

Considerations for the Preparation of Structural Steel Specifications

SEAC/ RMSCA Steel Liaison Committee

September 16, 2010

Disclaimer

SEAC, RMSCA, nor its committees, writers, editors and individuals who have contributed to this publication make any warranty, expressed or implied, or assume any legal liability or responsibility for the use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this document.

This document does not replace and is not to be used as an adjunct to the current edition of the American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges" or Case Document 962D.

This paper was prepared by the SEAC/ RMSCA Steel Liaison Committee, a coalition of Structural Engineers, Front Range Fabricators, Detailers and Erectors dedicated to improving the steel construction industry.

Participating Members of the Committee

Benton Cook, P.E., S.E., Wiss, Janney, Elstner Associates, Inc.
Dave Henley, P.E., Vulcraft
Robert Leberer, P.E., S.E., Anderson & Hastings Consulting Engineers, Inc.
Bill McGlue, B & C Steel
Justin Mitchell, P.E., LPR Construction Co.
Tom Skinner, P.E., JVA Consulting Engineers
Maynard Trostel, P.E., Puma Steel
Jules Van de Pas, P.E., S.E., Computerized Structural Design
David Weaver, P.E., Zimmerman Metals, Inc.
Bruce Wolfe, P.E., Structural Consultants, Inc. (Chairman)
Bill Zimmerman, P.E., Retired

Introduction

Specifications are written instructions accompanying the Design Drawings and are an integral part of the Construction Documents. Typically, they describe material standards, choices and quality, workmanship, performance, testing, inspection and installation procedures, and other information more easily presented in written form. By convention, Specifications are separately bound in book form, but not always, and issued with the Design Drawings, which together are intended to provide complimentary portions of the Construction Documents.

Specifications are prepared for selected new and renovation projects. There is not a rule regarding if Specifications must be prepared or if the format is to be the long form or short form version. These decisions are often based upon consideration of the project size and complexity, the preference of the Architect or Engineer of Record (EOR) and the requirements of the client. Preparation of the Specifications is sometimes done by an outside Specification Writer, but commonly is done in-house by the architectural firm, engineering firm or a joint effort by both firms.

The General Contractor, Detailer, Fabricator and Erector are sometimes faced with incomplete and conflicting Structural Steel Specifications and consequently can become confused about the designer's intent. Critical comments frequently voiced are that the Specifications are "not job specific", they are "boiler plate" or "cut and pasted" from another project. A related statement can be found in the MASTERSPEC editing instructions:

Leaving unnecessary or inapplicable MASTERSPEC text in the section can obscure the true extent of the work, causing bidders to allow for unnecessary contingencies in pricing the project. You should diligently proceed to remove all unnecessary text. Do not assume that quality control is increased and professional liability is reduced by retaining requirements that do not apply to the project.

AIA A201 *General Conditions of the Contract for Construction* states, "The drawings are the graphic and pictorial portions of the Contract Documents...showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams." The CSI Manual of Practice (MOP) says, "Drawings indicate the relationships between elements..."

With respect to Specifications, AIA A201 states, "The Specifications are that portion of the Contract Documents consisting of written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance related services." The CSI MOP further states, "Specifications define qualitative requirements for products, materials, and workmanship"... , including testing, inspections and standards.

Our committee has found that there is much more written regarding the proper preparation of Design Drawings than project Specifications. CASE Document 962D *A Guideline Addressing Coordination and Completeness of Structural Construction Documents*, Sections 5 and 6 is one example where specifications are briefly mentioned, while the Appendix B provides a comprehensive Drawing Review Checklist.

Designers face challenges that make the preparation of Specifications difficult:

1. Early packages must be issued before there is a complete understanding of the project complexity.
2. Sometimes there is a lack of understanding by the designer regarding the important issues that must be included or not included in the Specifications.
3. There often is a lack of formal training in the preparation of Specifications.

