CODE OF STANDARD PRACTICE

FOR COMPOSITE STEEL JOISTS

Adopted by the Steel Joist Institute May 10, 2006
Revised to May 18, 2010 - Effective December 31, 2010

SECTION 1
GENERAL

1.1 SCOPE

The practices and customs set forth herein are in accordance with good engineering practice, tend to ensure safety in composite steel construction, and are standard within the industry. There shall be no conflict between this code and any legal building regulation. This code shall only supplement and amplify such laws. Unless specific provisions to the contrary are made in a contract for the purchase of composite steel joists, this code is understood to govern the interpretation of such a contract.

1.2 APPLICATION

This Code of Standard Practice is to govern as a standard unless otherwise covered in the architects' and engineers' plans and specifications.

1.3 DEFINITIONS

Buyer. The entity that has agreed to purchase material from the manufacturer and has also agreed to the terms of sale.

Erector. The entity that is responsible for the safe and proper erection of the materials in accordance with all applicable codes and regulations.

Material. Composite steel joists and accessories as provided by the seller.

Owner. The entity that is identified as such in the contract documents.

Placement Plans. Drawings that are prepared depicting the interpretation of the contract documents requirements for the material to be supplied by the seller. These floor and/or roof plans are approved by the **specifying professional**, buyer or owner for conformance with the design requirements. The seller uses the information contained on these drawings for final material design. A unique piece mark number is typically shown for the individual placement of the composite steel joists and accessories along with sections that describe the end bearing conditions and minimum attachment required so that material is placed in the proper location in the field.

Seller. A company certified by the Steel Joist Institute engaged in the manufacture and distribution of composite steel joists and accessories.

Specifying Professional. The licensed professional who is responsible for sealing the building contract documents, which indicates that he or she has performed or supervised the analysis, design and document preparation for the structure and has knowledge of the load-carrying structural system.

Structural Drawings. The graphic or pictorial portions of the contract documents showing the design, location and dimensions of the work. These documents generally include plans, elevations, sections, details, connections, all loads, schedules, diagrams and notes.

1.4 DESIGN

In the absence of ordinances or specifications to the contrary, all designs prepared by the **specifying professional** shall be in accordance with the Steel Joist Institute Standard Specifications for Composite Steel Joists, **CJ**-Series, of latest adoption.

1.5 RESPONSIBILITY FOR DESIGN AND ERECTION

When material requirements are specified, the seller shall assume no responsibility other than to furnish the items listed in Section 5.2 (a). When material requirements are not specified, the seller shall furnish the items listed in Section 5.2 (a) in accordance with Steel Joist Institute Standard Specifications for Composite Steel Joists, **CJ**-Series, of latest adoption, and this code. Pertinent design information shall be provided to the seller as stipulated in Section 6.1. The seller shall identify material by showing size and type. In no case shall the seller assume any responsibility for the erection of the item furnished.

1.6 PERFORMANCE TESTS FOR CJ-SERIES STEEL JOIST CONSTRUCTION

When a performance test on a composite steel joist is required, the following criteria shall be used:

a) The performance test load shall be the maximum factored uniformly distributed composite design load for the selected composite steel joist.

b) Joist self-weight and the weight of all test materials (i.e. bridging, top deck, slab, ceiling materials, etc.) shall be included in the calculation of applied performance test loading as appropriate for the composite steel joist during testing.

c) Loading shall be uniformly distributed across the full length of the joist top chord, and the load application shall maintain uniform distribution throughout the test. At any stage during the application of the test loading, the test load shall not be distributed in such a manner as to result in any joist component being subjected to a higher proportion of force than intended by the composite steel joist design.

d) At a minimum, a panel test assembly shall be comprised of a pair of joists with bridging, top deck, shear studs and concrete slab applied as used. The concrete shall be allowed adequate cure time as determined by the **specifying professional** (typically 28 days) prior to testing. The deck attachments and bridging shall be installed per the approved joist and deck placement plans. All bottom chord horizontal bridging rows shall be terminated by bracing back to the top chord of the adjacent joist or by a lateral restraint system which does not inhibit the vertical deflection of the panel test assembly.

e) The performance test loading shall be applied at a rate of no greater than 25 plf per minute and shall be sustained for no less than 15 minutes. After the maximum test load has been removed for a minimum of 10 minutes, the remaining vertical displacement at midspan shall not exceed 20% of the vertical midspan deflection sustained under the full performance test load.

f) All costs associated with such testing shall be borne by the purchaser.

g) Joists that have been designed and manufactured and have satisfied the above performance test criteria shall be considered to satisfy the intent of the **CJ**-Series Standard Specification, and shall be considered safe for use in construction. No further proof of strength of individual joist components or connections is required.

