special consideration to the bridging design is required.
 - n. Special joist configurations.
 - o. Extended ends and the loads applied.
 - p. UL ratings.
 - q. Joist with a pitch of more than $\frac{1}{4}$ " in 12" should be considered to be a "special joist" and may require a design to account for the slope of the joist.
 - r. Anchorage of joist bridging. Unless there are special requirements all bridging should be per SJI requirements.
- 2.** The SSE may be required to design special joists, joists girders and accessories for loading designated by the SER. Design calculations should be requested for "special joist" only. Standard joist sections should not require a formal submittal of calculations.
- 3.** The SSE should design the joists and joists girders to meet the requirements of the Steel Joist Institute. The SSE should clearly note any violations of the Steel Joist Institute requirements that are shown on the structural drawings or shop drawings.

4. An engineer employed by the joist manufacturer may be designated as the SSE.

E. PRE-ENGINEERED STEEL STRUCTURES

The design of the entire building superstructure is usually entirely the responsibility of the SSE. The superstructure design is often excluded from the SER's contract. Relationship with other aspects of the building design, such as foundations, should be clearly identified in the contract and/or in the contract documents.

1. Structural contract documents for pre-engineered steel structures should indicate, as a minimum, the following: (Also, see Section IV A).
 - a. Special loadings such as concentrated or uniform collateral load for supported materials or equipment, crane loads, flood loads, roof top units, etc.
 - b. Appropriate serviceability criteria for vertical or horizontal deflection of components or overall building drift considering the building's usage, interior and exterior finishes, and other attached materials.
 - c. Acceptable positions for braced frames (for transmitting lateral forces to the ground).
 - d. Required building geometry such as column or frame spacing, roof slope, eave height, and horizontal or vertical clearance.
 - e. Consider specifying requirements for frame stability and stability bracing.
 - f. Connection requirements to other materials.
 - g. Assumptions or constraints regarding column base fixity.
 - h. Size, location, and type of openings in the building exterior and any related special loadings.
 - i. The Metal Building Manufacturer's Association (MBMA) Common Industry Practices (Section IV of the 2002 *Metal Building Systems Manual*) is a voluntary guideline. If the SER chooses to use the MBMA Common Industry Practices as a standard, they should be referenced in the structural contract documents with whatever modifications are desired.
2. The structural submittals should include:
 - a. Design calculations showing methods of analysis, and complete load paths through the structure.
 - b. Submittal drawings should illustrate the complete building structural system indicating the location, geometry, and properties of all structural members, column centers and offsets, anchor bolt locations, building reactions (vertical, horizontal, and moment) for the specified loads, details of all connections, and other information necessary to communicate the intended construction.
 - c. As a minimum, erection drawings used as submittals should include member sizes and properties.

F. STRUCTURAL STEEL SYSTEMS

The SER will normally design the structural steel framing of the primary structural system. That design will identify framing members and will either show the complete design of connections, will designate certain connection designs and details to be prepared by an SSE, or will designate that the fabricator is to select the connection type and complete certain standard connection details.

1. When the design of connection details have been delegated, or when the fabricator is to select and complete connection details, the contract documents should provide the information required by the AISC *Code of Standard Practice*. (Also see Section IV A)

2. Structural Submittals:

Calculations substantiating the selection or completion of the connection details should be prepared by the SSE and submitted to the SER for review and approval. Further, the SSE should review and approve the shop and erection drawings prepared by the fabricator and attest to that review with a shop drawing stamp, or other means, prior to the submittal of the shop and erection drawings to the SER. The SER should review the calculations along with the shop and erection drawing review to verify that the designs are consistent with project requirements.

3. Some projects may have structural steel elements that would normally be designed by the SER delegated to an SSE, either by the PDP or by the SER. Those elements might include space frames, bracing systems, and other portions of the primary structural system. Under these circumstances, the contract between the PDP and the SER, as well as the construction contract documents must carefully specify the scope of the work and who is to be responsible for that work. The responsibilities of the SSE and PDP or SER should be the same as identified in the section Pre-Engineered Steel Structures.

G. COLD-FORMED STEEL COMPONENT SYSTEM

The SER or PDP may delegate the design of cold-formed steel components, systems, and the design of prefabricated metal trusses, to an SSE.

Cold-formed steel components may be part of the primary structural system and/or secondary structural or non-structural components.

The design of cold-formed steel components should follow the requirements of the *AISI North American Specification for the Design of Cold Formed Steel Structural Members and the Standard for Cold-Formed Steel Framing – General Provisions*. The design of cold-formed steel trusses should follow the requirements of the *AISI Standard for Cold-Formed Steel Framing – Truss Design*.