4. Materials may be selected that satisfy the design criteria but are not readily available or appropriate.
5. Preparation of the Specifications is sometimes done by an individual not familiar with the project.
6. Preparation of the Specifications often occurs at the 11th hour when the pressure to complete the Design Drawings is at a peak. This pressure can cause the designer to choose the easier route between taking the time to customize the Specification for the specific project vs. “cutting and pasting” or providing “a boiler plate Specification”.

This paper briefly discusses comments concerning General Notes and discrepancies between Design Drawings and Specifications. The paper then wraps up with the top topics the committee has found in need of improvement. The Appendix provides an outline of the typical items found in Structural Steel, Steel Joist and Steel Deck Specifications with some added committee comments.

The purpose of this paper is to point out concerns that the structural steel industry has found with Structural Steel Specifications and to offer suggestions that can improve their preparation and effectiveness.

Comments Concerning General Notes

Structural General Notes are normally shown in the Design Drawings to provide guidance in the use of the drawings and to provide the design standards used to prepare the Documents. They are also used to document loading criteria and other information required by the governing building code. Sometimes the information contained in the General Notes is redundant with respect to the Specifications, thus allowing for the possibility of mistakes and confusion. Specifications are normally expected to contain specific information concerning the project whereas the Structural General Notes are normally regarded to be general in their content. On some projects when Specifications are not prepared, the General Notes are sometimes expanded to include information that would normally be found in the Specifications. Each project is unique and each structural design office has its own practice.

Instead of recommending where the information should be placed, we only suggest that the Specifications and the Structural General Notes be coordinated prior to issuance of the Contract Documents to avoid duplicating information, mistakes and confusion. See STRUCTURE magazine, *Structural Drawings...A Perspective*, June 2005.

Drawing and Specification Discrepancies

Regarding discrepancies, the AISC Code of Standard Practice (CSP), Section 3.3, states, “When discrepancies exist between the Design Drawings and Specifications, the Design Drawings shall govern. When discrepancies exist between scale dimensions in the Design Drawings and the figures written in them, the figures shall govern. When discrepancies exist between the structural Design Drawings and the architectural, electrical or mechanical Design Drawings or Design Drawings for other trades, the structural Design Drawings shall govern....”

This expectation can be a challenge to follow when the Design Drawings and Specifications are not well coordinated. From a practical viewpoint, when a Fabricator reviews the Specifications for a project, he is looking for exceptions to standard practice, anything out of the ordinary that can have cost, schedule, coordination or quality implications such as:

1. Special or unusual materials
2. Standard bolts vs. TC bolts

3. Long lead items
4. Special prime painting or galvanizing
5. Special connection design requirements
6. Special construction requirements
7. Exceptions to the CSP

When the Specifications are not prepared for the unique project with the appropriate information, the Fabricator will find conflicts and he will not clearly understand what to price. Our committee has found that Fabricators most often have the most confidence in the Plan Notes, then the General Notes and least of all, the Specifications. The Designer should make sure the General Notes complement the Specifications. Conflicts, repetition, redundancy and ambiguous language should be minimized. However, because of IBC Code requirements, Owner expectations and key information needed in the Design Drawings for future considerations, redundancies cannot be completely avoided.

Top Topics Needing Attention

1. **Prime Painting/ Galvanizing**
2. **Removal of Steel Backing**
3. **AISC Certification for Fabricators & Erectors**
4. **Independent Testing & Inspection**
5. **Unstated Expectations**

