Considerations for Structural Drawings

SEAC/RMSCA Steel Liaison Committee

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This document does not replace and is not to be used as an adjunct to the current edition of AISC 303-16 *Code of Standard Practice for Steel Buildings and Bridges* or CASE Document 962D.

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Clear, concise, and complete Structural Design Documents are imperative to the success of a project. This document attempts to provide structural engineers a list of items that should be implemented in the Design Documents.

Both the International Code Council (ICC) and American Institute of Steel Construction (AISC) have requirements for the Structural Design Documents (Structurals). Those requirements are the bare minimum for what must be included in set. Some of those requirements are repeated in this document. Additional items are provided to optimize the construction process.

General

- Ensure Structural documents have been coordinated with the balance of contract documents. This includes but is not limited to the civil, architectural, mechanical, electrical, and plumbing documents. Any items called out on other's drawings as "Per/Re Struct" are specified.
- Revisions should be clouded and tagged, including from bid to construction documents.

General Notes & Specifications

- Structural Specifications are agreement with contract drawings (Structural drawings and other drawings).
- ICC required design loads are included. IBC Section 1603 outlines the minimum loads.
  - Lateral system defined
- Provide service level loads and avoid the use of "factored" loads.
- Include special inspections required by the IBC and any additional required inspections.
- Materials specified are consistent with the design and code requirements and applicable to the profile/shape specified.
- Definition of finish paint for coordination with shop primer.
- Ensure all AESS requirements are specified as required by the AISC Code of Standard Practice.
- Responsibility for temporary shoring & bracing design and implementation is clearly stated.
- Clearly define all delegated design items (stairs, joists, etc.).
- If any existing conditions exist, include disclaimer and define responsible party.

Layout Plans/Elevations

- Grid system fully dimensioned and coordinated with architectural drawings. Where complex grid systems are utilized, provide a grid plan sheet.
- On plan ensure major framing members are:
  - Sized with any required camber clearly stated
    - Shear connectors for composite beams are completely defined.
      - Distribution and layout requirements are clearly defined.
      - Required quantities are defined per member.
  - Located from a gridline
  - Elevation of top steel at each of member called out. As a minimum, provide control points which allow detailer to calculate. Deck bearing may be applicable at hip/valley roofs and other complex geometry.
  - Clearly identify any members that do not follow typical construction material/grade specifications. All AESS members must clearly be defined on plan.
- Indicate slip critical connections on plan.

- Where floor and roof penetrations are not completely coordinated, provide clear parameters for reinforcement framing. Include options for locations close to main framing (e.g. exclude parallel opening framing within #" of joist/girder).
- Top of concrete elevation Identified at all bearing points of steel.
- Coordinate structural drawings with minimum sizes and spaces required by UL assemblies noted on the architectural drawings.
- Slab edge conditions defined (bent plates, light gage pour stops, etc.) and dimensioned from grid.
- Locations and sizes of outriggers, kickers, etc., defined or shown. Identify or note Architectural or mechanical items which may control the installation dimensions.
- Any permanent structural bracing requirements are identified and detailed.
- Locations of penetrations or notches in steel beams identified.
- Specific design loads on the drawings where designed by others are included in set.
    - Required reactions for all connections noted on plan or in schedules. Avoid using generic loading information such as, end reactions are a percent of a member's Total Maximum Uniform Load (UDL).

Joist

- Assign coordination for joist bearing depth changes.
- Identify loads on joists and girders.
- Identify joist depth at the center line of bearing to accommodate 2 ½" minimum depths for K series joists.
- Use 7 ½" deep bearings (minimum) at all joist girders.
- Use 5" deep bearings at all joists with gravity end reactions exceeding 10k or uplift end reactions exceed 5k.
- Joists and girders with top chord axial force or applied end moments are designed with strap plates to transfer load into the chord.
- Indicate net wind uplift loads for design on the drawings.
- When defining loads on special joists:
    - Define gravity and lateral load separately.
    - Indicate gravity, add self-weight to above loads where member self-weight is unknown.
    - Do not specify a standard joist designation with special loading.
- Consider constant shear joists where locations of loading are uncertain.
- Composite joist: provide pre/post composite service level design loads. Typically shown on generic elevation(s).