SECTION 2
COMPOSITE JOISTS AND ACCESSORIES

2.1 COMPOSITE STEEL JOISTS

Composite steel joists shall carry the loads and meet the requirements of the Steel Joist Institute Standard Specifications for Composite Steel Joists, **CJ**-Series, of latest adoption.

CJ-Series joists are furnished with parallel chords only, and with minimum standard end bearing depth of 2½ inches (64 mm). **CJ**-Series joists shall be permitted to be furnished with either under slung or square ends.

2.2 JOIST LOCATION AND SPACING

The maximum joist spacing shall be in accordance with the requirements of Section 104.8, Steel Joist Institute Standard Specifications for Composite Steel Joists, **CJ**-Series, of latest adoption.

Where sidewalls, wall beams or tie beams are capable of supporting the floor slab or roof deck, the first adjacent composite steel joists may be placed one full space from these members. **CJ-**Series joists are provided with camber. These joists may have a significant difference in elevation with respect to the adjacent structure because of this camber. This difference in elevation should be given consideration when locating the first composite steel joist adjacent to a sidewall, wall beam or tie beam. Therefore, it is recommended that this joist be located one full space away from these members.

Where load bearing partitions occur parallel to joists, joists are generally placed under each such partition, and more than one such joist shall be provided if necessary to safely support the weight of such partition and the adjacent floor, less the live load, on a strip of floor one foot (0.305 m) in width. Where partitions occur perpendicular to the joists, they shall be treated as concentrated loads in accordance with Section 6.1.

2.3 JOIST EXTENSIONS

Composite steel joist extensions shall be in accordance with the requirements of the Steel Joist Institute Standard Specifications Load Tables & Weight Tables of latest adoption.

The magnitude and location of the loads to be supported, deflection requirements, and proper bracing of joist or Joist Girder Top Chord Extensions (S Type), Extended Ends (R Type) or full depth cantilever ends shall be clearly indicated on the structural drawings.

Extended joist ends shall be assumed to act non-compositely. In the absence of a load diagram, the extended top chord shall be designed for the uniformly distributed load.

2.4 CEILING EXTENSIONS

Ceiling extensions shall be furnished to support ceilings which are to be attached to the bottom of the joists. They are not furnished for the support of suspended ceilings. The ceiling extension shall be either an extended bottom chord element or a loose unit, whichever is standard with the manufacturer, and shall be of sufficient strength to properly support the ceiling.

2.5 BRIDGING AND BRIDGING ANCHORS

(a) Bridging standard with the manufacturer and complying with the applicable Steel Joist Institute Standard Specifications for Composite Steel Joists, **CJ**-Series, of latest adoption shall be used for bridging all joists furnished by the manufacturer. Positive anchorage shall be provided at the ends of each bridging row at both top and bottom chords.

(b) Diagonal cross bridging consisting of angles or other shapes connected to the top and bottom chords of **CJ-**Series joists shall be used when required by the Steel Joist Institute Standard Specifications for Composite Steel Joists, **CJ**-Series, of latest adoption.

Diagonal bridging, when used, shall have a ℓ/r ratio not exceeding 200.

(c) For the **CJ**-Series joists, horizontal bridging is recommended for spans up to and including 60 feet (18.3 m) except where code requirements for *erection stability* and/or the Steel Joist Institute Specifications require bolted diagonal bridging.

CJ-Series joists, exceeding 60 feet (18.3 m) in length shall have bolted diagonal bridging for all rows.

Refer to Section 105 in the Steel Joist Institute Standard Specifications for Composite Steel Joists, **CJ**-Series, of latest adoption for erection stability requirements.

Refer to OSHA *Safety Standards for Steel Erection, 29 CFR 1926.757 – Open Web Steel Joists* for erection stability requirements.