Conclusions

1. Specifiers need to take the time necessary to customize the Specifications for the specific project. Specifications are an important part of the Design Documents. The Specifier is also encouraged to begin preparation with an unedited version of a master or a partially edited version from the outside specification consultant.
2. Editing instructions that accompany the Specification master are normally available to assist the Specifier regarding decisions that need to be made.
3. Specifications should be edited by an experienced person who is intimately familiar with the project.
4. An internal Quality Control program within a firm to properly prepare Specifications, to monitor mistakes and problems and to update the preparation procedures is encouraged. A comprehensive checklist would be beneficial.
5. Avoid ambiguous language and redundancy. Words, descriptions, terminology, and abbreviations should be consistent.
6. Carefully coordinate the Specifications with the Plan Notes and the General Notes.
7. The committee believes there can be quality benefits for the project when AISC certification is required. Non-AISC certified Fabricators may not have a specific quality control program to follow, although the Specifications generally require that a Fabricator adhere to the CSP. AISC Certified Fabricators are required to adhere to the CSP. Specifiers are encouraged to become familiar with this document and to clearly define any necessary exceptions in the Structural Steel Specification so as to define the Design Team expectations. The AISC CSP is available as a free download at www.aisc.org.
8. Unstated expectations should be avoided and clearly defined in the Specifications.
9. To avoid confusion, delays and unexpected costs, galvanizing and special paint system requirements need to be quantified and defined qualitatively.
10. AISC Certified Fabricators are usually very open to discussing the Specifications prior to their issuance to assist the Specifier in their preparation. Sometimes an item that seems clear to the Specifier may be unclear to the Fabricator.

11. The Designer should carefully consider if Specifications are required for any given project.

Appendix

Following are representative Specification master templates that a Specification editor may start with. The full text is not included, only the general topics. Committee comments are included in *italics*.

Typical 05120 Structural Steel Specification Template

Part 1 – General

1.1 Related documents – *Unusual conditions or exceptions should be included.*

1.2 Summary

- A. Included work – *How specific should this be? Grout is generally excluded by Fabricators and almost always performed by the General Contractor. Sometimes grout is a stand-alone section.*
- B. Related sections – *How do Fabricators, Detailers and Erectors use this section? Bituminous mastic? (below grade steel protection)*

1.3 Definitions

- A. Structural steel – *Reference to AISC 303-05 (CSP) is good.*
- B. Seismic-load-resisting system - *The AISC 360 references can be found in the back of the 13th edition.*
- C. Protected zone – *High seismic projects.*
- D. Demand critical welds – *High seismic projects.*

1.4 Performance requirements

- A. Connections – *There are a number of directions to take with connections. Here it is sufficient to say that any statements in the Specifications must be consistent with the EOR design intent and description in the drawings regarding connections. Documents must be clear whether or not ASD or LRFD is to be used.*
- B. Moment connections – *Define partially or fully restrained.*
- C. Construction

1.5 Action submittals – *Delineation from Information Submittals appears to be because of importance of timing for fabrication. Some mention of the electronic and/ or BIM model submittals can be made here as well.*

- A. Product data – *Standard.*
- B. LEED submittals – *Should be deleted if not included.*
- C. Shop drawings – *Standard. Edit for the project. Inclusion of calculations can be mentioned here, if required.*
- D. WPSs (welding procedure specifications) and PQRs (procedure qualification records) – *Only include when required.*

1.6 Information submittals – *Often, but not always, EOR will review and stamp these submittals.*

- A. Qualification data – *This section gives Owner assurance that the Fabricator and Erector have recently done a project of comparable complexity and size.*
- B. Welding certificates – *Standard.*
- C. Paint compatibility certificates – *Not sure why this is here. It is needed from a project standpoint, but should not be the responsibility of the Fabricator. This is a real sticking point for Fabricators. The Fabricator is not in the painting business but he is often assigned the responsibility to pull this together. This task should be the responsibility of the General Contractor since multiple trades are involved. Issues generally arise for projects with high performance paint and/ or on industrial projects where special painting systems are required. Timing for resolving paint compatibility is often an issue. Steel*