Deck

- Clearly state required section shape and gauge aligned with a manufactures for basis of design. Leave the option to substitute manufacturer with equivalent specifications.
- Call out minimum section properties required and fastening requirements.
- List design diaphragm shear loads.
- Extent of metal deck noted on plan
- Span directions are shown. Any changes in deck directions are clearly defined at the edge to change direction.
- Where concrete span is limited, clearly define the limits.
- Define maximum concrete overrun for basis of design
- Indicate required locations of constant thickness slab vs constant T.O. slab elevation

- Coordinate concrete finishes with structural slab elevations.

Mechanical Coordination

- Locate specific floor and roof opening sizes and locations, when known prior to issuance.
- Identify general location of RTU with framing requirements.
- Ensure framing does not interfere with required openings.
- Schematically define potential openings and framing requirements.
- Specify minimum penetration size that requires framing.

Finishes

- Location of which areas do not require painting in finished structure.
- Unfinished surface for joist and composite deck noted.
- Where a specific deck finish, coordinate with manufactures available finishes.
- Define extent of "exposed structural steel" and AESS Category per AISC Code of Standard Practice
- Items requiring galvanizing clearly noted.
- Consider any vent/hoisting hole restrictions for structural design. Specify locations if critical to design. Note where plugging is required.
- Clearly state minimum surface preparation for painting, if more stringent than required by paint manufacturer's minimums. Use latest SSPC specifications.

Details

- Include adequate section cuts to define extent of details. Make the transition between details clear.
- Avoid the use of "similar" details. If used, specify exactly what is variable so the builder can identify what is expected.
- Do not rely on others interpretation and application of typical details at similar conditions, specifically detail all non-typical (unique) conditions.
- Locate, size, and provide details for unique conditions (bearing pads, slide bearings) and other specialty items.
- Field welding expectations are outlined primarily for bidding purposes.
- Column splices detailed with location defined or criteria identified.

Connections

- Ensure each connection clearly indicates the connection design method. Use the same language as AISC Code of Standard Practice 3.1.1 options.
    - Option 1: Connection is completely designed and adequately detailed in the Structural documents. Nothing is to be designated or selected by the detailer. Anything that is not defined will need to be clarified by the detailer prior to detailing, not in the approval process.
    - Option 2: An experienced detailer shall select and complete the connection utilizing information contained in the design documents and the AISC Steel Construction Manual, or other reference information provided by the engineer of record. Per the AISC Code of Standard Practice, "it is not the intent that this method be used when the practice of engineering is required."
    - Option 3: Full connection design is to be provided by a licensed engineer working for the fabricator.
- When option 1 is implemented, ensure all moment connections are fully sized and defined.
- For Options 2 & 3:
    - Any restrictions on the connections are clearly defined. Connections rejected at approval that meet the specified design requirements may incur additional charges for redesign.

    - All the loading requirements (axial forces, transfer forces, shear, and moments) are provided in the design documents. Be sure to indicate if the values are service-level or factored-load level and LRFD or ASD.
    - Note if safety factors (omega) been included in the loads.
- Explicitly define what details are required as detailed vs those that may be substituted by the fabricator with accompanying sealed calculations.
- Fully define all connections that are not structural steel to structural steel. These include steel to: concrete, CFMF, light/heavy timber, etc.
    - All anchors, embeds, minimum/maximum grout thicknesses, base plates, etc. are completely defined.
    - Holes in column base plates that receive concrete anchors should be designed with hole sizes and plate washers according to AISC Recommended Sizes for Washer and Anchor Rod Holes in Base Plates
    - Consider all trades tolerances when designing/detailing a connection
- Bolt size, type, thread conditions, and slip critical class are identified where required.
- Member reinforcing must be shown, at minimum, in sufficient detail for bidding. This includes sufficient information to determine quantities of member reinforcement.
    - Locations away from connections are to be completely designed and detailed in the Structurals.
    - Locations at connections are to be completely designed and detailed in the Structurals except if connection design Option 3 is specified. When Option 3 is defined, at minimum, project-specific conceptual reinforcing details are required. These conceptual reinforcing details will be completed by the licensed engineer working for the fabricator.