Note: The requirements as per OSHA also apply for composite steel joists since, during erection, a composite joist is like any SJI steel joist. Only after the concrete has cured, does the joist become composite.

Horizontal bridging shall consist of continuous horizontal steel members. The ℓ/r ratio for horizontal bridging shall not exceed 300.

(d) When bolted diagonal erection bridging is required, the following shall apply:

1. The bridging shall be indicated on the joist placement plan.
2. The joist placement plan shall be the exclusive indicator for the proper placement of this bridging.
3. Shop installed bridging clips, or functional equivalents, shall be provided where the bridging bolts to the steel joist.
4. When two pieces of bridging are attached to the steel joist by a common bolt, the nut that secures the first piece of bridging shall not be removed from the bolt for the attachment of the second piece.
5. Bridging attachments shall not protrude above the top chord of the steel joists.

2.6 CAMBERING

(a) Manufacturing Tolerances

The camber tolerance for **CJ**-Series joists, as shown in Table 2.6, shall be -0 in., +1/4 in. (6 mm) or -0 in., + L/1600 [where L = top chord length, in. (mm)] whichever is greater. Negative camber is not permitted.

TABLE 2.6
Camber Tolerances

TOP CHORD LENGTH feet (mm)	TOLERANCE - or + inches (mm)
20 (6,096)	-0, +1/4 (6)
30 (9,144)	-0, +1.4 (6)
40 (12,192)	-0, +1/4 (6)
50 (15,240)	-0, +3/8 (9)
60 (18,288)	-0, +1/2 (12)
70 (21,336)	-0, +1/2 (12)
80 (24,384)	-0, +5/8 (16)
90 (27,432)	-0, +5/8 (16)
100 (30,480)	-0, +3/4 (19)
110 (33,528)	-0, +7/8 (22)
120 (36,576)	-0, +7/8 (22)

(b) Camber Design

It is standard practice that a **CJ**-Series joist be furnished with sufficient camber for 100 percent of the non-composite dead load (joist, bridging, deck, and concrete slab). Joist bearings act as pinned/pinned-end connections with negligible end rotation restraint provided. Hence one shall obtain 100% of the predicted non-composite joist deflection when the full non-composite dead load has been placed on the composite joist. With the composite joist cambered for 100% of the non-composite dead load and the floor slab placed to a uniform thickness as suggested in Section 9, Concrete Placement, the floor shall be approximately level after the concrete has been placed.

Should the **specifying professional** strive to achieve a level floor after the composite dead and live loads are placed on the floor, additional joist camber can be specified on the “Composite Joist Floor Design Parameters Checklist”, see Appendix A. It is typical that the “Actual” composite dead and live loads supported by the composite steel joist are less than the full “Design” composite dead and live loads.

(c) Shop Inspection

When a check is to be made of the camber of a **CJ**-Series joist, the joist shall be carefully laid on its side with the joist intermittently supported prior to measuring the camber. With the joist lying on its side, the joist shall be in an unstressed condition at which time the amount of camber provided can be accurately determined.

Joists having measured camber outside of the camber tolerances shown in Table 2.6 shall have their camber adjusted by the joist manufacturer. At the option of the joist manufacturer, the joists shall be permitted to be rebuilt with the corrected camber.

2.7 SHEAR STUDS

The joist manufacturer shall indicate the size, quantity and layout of shear studs required on the stud installation drawings. Purchasing of the shear studs and ferrules, rental of shear stud welding equipment, installation of shear studs and field testing of shear studs is the responsibility of the shear stud installer.

SECTION 3
MATERIALS

3.1 STEEL

The steel used in the manufacture of composite joists shall comply with the Steel Joist Institute Standard Specifications for Composite Steel Joists, **CJ**-Series, of latest adoption.

3.2 PAINT

Standard shop practice is to supply composite steel joists unpainted to facilitate installation of welded shear studs. Paint may potentially hinder the installation of welded shear studs to the joist top chord.

SECTION 4
INSPECTION

Inspection of composite steel joists at the joist manufacturer's plant shall be made in accordance with the Steel Joist Institute Standard Specifications for Composite Steel Joists, **CJ**-Series, of latest adoption, Section 104.13.