- painting decisions need to be made well before the painting subcontractor is on board. Usually, the Fabricator submits his preferred primer for approval.*
- D. MTRs (mill test reports) – *Standard.*
 - E. Product test reports – *Standard. Only should be included when needed.*
- 1.7 Quality assurance – *See Chapter N in the 2010 AISC 360 Specification for Structural Steel Buildings, planned for publication late in 2010.*
- A. Fabricator qualifications – *AISC certification. Category Std is important. AISC is a resource to find data on the benefits of certification. Owners may reject this requirement.*
 - B. Installer qualifications – *Most EOR's are not aware of the benefits. Are there enough Erectors to provide competitive pricing? ASCE vs. CSE? Owners may reject this requirement, especially on small projects.*
 - C. Shop-painting applicators – *This requirement is usually more appropriate for high performance paint or industrial projects.*
 - D. Welding qualifications – *Take care to ask for qualifications appropriate to the project.*
 - E. Compliance with applicable provisions – *This is a reference to industry standard documents.*
 - F. Pre-detailing conference – *Yes! Define the required participants. Come prepared.*
 - G. Pre-installation conference – *Yes, when warranted. Define the required participants. Come prepared.*
- 1.8 Delivery, storage, and handling
- A. Storage of materials - *Standard*
 - B. Storage of fasteners - *Don't allow them to get them wet. Some Erectors discard previously opened kegs.*
- 1.9 Coordination
- A. Selection of shop primers – *Fabricator usually submits his standard primer data for approval by the design team and General Contractor.*
 - B. Installation of anchorage items in other construction – *Early embed/ anchorage submittals are usually required.*

Part 2 – Products

- 2.1 Structural-steel materials – *Take care to specify materials appropriate to the project. If a non-standard shape is needed, call a local RMSCA Fabricator or go to www.ryerson.com/products-services to check on availability.*
- A. Recycled content of steel products – *Important if the Owner is seeking a LEED certification. Clarify 500 mile distance and the location of “source” or “harvesting”. Delete if not needed.*
 - B. W-shapes – *State that beams are always ASTM A 992, unless something else is specifically needed. There is no longer a dual spec.*
 - C. Channels, angles and S-shapes – *Almost always A 36, unless higher strengths are required.*
 - D. Plate and bar
 - E. Corrosion-resisting shapes – *Don't include unless needed.*
 - F. Cold-formed hollow structural sections – *Take care in choosing HSS for columns, not ASTM A53, Grade B sections. Specify Fy.*
 - G. Corrosion-resisting hollow structural sections - *Don't include unless needed.*
 - H. Steel pipe – *See 2.1.F. ASTM A 53, Grade B is normally selected. Push to use this for handrails, etc. and to use HSS for columns. Dimensions are nominal. Round shapes are sometimes distorted. Specify Fy.*
 - I. Steel castings - *Don't include unless needed.*
 - J. Steel forgings - *Don't include unless needed.*
 - K. Welding electrodes – *Either standard or low hydrogen is used, based upon the metals being welded. Specify E70XX? State that welding must be compatible with AWS and the metals being welded.*
- 2.2 Bolts, connectors, and anchors – *A 307 is now pretty well relegated to residential projects or timber framing connections.*