1. For cold-formed steel components, either the SER or the PDP should provide, as a minimum, the following items: (Also see Section IV A).
 - a. The configuration and details of supports, anchors, clips, connections and any other interface of the cold-formed steel system or components with the primary structural system.
 - b. Primary structural system deflection allowances to be accommodated.
 - c. Deflection criteria for the design of the cold-formed steel system, including seismic drift requirements if applicable.
 - d. Limitations of the primary structural system to receive loading from the cold-formed steel system.
 - e. Indicate whether or not sheathing can be used for bracing.
 - f. Specify limitations on connection type.
 - g. Specify any requirements for or limitations on construction load criteria
2. For prefabricated cold-formed steel trusses, the SER or PDP should also include the general truss layout, roof slopes, support locations, bearing conditions, permanent lateral and cross bracing, and anchorage to resist uplift and lateral forces.
3. The SSE should perform the following and provide on submittal documents:
 - a. Confirm that the specified loading criteria meet or exceed governing code requirements.
 - b. All materials, grades and strengths for all members, may be shown either on the drawings or within a “standard” calculation set.
 - c. Indicate all required web stiffening and bridging.
 - d. Communicate any special requirements, changes, or modifications to the primary structural system necessary for the cold-formed steel component system.
4. For prefabricated cold-formed steel trusses, the SSE’s structural submittals should also include:
 - a. Truss system layouts, component details, as well as calculations to substantiate the design. Submittal drawings should also identify each truss, member connections, member load forces, lateral bracing requirements, bracing of individual component members to the primary structural system, forces at bearing points, and applicable fabrication and erection requirements.
 - b. Handling and temporary bracing requirements during erection should be in accordance with the fabricator/design engineer recommendations, and are the responsibility of the contractor.
5. Either the SER or the PDP should review structural submittals by the SSE to verify that specified criteria have been used and that the resulting loads are compatible with the primary structural system. If it is part of SER’s scope, the SER should review adequacy of connections to the primary structural system.

H. ARCHITECTURAL CLADDING SYSTEMS

Architectural cladding systems may include curtain wall, window wall, or storefront systems; metal, composite or other panel systems; stone or stone backup systems or architectural precast concrete.

Architectural cladding systems are usually considered secondary or non-structural systems. They may however impose loads on, have connections to the primary structural system, and impose certain performance criteria on the primary structural system. While the design of architectural cladding systems may be delegated, the SER should be aware of the effect on the primary structural system.

- 1.** Either the SER or the PDP should provide, as a minimum, the following items: (Also see Section IV A)
 - a. The configuration and the interface of the architectural cladding system with the primary structural system.
 - b. Primary structural system allowances to be accommodated.
 - c. Deflection criteria for the design of the architectural cladding system and how it relates to the primary structural system.
 - d. Limitations of the primary structural system to receive loading from the architectural cladding system.
 - e. Assumptions of the locations and magnitude of architectural cladding connections.
- 2.** The SSE should perform the following and provide on submittal documents:
 - a. Indicate either in drawings or within a “stand alone” calculation set, all materials, grades and strengths for all members, connections and fasteners used in the architectural cladding system.
 - b. Communicate any special requirements, changes, or modifications to the primary structural system necessary for the architectural cladding system.
- 3.** Either The SER or the PDP should review structural submittals by the SSE to verify that specified criteria have been used and that the resulting loads are compatible with the primary structural system. If it is part of the SER’s scope, the SER should review adequacy of architectural cladding

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DEFINITIONS

AGREEMENT

See contract.

BASIC SERVICES (SER)

The services of the SER necessary to provide construction documents and construction administration services for use in the construction of the primary structural system, and as defined in the contract.

BASIC SERVICES (SSE)

The services of the SSE as designated in the agreement between the client and the specialty structural engineer.

BUILDING

A structure used or intended for supporting or sheltering a specific use or occupancy.

CLIENT

The individual, agency, corporation, or other legally recognized entity that engages the services of the specialty structural engineering firm that is legally authorized to provide professional structural engineering services.

CONSTRUCTION ITEMS/SERVICES

Structural engineering services required by construction activities. These include, but are not limited to, demolition plans, excavation bracing, shoring, temporary stability bracing, erection sequencing, and formwork design.

CONTRACT

The legally recognized document providing definitions of service requirements, payment terms, time of service, and other items deemed appropriate by the client and the specialty structural engineering firm. This is sometimes also called the Agreement.

CONTRACT DOCUMENTS

The owner-contractor agreement, the conditions of the contract (general, supplementary, and other conditions), drawings, specifications, clarification drawings, and addenda issued prior to the execution of the construction contract, all modifications issued after the execution of the construction contract, and any other items that may be specially stipulated as being included.