Provisions for field inspection of projects involving composite steel joists shall be made by the **specifying professional**. This field inspection shall include verifying the concrete strength, concrete thickness and placement of the steel shear studs. For more information on stud placement see Section 106 of the Steel Joist Institute Standard Specifications for Composite Steel Joists, **CJ**-Series, of latest adoption. This field inspection shall not be provided by SJI member manufacturers.

SECTION 5
ESTIMATING

5.1 PLANS FOR BIDDING

Plans to serve as the basis for bids shall show the character of the work with sufficient clarity to permit making an accurate estimate and shall show the following:

- Designation and location of materials (see Section 5.2(a)), including any special design or configuration requirements.
- Locations and elevations of all steel and concrete supporting members and bearing walls.
- Joist depth.
- Joist span.
- Distance, each side of the joist centerline, to adjacent joists or other supporting members.

- Type and depth of floor deck.
- Concrete unit weight.
- Concrete compressive strength.
- Total depth of concrete slab.
- Loads and their locations as defined in Section 6.1(a).
- Location and length of joist extended ends.
- Location and size of all openings in floors and roofs.
- Location of all partitions.
- Composite Steel Joists requiring extended bottom chords.
- Deflection limitation.
- No paint on the joist. See **CJ**-Series Standard Specifications, Section 102.6 Paint.

5.2 SCOPE OF ESTIMATE

(a) Unless otherwise specified, the following items shall be included in the estimate, and requirements shall be determined as outlined in Section 6.1.

- Composite Steel Joists.
- Joist Extensions.
- Ceiling Extensions.
- Extended bottom chord used as strut.
- Bridging and bridging anchors.

(b) The following items shall not be included in the estimate but may be quoted and identified by the joist manufacturer as separate items:

- Headers for Composite Steel Joists, **CJ**-Series.
- Shear connectors and/or ferrules.
- Centering material and attachments.
- Miscellaneous framing between joists for openings at ducts, dumbwaiters, ventilators, skylights, etc.
- Loose individual or continuous bearing plates and bolts or anchors for such plates.
- Erection bolts for composite joist end anchorage.
- Horizontal bracing in the plane of the top and bottom chords from joist to joist or joist to structural framing and walls.
- Moment plates.
- Special joist configuration or bridging layouts for ductwork or sprinkler system.

SECTION 6
PLANS AND SPECIFICATIONS

6.1 PLANS FURNISHED BY BUYER

The buyer shall furnish the seller plans and specifications as prepared by the **specifying professional** showing all material requirements and composite steel joist designations.

(a) Design Input Required for Composite Steel Joists

The following basic information shall be provided by the **specifying professional**.

1. Joist Depth:

   The joist depth includes the steel joist portion only, not the deck or concrete slab, in. (mm).

2. Joist Layout:

   The joist plans shall show the layout of the composite steel joists, walls, columns, beams, girders and other supports, as well as floor and roof openings. The joist manufacturer shall determine the required composite joist span to be fabricated based on this information.

3. Finished Floor, Roof, and Bearing Elevations:

   The elevation of finished floors, roofs, and bearings shall be shown with due consideration taken for the effects of dead load deflection.

4. Adjacent Member Spacing:

   This is the distance to the adjacent member or to the edge of the slab (if an exterior joist), feet (m).

5. Type of Floor Deck:

   Review each manufacturer's deck capacity for load capacity and deflection characteristics and specify the deck depth, profile and thickness to meet the building design.

6. Concrete Unit Weight, lb/ft.^{3} (kg/m^3).

7. Concrete Compressive Strength:

   28 day specified compressive strength of concrete, ksi (MPa).

8. Slab Thickness above the top ribs of the deck, in. (mm).

9. Loads

   The Steel Joist Institute does not presume to establish the loading requirements for which structures are designed. The **specifying professional** shall provide the nominal loads and load combinations as stipulated by the applicable Code under which the structure is designed. At the present time the **CJ**-Series joists are assumed to be designed utilizing an LRFD design basis.