- A. High-strength bolts, nuts, and washers, A 325
 - B. High-strength bolts, nuts, and washers, A 490
 - C. Zinc-coated high-strength bolts, nuts, and washers – *Specify when moisture or corrosion is a concern.*
 - D. Tension-control, high-strength bolt-nut-washer assemblies
 - E. Shear connectors – *Often called HAS or headed anchor studs.*
 - F. Un-headed anchor rods – *No longer call anchor bolts. Specify ASTM F 1554 (not A 307) and the grade, often Grade 36. Be aware that Grades 55 & 105 may NOT be weldable.*
 - G. Headed anchor rods - *No longer call anchor bolts. Specify ASTM F 1554 (not A 307) and the grade, often Grade 36. Be aware that Grades 55 & 105 may NOT be weldable.*
 - H. Threaded rods – *Usually hanger or sag rods. Specify Grade 36 unless the EOR requires a higher strength.*
 - I. Clevises and turnbuckles – *Make sure the size (number) and pin diameter are defined in the drawings.*
 - J. Eye bolts and nuts
 - K. Sleeve nuts
 - L. Structural slide bearings
- 2.3 Shop Primer - *It has been suggested that the strategy for painting be as follows:*
- a. *If shop priming is NOT required, state this.*
 - b. *If shop priming IS required, state a baseline primer such as a red oxide primer with the appropriate SSPC preparation requirement and then defer all other requirements to the appropriate Division 9 section.*
- A. Low-emitting materials – *Usually a concern only with LEED.*
 - B. Shop Primer – *If required, but if it is not part of an overall paint system, then the Fabricator should be allowed to submit his standard.*
 - C. Galvanizing repair paint – *Spray is normally used.*
- 2.4 Grout
- A. Metallic, shrinkage-resistant grout
 - B. Nonmetallic, shrinkage-resistant grout – *Specify this choice where exposed or when the loadings (psi) are not super high.*
- 2.5 Fabrication
- A. Structural steel
 - B. Thermal cutting – *AISC CSP allows this to occur with conditions, section 6.2.*
 - C. Bolt holes
 - D. Finishing – *For columns, state “finish to bear”.*
 - E. Cleaning – *Follow CSP, section 6.*
 - F. Shear connectors
 - G. Steel wall-opening framing – *Delete if not used.*
 - H. Welded door frames – *Delete if not used.*
 - I. Holes – *Follow AISC*
- 2.6 Shop connectors
- A. High-strength bolts
 - B. Weld connections
- 2.7 Prefabricated building columns – *Proprietary; Delete if not used.*
- A. Description - *(concrete fill)*
 - B. Fire-resistance ratings
- 2.8 Shop priming – *Some primers are inorganic zinc. Special products are acceptable for connection zones.*
- A. Description of surfaces to be and not be painted
 - B. Surface preparation – *See April 2008 MSC “Properly Prepared” article.*
 - C. Priming - *Check AISC CSP and Design Manual for slip coefficient.*
 - D. Painting
- 2.9 Galvanizing – *Dacromet could be an alternative consideration, but it is costly. Do not hot dip galvanize bolts. It is better to get powder coated or electro-plated. Venting is required.*
- A. Hot-dip galvanized finish - *G60 is the normal thickness than is provided. Galvanized surfaces can be painted after acid etch preparation “pickling” is done.*

- 2.10 Source quality control – *What does AISC CSP say? Sometimes waived by building official.*
- A. Testing agency - *If a non-AISC Fabricator is allowed, we suggest the Owner be advised that additional testing costs may be incurred. An added statement in the specifications could be “The Owner reserves the right to inspect”.*
 - B. Correction of deficiencies
 - C. Bolted connection testing
 - D. Welded connection testing
 - E. Shop-welded shear connector testing

Part 3 – Execution

3.2 Examination

- A. Field verification – *This is normally stated to be the responsibility of the General Contractor. However, it is much more common for the Erector to do this work. Our committee prepared a paper concerning this. See RMSCA website. Also see the AISC CSP, Section 7.*
- B. Proceed after unsatisfactory conditions have been corrected - *OSHA sub-part R requires deficient anchor rods and embed plates to be repaired and signed-off prior to commencing work.*

3.3 Preparation

- A. Temporary shores, guys, braces, etc. – *If the designer has concerns about stability during erection that are not apparent, this would be a good place to state this concern. Also include in the drawings. Be careful to separate “means and methods” vs. stating concerns.*

3.3 Erection

- A. Setting requirement standards
- B. Base and leveling plates – *Timing of grouting?*
- C. Maintaining of erection tolerances – *State specific requirements if different than the industry standards.*
- D. Alignment and adjustment
- E. Splicing
- F. Don't use thermal cutting – *Allow in certain cases? See the CSP.*
- G. Limitations on hole enlargement – *Ream if necessary.*
- H. Shear connector surface preparation – *As recommended by the shear connector manufacturer.*

3.4 Field connections

- A. High-strength bolts – *Refer to the bolt specification.*
- B. Weld connections – *Here is where we discuss removal of backing bars. AISC Design Guide 21, AISC 360, AISC 303-05 and AISC 341.*

3.5 Prefabricated building columns

- A. Installation standard

3.6 Field quality control

- A. Testing agency – *Almost always paid by the Owner, but the General Contractor is responsible to coordinate.*
- B. Bolted connection testing
- C. Welded connection testing
- D. Field-welded shear connector testing
- E. Correction of deficiencies

3.7 Repairs and protection– *Be specific to touch up only the required surfaces. Or if it is not required, state, “Touch up painting or galvanizing is not required”.*