CONTRACTOR

The individual or other entity responsible for performing and completing all or a portion of the construction of a project required by the contract documents.

DRAWINGS

Design documents that descriptively illustrate and graphically show the requirements and intent for construction of the building. The structural drawings are a part of all the drawings for a project.

EXTRA SERVICES

Services that are required as a result of unforeseen circumstances during the design or construction of a project. These services are not included in basic services.

GUIDELINES

The principles used in making a judgment or determining a policy or course of action.

NON-STRUCTURAL SYSTEM/ELEMENTS

Elements of a building that are not primary or secondary structural elements. Items in this category could include exterior curtain walls, exterior cladding, non-bearing partitions, stair railings, etc.

NORMALIZED FORCE

The transverse force needed to prevent a component member from buckling (e.g. unsheathed top/bottom chords, midpoint or third points of a web member).

OWNER

The individual or entity who has legal possession or equitable interest in the structure.

PRE-ENGINEERED STRUCTURAL ELEMENTS

Structural elements that are specified by the SER and may be designed by an SSE. These elements are normally fabricated off-site, require specialized equipment not usually available at the job site, or could require a proprietary process.

Examples of pre-engineered structural elements may include open web steel joists or joist girders, wood trusses, wood and metal joists, plywood web joists, precast concrete elements, prefabricated wood or metal buildings, and reinforcing and hardware necessary to lift tilt-up concrete panels into position.

PRIMARY STRUCTURAL SYSTEM/ELEMENTS

The completed combination of elements that serve to support the building's self weight, the applicable live load, based on the occupancy and use of the spaces, and environmental loads such as wind, thermal, and seismic loads.

PRIME DESIGN PROFESSIONAL (PDP)

The leader of the design team charged with the design of a new or remodeled building, either an architect or an engineer. The prime design professional is responsible for determining and interpreting the needs of the client and for coordinating the work of the other members of the design team.

REQUEST FOR INFORMATION (RFI)

Written request for information or clarification generated by the contractor during the construction phase of a project.

SCOPE OF SERVICES

A detailed description and list of tasks required to provide structural engineering on a given project.

SECONDARY STRUCTURAL SYSTEM/ELEMENTS

Structural elements that are structurally significant for the function they serve but do not contribute to the strength or stability of the primary structural system. Examples may include mechanical equipment supports, stairs, elevator support rails and beams, retaining walls independent of the building, and flagpole or light pole foundations.

SPECIAL SERVICES

Services that may or may not be foreseen at the beginning of the design of a project but are not necessary for the design of the primary structural system. These are not included in the SER's basic services unless specifically outlined in the contract.

SPECIALTY STRUCTURAL ENGINEER (SSE)

A licensed professional engineer, not the structural engineer of record, who performs structural engineering functions necessary for the structure to be completed and who has shown experience and/or training in the specific specialty.

The SSE is usually retained by a contractor or sub-contractor responsible for construction related services or by a supplier or sub-contractor who is responsible for the design, fabrication, and/or installation of engineered elements.

SPECIFICATIONS

A written description of the material and construction requirements of the items included in a project.

STRUCTURAL CONTRACT DOCUMENTS

That portion of the contract documents prepared, issued, and sealed by the SER.

STANDARD OF CARE

That level of professional skill and competence ordinarily demonstrated by professionals of the same discipline practicing at the same time, in the same location, and with the same or similar facts and circumstances.

STRUCTURAL CONNECTION

That part of the structure used to establish a load path between two or more structural elements

STRUCTURAL ELEMENT

A single beam, column or other structural member which, when combined with other structural elements, forms the structural system.

STRUCTURAL ENGINEER

An engineer with specialized knowledge, training, and experience in the sciences and mathematics necessary to analyze and design force-resisting systems for buildings.

STRUCTURAL ENGINEER OF RECORD (SER)

The structural engineer who is legally eligible to seal the structural contract documents for a building project. This seal acknowledges that the SER has performed or supervised the analysis, design, and document preparation for the building structure and has knowledge of the requirements for the structural system. The SER is responsible for the design of the primary structural system.

STRUCTURAL SYSTEM

The portion of a building that carries and transmits self-weight and externally applied loads.

SUBMITTALS

Items required by the contract documents to be submitted by the contractor. These might include shop drawings, fabrication drawings, manufacturer's literature for equipment, concrete mix designs, preconstruction test reports, product data, schedules, etc. Submittals are not a part of the contract documents but are a work effort requirement of the contract documents. If the SER has responsibility for contract administration, other submittals may include requests for payment, progress reports and other such items.

Reproductions of the contract documents should not be used for submittals without the written permission of the SER.

TRUSSED VOLUME

The volume of space between the top chord and bottom chord for a distance along the spacing of multiple trusses.