   The **specifying professional** shall calculate and provide the magnitude and location of ALL JOIST LOADS including those shown below. When necessary to clearly convey information, a Load Diagram or Load Schedule shall be provided.

a. Non-composite DL, lb/ft.^{2} (kPa) - Concrete, joists, deck, bridging, and any other non-composite dead loads.

b. Construction LL, lb/ft.^{2} (kPa) – It is suggested that construction live load be determined considering the tributary area for each composite steel joist. See Appendix A, Footnote 1.

c. Composite DL, lb/ft.^{2} (kPa) - Partitions, mechanical, electrical, fireproofing, floor covering, ceilings, and other composite dead loads. The magnitude and location of composite dead loads shall be clearly dimensioned.

d. Composite LL, lb/ft.^{2} (kPa) - Reduced design live loads shall be permitted to be specified if applicable.

10. Special Loads:

The **specifying professional** shall be responsible for determining the applicable building code combinations. If the loading criteria are too complex to be adequately communicated in a simple load diagram, then the Specifying Professional shall provide a load schedule showing the specified design loads, load categories and required load combinations with applicable load factors.

The **specifying professional** shall show on the structural drawings and give due consideration to the following special loads and load effects:

a. Snow drift loads including the accumulation of snow in the vicinity of obstructions such as penthouses, signs, parapets, adjacent buildings, etc.

b. Axial loads at the joist end supports.

c. Type and magnitude of end moments. For moment resisting joists framing near the end of a column, due consideration shall be given to extend the column length to allow a plate type connection between the top of the joist top chord and the column. Whenever possible, avoid resolving joist end moment forces through the joist bearing seat connection. A note shall be provided on the structural drawings stating that all moment resisting joists shall have all dead loads applied to the joist before the bottom chord struts are welded to the supporting connection whenever the moments provided do not include dead load. The top and bottom chord moment connection details and reinforcing steel placed in the concrete slab to resist negative flexural moments shall be designed by the **specifying professional**. The joist designer shall furnish the Specifying Professional with the joist detail information if requested.

d. Structural bracing loads.

e. Ponded rain water.

f. Wind Uplift - When composite steel joists are utilized in roof applications, the magnitude and location of all wind uplift loads shall be clearly shown in terms of net uplift.

g. Concentrated loads from mechanical units, fans, blowers, tanks, monorails, etc. - Where concentrated loads occur, the magnitude and location of these concentrated loads shall be shown on the structural drawings when, in the opinion of the **specifying professional**, they shall require consideration by the manufacturer.

For nominal concentrated loads, which have been accounted for in the specified uniform design loads, a "strut" to transfer the load to a panel point on the opposite chord shall not be required provided the sum of the concentrated loads within a chord pane, does not exceed 100 pounds and the attachments are concentric to the chord. If the slab is already designed to transfer concentrated loads from above to top chord panel points, the added member would not be required.

11. Camber:

Composite steel joists, unless otherwise specified, are cambered, in. (mm), for 100% of the non-composite weight of joist, bridging, deck and concrete slab. Additional camber to accommodate for actual sustained composite dead and live loads and concrete shrinkage/creep shall be identified by the **specifying professional.**

(b) Design Parameter Checklist

The SJI Composite Joist Floor Design Parameters Checklist shown in Appendix A provides a form for filling in the above standard design information listed in Section 6.1(a)(1) and Sections 6.1(a)(4) – 6.1(a)(9).

(c) Composite Joist Limitations

Composite Steel Joists have some limitations that the **specifying professional** shall be aware of. These include:

- The maximum deck depth is 3 inches (76 mm).
- The minimum slab thickness above the top of the deck shall be 2 inches (51 mm).
- When shear studs are utilized, they shall have at least 1/2 inch (13 mm) of concrete cover.
- The concrete shall be placed to provide a constant thickness along the entire span.

(d) Connections

Minimum End Anchorage for simple span gravity loading shall be in accordance with Steel Joist Institute Standard Specifications; Section 104.7 for **CJ-**Series. The end anchorage of a composite steel joist is the connection of the joist bearing seat to the support of the composite steel joist.

The adequacy of the end anchorage connection (bolted or welded) between the composite steel joist bearing seat and the supporting structure is the responsibility of the **specifying professional**. The contract documents shallclearly illustrate the end anchorage connection.

When the end anchorage is welded, it is recommended that the **specifying professional** consider a smaller fillet weld thickness in conjunction with a longer weld length.