- A. Galvanized surfaces
- B. Touchup painting

Typical 05210 Steel Joists Specification Template

Part 1 – General

1.1 Related Documents

1.2 Summary

- A. Included Work -
- B. Related Sections – *Important if other trades affect the manufacture of the joists.*

1.3 Definitions

- A. SJI "Specifications" – *Normally found in the manufacturer's catalogue.*
- B. Special Joists – *Joist manufacturers require specific loads to be shown in the drawings.*

1.4 Performance Requirements

- A. Structural Performance – *Be definitive for non-standard requirements and understand that non-standard joists may be more costly. Make sure drawing notes agree.*
- B. Design special joists to withstand design loads with live load deflections no greater than the following - *Deflection control can be exceptionally expensive.*
- C. Vibration Considerations – *SJI & AISC have published data to determine the vibration characteristics of steel joist and concrete-floor assemblies.*
- D. Mechanical Considerations – *Alignment of openings for ducts.*

1.5 Submittals

- A. Product Data
- B. LEED Submittal – *Check with joist supplier on re-cycled content. This can be 90% or greater.*
- C. Shop Drawings – *These should be called "Placement" or "Joist" drawings.*
- D. Welding certificates – *For field welding only. SJI welding certification for welding done at in the plant is different than AWS. See SJI Technical Digest #8.*
- E. Manufacturer Certificates – *This instead should say, "Manufacturer's SJI Certification."*
- F. Mill Certificates – *Include only if needed.*
- G. Erector Qualification Data
- H. Field quality-control test and inspection reports
- I. Research/Evaluation Reports – *This term is too generic. Specify which reports are required.*

1.6 Quality Assurance

- A. Manufacturer Qualifications
- B. SJI Specifications
- C. Welding

1.7 Delivery, Storage, and Handling

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications." See *SJI Technical Digest No. 9 "Handling and Erection of Steel Joists and Joist Girders"*.
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

Part 2 – Products

2.1 Materials

- A. Steel
- B. Carbon-Steel Bolts and Threaded Fasteners
 - High-Strength Bolts, Nuts, and Washers
 - Welding Electrodes
 - Galvanizing Repair Paint

2.2 Primers

2.3 K-Series Steel Joists – *The 8" depth has been eliminated. Span range is 10' to 60'.*

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel chords. *Unless noted or shown otherwise.*
 - B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or steel-channel members. *Loadings or sizes must be specified in the drawings. SJI no longer arbitrarily advises "Proportionally reducing carrying capacity for reduction of chord area due to holes in chords".*
 - C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work. *No – The welding requirements fall under SJI certification.*
 - D. Top-Chord Extensions/ Extended Ends – *Consider leaving the choice to the manufacturer unless there are clearance or appearance issues.*
 - E. Ceiling Extension – *Normally only required for ceiling directly attached to the bottom chord.*
 - F. Camber joists – *SJI standard is to provide camber on a standard radius in accordance with the SJI camber tables. If the standard camber is to be modified, clearly state this. SJI no longer considers camber to be at the option of the manufacturer.*
 - G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).
- 2.4 CJ-Series Composite Steel Joists – *Maximum span-to-depth ratio is L/30. Specify camber for 100% of the non-composite dead load.*
- 2.5 Long Span Steel Joists
- A. Manufacture steel joists according to "Standard Specifications for Long span Steel Joists, LH-Series and Deep Long span Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as follows: *Joist profiles are normally indicated in the drawings. DLH joists can be used to support floor loads.*
 - B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work. *No – The welding requirements fall under SJI certification.*
 - C. Camber long-span steel joists – *The standard will come from the SJI camber tables. Otherwise, specify the required camber.*
 - D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).
- 2.6 Joist Girders
- A. Manufacture joist girders according to "Standard Specifications for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord members – *With underslung ends and bottom chord extensions.*
 - B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work. *No – The welding requirements fall under SJI certification.*
 - C. Camber joist girders – *The camber will be done in accordance with the SJI camber tables unless noted otherwise.*
 - D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).
 - E. Provide holes in chord members for connecting and erecting other construction to joist girders following O.S.H.A. requirements. *This is rarely done.*
- 2.7 Joist Accessories
- A. Bridging – *While SJI provides tables for the bridging sizes and spacing, the manufacturer normally designs it for the specific project. Where it does not matter to the EOR, leave the choices for horizontal or diagonal bridging, to allow the joist manufacturer to optimize the design. The main purpose for bridging is for stability and lateral support for the joists during and after erection. Bracing can look a lot like bridging, but it is not bridging and is not designed or provided by the joist manufacturer.*