The **specifying professional** is responsible for bridging termination connections. The contract documents shall clearly illustrate these termination connections.

The joist manufacturer is responsible for the design of the bearing seats of composite steel joists for the loads designated by the **specifying professional** in the contract documents.

(e) Special Considerations

The **specifying professional** shall indicate on the construction documents special considerations including:

a) Oversized or other non-standard web openings
b) Extended ends
c) Non-SJI standard bridging

6.2 PLANS FURNISHED BY SELLER

The seller shall furnish the buyer with steel placement plans to show the material as specified on the construction documents and are to be utilized for field installation in accordance with specific project requirements as stated in Section 6.1. Composite Steel Joist placement plans shall include, at a minimum, the following:

1. Listing of all applicable loads as stated in Section 6.1 and used in the design of the composite steel joists as specified in the construction documents
2. Connection requirements for:
   a) Joist supports
   b) Field splices
   c) Bridging attachments

3. Deflection criteria for live load and total load
4. Shear stud installation plans showing:
   a) Size, quantity and location of all shear connectors to be installed on the composite steel joists
   b) Design camber for each composite steel joist or reference to a table giving the design camber for each composite steel joist
5. Size, location, and connections for all bridging
6. Joist headers

All material shall be identified with its piece mark which also appears on the bill of material. **Composite Steel Joist placement plans do not require the seal and signature of the joist manufacturer's registered design professional.**

6.3 DISCREPANCIES

The **specifying professional's** bid plans and specifications shall be assumed to be correct in the absence of written notice from the buyer to the contrary. When plans are furnished by the buyer which does not agree with the Architect's bid plans, such detailed plans shall be considered as a written notice of change of plans. However, it shall be the buyer's responsibility to advise the seller of those changes which affect the composite steel joists.

6.4 APPROVAL

When composite joist placement plans are furnished by the seller, prints thereof are submitted to the buyer and owner for examination and approval. The seller allows a maximum of fourteen (14) calendar days in his schedule for the return of placement plans noted with the owner's and customer's approval, or approval subject to corrections as noted. The seller makes the corrections, furnishes corrected prints for field use to the owner/customer and is released by the owner/customer to start composite joist manufacture.

Approval by the owner/customer of the placement plans, sections, notes and joist schedule prepared by the seller indicates that the seller has correctly interpreted the contract requirements, and is released by the owner/customer to start joist manufacture. This approval constitutes the owner's/customer's acceptance of all responsibility for the design adequacy of any detail configuration of joist support conditions shown by the seller as part of his preparation of these placement plans.

Approval does not relieve the seller of the responsibility for accuracy of detail dimensions on the plans, nor the general fit-up of joists to be placed in the field.

6.5 CHANGES

When any changes in plans are made by the buyer (or the buyer's representative) either prior to or after approval of detailed plans, or when any material is required and was not shown on the plans used as the basis of the bid, the cost of such changes and/or extra material shall be paid by the buyer at a price to be agreed upon between buyer and seller.

6.6 CALCULATIONS

The seller shall design the composite steel joists in accordance with the Steel Joist Institute Standard Specifications, **CJ**-Series, of latest adoption, to support the load requirements of Section 6.1. The **specifying professional** may require submission of the composite steel joist calculations as prepared by a registered design professional responsible for the product design. If requested by the **specifying professional**, the composite steel joist manufacturer shall submit design

calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional. In addition to standard calculations under this seal and signature, submittal of the following shall be included:

1. Non-SJI standard bridging details (e.g. for cantilevered conditions, net uplift, etc.)
2. Connection details for:
   a) Non-SJI standard connections (e.g. flush framed or framed connections)
   b) Field splices
   c) Joist headers
3. Shear stud requirements

SECTION 7
HANDLING AND ERECTION*

The current OSHA SAFETY STANDARDS FOR STEEL ERECTION, 29 CFR PART 1926, SUBPART R - STEEL ERECTION, refers to certain joists at or near columns to be designed with sufficient strength to allow one employee to release the hoisting cable without the need for erection bridging. **This STANDARD shall not be interpreted that any joist at or near a column line is safe to support an employee without bridging installed**. Many limitations exist that prevent these joists from being designed to safely allow an employee on an unbridged joist. Because of these limitations and as required by OSHA, these joists shall be erected by incorporating erection methods ensuring joist stability and either:

1. Installing bridging or otherwise stabilizing the joist prior to releasing the hoisting cable, or
2. Releasing the hoisting cable without having a worker on the joist.

A composite steel joist shall not be placed on any support structure unless such structure is stabilized. When composite steel joists are landed on a structure, they shall be secured to prevent unintentional displacement prior to installation.

A bridging terminus point shall be established before joist bridging is installed.

Composite steel joists shall not be used as anchorage points for a fall arrest system unless written direction to do so is obtained from a "qualified person" as defined in the Steel Joist Institute Standard Specifications for Composite Steel Joists, **CJ**-Series, of latest adoption, Section 105(c)(3)(a).

No modification that affects the strength of a composite steel joist shall be made without the written approval of the project engineer of record.

The buyer and/or erector shall check all materials on arrival at job site and promptly report to seller any discrepancies and/or damages. The buyer and/or erector shall comply with the requirements of the Steel Joist Institute Standard Specifications for Composite Steel Joists, **CJ**-Series, of latest adoption in the handling and erection of material.

The seller shall not be responsible for improper fit of material due to inaccurate construction work.

*For thorough coverage of this topic, refer to SJI Technical Digest #9, "Handling and Erection of Steel Joists and Joist Girders".

SECTION 8
INSTALLATION AND INSPECTION OF SHEAR STUD CONNECTORS

8.1 INSTALLATION

(a) Locate headed shear studs, hereafter referred to as shear studs, on composite steel joists per details shown on the manufacturer's shear stud placement drawings and as outlined in any shear stud layout tables. Start laying out shear studs from each end of the joist and working toward the center. Alternate installation of the shear studs from one top chord angle to the other. Note minimum concrete longitudinal edge distance for shear studs on ends of joists as shown on placement drawings.

(b) All shear studs shall be welded through the steel deck after the deck has been placed on the joists. Welding voltage, current, time, and gun settings for lift and plunge shall be set at optimum settings for the particular size of shear studs and range of joist top chord thicknesses, based on recommendations of the shear stud manufacturer and automatic shear stud welding equipment manufacturer, or both. The shear stud installer should consult AWS C5.4, *Recommended Practices for Stud Welding*, for technique guidance. All welding shall comply with AWS D1.1, Structural Welding Code - Steel, Section 7, *Stud Welding.*

(c) Each shear stud shall be provided with the appropriate ceramic ferrule (arc shield) designated by the shear stud manufacturer as designed for weld through deck application. Ferrules shall be stored in a moisture free environment and kept dry during installation.

(d) Prior to welding of shear studs, the top surface of the joist top chords shall be clean, unpainted and free of heavy rust, dirt, sand, oil, grease, water, or other foreign substances. The surfaces of the deck prior to stud welding shall be free of heavy rust or mill scale, moisture, dirt, sand, or other construction related waste materials.

(e) Prior to welding, the steel deck shall rest tightly against the top chord of the composite steel joist.

(f) Shear studs shall not be welded through more than 1 thickness of 16 gage deck or two thicknesses of 18 gage deck or lighter. Total galvanizing thickness on one thickness or two thicknesses of deck shall not exceed 1.25 oz. per square foot total for both sides of the deck.

(g) Welding of shear studs shall not be done when the base metal is below 0°F (-18°C) or when the surface is wet or exposed to falling rain or snow. When the base metal temperature is between 0°F (-18°C) and 32°F (0°C), welding shall be permitted to only be done with appropriate set up, pre-production testing and inspection procedures as outlined in AWS D1.1 Structural Welding Code - Steel, Section 7.5, *Technique*.

(h) Qualification of the stud application procedure used to weld shear studs through metal deck is outlined in AWS D1.1, Structural Welding Code –Steel, Section 7.6 *Stud Application Qualification Requirements*. This document requires that a minimum of ten (10) shear studs shall be welded using the decking and base material representative of the conditions to be used during construction. The ten (10) studs shall then be successfully bend or tensile tested. A document recording the details and settings including the weld set up used for this test shall be prepared prior to beginning of any production shear stud welding. A copy of the Application Qualification Test Data shall be furnished to the Engineer of Record as outlined in AWS D1.1, Structural Welding Code- Steel, Section 7.6.7 *Application Qualification Test Data*. At the beginning of each day's or shift's production, Pre-production testing in accordance with AWS D1.1 Structural Welding Code - Steel, Section 7.7 *Production Control* shall be performed on the first two shear studs that are welded.