- B. Steel bearing plates with integral anchorages are specified in Division 5 Section "Structural Steel."
 - C. Supply ceiling extensions, either an extended bottom-chord element or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface, unless otherwise indicated. – *Normally only required for ceiling directly attached to the bottom chord.*
 - D. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.
- 2.8 Cleaning and Shop Painting – *Non standard primers normally must be applied by a 3rd party and will be very costly.*
- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2. - *Power-tool SSPC-SP 3 cleaning is non-standard and will be more costly.*
 - B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials. *This concern is no longer relevant. Individual joist members are relatively small and can be painted to satisfy UL. Don't specify unpainted unless it is required. However, composite joists normally are not shop primed. If a special finish paint system is specified, consider a field applied primer.* Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick. *Specify SSPC-15 prime painting rather than a thickness which is covered by the primer specification. This specification covers a one coat shop-applied primer for open web and long span steel joists and joist girders and for cold formed steel framing, and for primary and secondary structural framing for metal buildings. This coating is intended to provide temporary protection to the steel joist during delivery, storage on site, and erection in an atmosphere comparable with SSPC Environmental Zone 1, normally dry. This coating is intended to be used as a holding primer that may or may not be removed before or after erection or assembly in the field. The specification does not address the formulation of the coating but covers the physical and performance characteristics of the coating.*
 - C. Shop priming of joists and joist accessories is specified in Division 9. *If this statement is included, coordinate with the Architect.*

Part 3 – Execution

3.1 Examination

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 Installation

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work. *K-Series joists normally can only have a 1/8" maximum fillet weld (2"x1/8"x1" long minimum). LH-Series joists should have a 2"x¼"x 2" minimum fillet weld.*
- D. When bolting joists to supporting steel framework, use carbon-steel bolts. *Joist seats should also be welded after bolted connections are made since the joist slots are for erection only. Avoid rigid bottom chord connections unless the members have been designed to be part of the frame.*
- E. When bolting joists to supporting steel framework, use high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements. *The connections must be designed and provided to the manufacturer.*

- F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams. *Last sentence should read, "Terminate bridging lines per OSHA regulations". "Bracing" indicated in the EOR drawings is different than "bridging" and is not provided by the joist supplier.*

3.3 Field Quality Control

- A. Testing Agency
- B. Field welds will be visually inspected according to AWS D1.1/D1.1M.
- C. In addition to visual inspection, field welds will be tested according to AWS D1.1/D1.1M and the following procedures, as applicable.
- D. Bolted connections will be visually inspected.
- E. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."
- F. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- G. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 Repairs and Protection

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting -
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

Typical 05310 Steel Deck Specification Template

Part 1 - General

1.1 Related Documents

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

- A. Included work
- B. Related Sections

1.3 Action Submittals

- A. Product Data
- B. LEED Submittal – *The recycled content can vary from 15% to 90% depending on the manufacturer. Check with a local supplier.*
- C. Shop Drawings – *Should be called "Deck Placement Drawings." See SDI Publication "Deck Damage and Penetrations" for recommended opening sizes that should be considered to be reinforced.*

1.4 Informational Submittals

- A. Welding certificates
- B. Product Certificates – *SDI does not provide certifications. SDI members can provide a certificate showing membership in SDI. Usually, SDI manuals or other tables developed in accordance with SDI methods by manufacturers are used for deck design.*
- C. Product Test Reports – *Fasteners and acoustic deck.*
- D. Research/Evaluation Reports – *Refer to specific, proprietary ICC reports instead of the SDI if the report was the basis of deck design. State if FMG is required.*
- E. Field Quality Control Reports

1.5 Quality Assurance

- A. Installer Qualifications
- B. Test Agency Qualifications

- C. Source Limitations for Electrified Cellular Floor Deck
 - D. Welding
 - E. Fire-Test-Response Characteristics
 - F. AISI Specifications
 - G. Electrical Raceway Units
 - H. FMG Listing – *There are currently 3-5 manufacturers who have FMG approval for 3” roof deck.*
 - I. Recycled Content of Steel Products
- 1.6 Delivery, Storage, and Handling
- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
 - B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
- 1.7 Coordination
- A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation specified in Division 7 Section to ensure protection of insulation strips against damage from effects of weather and other causes.
 - B. Coordinate layout and installation of trench headers, preset inserts, duct fittings, and other components specified in Division 16 Section "Under-floor Raceways" with installation of electrified cellular metal floor deck.

Part 2 – Products *Manufacturers prefer gages to be specified in lieu of thicknesses, to avoid the mistake of specifying an unintended thickness.*

- 2.1 Manufacturers – *Deck lengths are controlled by manufacturing limitations, which is in the 42’ to 45’ range. Check with a local supplier. Use SDI when specifying the gage and Fy. Manufacturers prefer this information be shown in the drawings.*
- 2.2 Roof Deck
- A. Steel Roof Deck – *Side laps are normally overlapped, not interlocking.*
- 2.3 Acoustical Roof Deck
- A. Acoustical Steel Roof Deck – *Insulation for placement within the flutes is now limited to only glass-fiber. The choice of the rigid insulation above the deck can have a significant impact on the NRC. Make sure the roofing insulation corresponds with the acoustic NRC specified.*
- 2.4 Composite Floor Deck
- A. Composite Steel Floor Deck
- 2.5 Electrified Cellular Floor Deck – *Available profiles vary with manufacturers.*
- A. Electrified Cellular Floor Deck
- 2.6 Non-composite Form Deck
- A. Non-composite Steel Form Deck
- 2.7 Accessories
- A. General
 - B. Mechanical Fasteners
 - C. Side-Lap Fasteners
 - D. Flexible Closure Strips – *Normally EPDM.*
 - E. Miscellaneous Sheet Metal Deck Accessories – *Piercing hanger tabs are no longer used.*
 - F. Pour Stops and Girder Fillers – *Normally supplied as G60 galvanized.*
 - G. Column Closures, End Closures, Z-Closures, and Cover Plates
 - H. Weld Washers
 - I. Recessed Sump Pans – *Often, the only choice is recessed, not flat. Use when the drain is within the plane of the roof deck.*
 - J. Flat Sump Plate
 - K. Galvanizing Repair Paint
 - L. Repair Paint

Part 3 – Execution

3.1 Examination

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 Installation, General

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks. *This procedure will damage the side laps.*
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work. *Weld washers are required for decks 22 gage or thinner. For side laps, do not weld for decks thinner than 22 gage. Avoid all side lap welding if possible due to quality and expense.*
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions. *This should read "Fastener manufacturer", not "deck manufacturer".*

3.3 Roof Deck Installation

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
- B. Side-Lap and Perimeter Edge Fastening – *Normally lap 2" to 3"*.
- C. End Bearing – *Often lap 3"*.
- D. Roof Sump Pans and Sump Plates
- E. Miscellaneous Roof-Deck Accessories
- F. Flexible Closure Strips
- G. Sound-Absorbing Insulation

3.4 Floor Deck Installation

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
- B. Side-Lap and Perimeter Edge Fastening
- C. End Bearing
- D. Pour Stops and Girder Fillers
- E. Floor-Deck Closures
- F. Electrified Cellular Floor Deck

3.5 Field Quality Control

- A. Testing Agency
- B. Field welds and other attachments will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 Repairs and Protection

- A. Galvanizing Repairs
- B. Repair Painting
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.