8.2 INSPECTION

(a) The welding of shear studs requires special inspection. The owner, or the **specifying professional**, acting as owner's agent, shall employ one or more special inspectors who shall provide inspections of the shear stud welds on a continual and timely basis. The special inspector's duties include verifying welder's qualifications, welding preparation, welding procedures and conformance of materials. Unless otherwise specified in a contract document, the stud installer shall be responsible for application qualification tests, pre-production tests and removal of the ferrule from each weld for inspection purposes.

(b) To ensure proper welds, bend test a minimum of 1 out of every 100 shear connector studs production welded, by either striking the shear stud with a hammer or placing a pipe or other hollow device over the shear stud and manually or mechanically bending the shear stud 15° from its original axis. Shear studs shall be bent along the longitudinal axis of the joist toward the nearest end of the joist. If failure occurs in the weld zone, a minimum of two adjacent shear studs shall be satisfactorily bend tested. The special inspector, where conditions warrant, shall be permitted to select a reasonable number of additional shear studs to be subjected to a 15° bend test.

(c) If, in the judgment of the **specifying professional**, shear studs welded during the progress of the work are not in accordance with AWS D1.1, Structural Welding Code - Steel, Section 7, *Stud Welding* requirements, as indicated by inspection and testing, corrective action shall be required of the shear stud installer. At the shear stud installer's expense, the shear stud installer shall make the set-up changes necessary to ensure that shear studs subsequently welded meet code requirements.

(d) The shear stud installer shall certify to the **specifying professional** that the shear studs were installed in accordance with the requirements of AWS D1.1, Structural Welding Code - Steel, Section 7, *Stud Welding.*

SECTION 9
CONCRETE PLACEMENT

It is normal practice for joist manufacturers to camber composite steel joists for the full non-composite dead load. This joist camber, while theoretically providing a flat floor surface, after placing of the concrete is completed, requires special consideration relative to concrete placement.

The SJI suggested method for concrete placement is to utilize the "Constant Slab Thickness Method". In this method the concrete slab is placed at a constant thickness across the entire length of the composite steel joist. The reasons to use this method include the following:

- Full concrete slab thickness shall be provided along the entire composite joist span to carry the composite steel joist compressive loads.
- A full thickness slab is necessary to provide required fire protection.
- Sufficient concrete cover shall be provided over the heads of the shear studs.
- The potential for over runs in concrete placing volume shall be greatly reduced.
- Deflections of the composite steel joist under the non-composite loading can be more accurately predicted vs. with a variable thickness slab.

Concrete construction joints should ideally be located between joists. When a construction joint is located closer than 12 in. (305 mm) from the longitudinal centerline of any given composite steel joist, it is the responsibility of the **specifying professional** to determine whether extra transverse steel reinforcing needs to be provided to assure that the composite properties of the supporting member with shear studs has not been affected.

SECTION 10
BUSINESS RELATIONS

10.1 PRESENTATION OF PROPOSALS

All proposals for furnishing material shall be made on a Sales Contract Form. After acceptance by the buyer, these proposals shall be approved or executed by a qualified official of the seller. Upon such approval the proposal becomes a contract.

10.2 ACCEPTANCE OF PROPOSALS

All proposals are intended for prompt acceptance and are subject to change without notice.

10.3 BILLING

Contracts on a lump sum basis are to be billed proportionately as shipments are made.

10.4 PAYMENT

Payments shall be made in full on each invoice without retention.

10.5 ARBITRATION

All business controversies which cannot be settled by direct negotiations between buyer and seller shall be submitted to arbitration. Both parties shall sign a submission to arbitration and if possible agree upon an arbitrator. If they are unable to agree, each shall appoint an arbitrator and these two shall appoint a third arbitrator. The expenses of the arbitration shall be divided equally between the parties, unless otherwise provided for in the agreements to submit to arbitration. The arbitrators shall pass finally upon all questions, both of law and fact, and their findings shall be conclusive.