SECTION 054400 - COLD-FORMED METAL TRUSSES

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			2. SUMMARY
				1. Section Includes:

Roof trusses.

Floor trusses.

* + - * 1. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 052100 "Steel Joist Framing" for trusslike, steel floor or roof joists and joist girders.

Section 054000 "Cold-Formed Metal Framing" for cold-formed steel studs, joists, and rafters.

* + - 1. PREINSTALLATION MEETINGS

Retain "Preinstallation Conference" Paragraph below if Work of this Section is extensive or complex enough to justify a conference.

* + - * 1. Preinstallation Conference: Conduct conference at Project site.

If needed, insert list of conference participants.

**<Insert participants>**.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For the following:

Cold-formed steel truss materials.

Anchor bolts.

Post-installed anchors.

Power-actuated fasteners.

Mechanical fasteners.

USE PARAGRAPH BELOW WITH EPD REQUIREMENT WHEN PROJECT ESTIMATE IS $1M OR MORE.

* + - * 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel trusses within this specification section, if available. A statement of the contractor’s good faith effort to obtain the EPD shall be provided if not available.

Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

* + - * 1. Shop Drawings:

Include layout, spacings, sizes, thicknesses, and types of cold-formed steel trusses; fabrication; and fastening and anchorage details, including mechanical fasteners.

Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

Retain "Delegated-Design Submittal" Paragraph below if design services have been delegated to Contractor.

* + - * 1. Delegated-Design Submittal: For cold-formed steel trusses.

Coordinate "Qualification Data" Paragraph below with qualification requirements in "Quality Assurance" Article.

* + - * 1. Qualification Data: For testing agency.

Retain "Welding certificates" Paragraph below if retaining "Welding Qualifications" Paragraph in "Quality Assurance" Article.

* + - * 1. Welding certificates.
				2. Product Test Reports: For each listed product, for tests performed by **[manufacturer and witnessed by a qualified testing agency] [a qualified testing agency]**.

Steel sheet.

Expansion anchors.

Power-actuated anchors.

Mechanical fasteners.

Miscellaneous structural clips and accessories.

* + - * 1. Research Reports: For **[post-installed anchors] [and] [power-actuated fasteners]**, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

Design Consultant to review code references and verify that the referenced sections/tables are current. Note that code references shall be based on the current version of the Uniform Code.

Retain "Source quality-control reports" Paragraph below if Contractor is responsible for source quality-control testing and inspecting.

* + - * 1. Source quality-control reports.

Use subparagraph below for projects over $100,000. See Article 1.4. below.

Documentation to confirm compliance with General Conditions Article 25.4 Domestic Steel.

Retain "Field quality-control reports" Paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
			1. QUALITY ASSURANCE

Retain "Testing Agency Qualifications" Paragraph below if Contractor or manufacturer selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article.

* + - * 1. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

Usually retain "Product Tests" Paragraph below. Retain option if permitted. Insert option for testing ductility if required. See "Mill Certification" Paragraph in "Materials" Article in the Evaluations for more information.

* + - * 1. Product Tests: Mill certificates or data from a qualified independent testing agency**[, or in-house testing with calibrated test equipment,]** indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

Retain "Welding Qualifications" Paragraph below if shop or field welding is required. If retaining, also retain "Welding certificates" Paragraph in "Informational Submittals" Article.

* + - * 1. Welding Qualifications: Qualify procedures and personnel according to the following:

AWS D1.1, "Structural Welding Code - Steel."

AWS D1.3, "Structural Welding Code - Sheet Steel."

Use paragraph below for projects over $100,000. Paragraph is taken from Article 25.4 of the General Conditions.

* + - * 1. If the value of the contract exceeds $100,000 all structural steel, reinforcing steel and other major steel items to be incorporated in the Work of this Contract shall be produced and made in whole or substantial part in the United States, its territories or possessions.
1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. MANUFACTURERS
				1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Steele Truss & Panel LLC.

Timplex Corporation.

Approved equivalent.

* + - 1. PERFORMANCE REQUIREMENTS

Coordinate this article with other Part 2 articles, deleting prescriptive requirements, such as steel thickness and minimum yield strength unless imposing minimum design restrictions. Insert other performance and design criteria below to suit Project or add them to Drawings.

Retain "Delegated Design" and "Structural Performance" paragraphs below if Contractor is required to assume responsibility for design.

* + - * 1. Delegated Design: Engage a qualified professional engineer, licensed and registered to practice in New York State, to design cold-formed steel trusses.
				2. Structural Performance: Provide cold-formed steel trusses capable of withstanding design loads within limits and under conditions indicated.

Design Loads: **[As indicated on Drawings] <Insert design loads>**.

Deflection Limits: Design trusses to withstand design loads without deflections greater than the following:

Component deflection limits in "Floor Trusses," "Roof Trusses," and "Scissor Roof Trusses" subparagraphs below are examples only. Retain deflection limits in applicable subparagraphs, or insert other limits as appropriate for floor or ceiling finish materials.

Floor Trusses: Vertical deflection of 1/480 for live loads and l/360 for total loads of the span.

Roof Trusses: Vertical deflection of [1/240] [1/360] of the span.

Scissor Roof Trusses: Horizontal deflection of 1-1/4 inches at reactions.

Design trusses to provide for movement of truss members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

Retain "Cold-Formed Steel Truss Standards" Paragraph below whether delegating design or prescriptively specifying cold-formed steel framing; revise to suit Project.

* + - * 1. Cold-Formed Steel Truss Standards: Unless more stringent requirements are indicated, trusses shall comply with the following:

Retain subparagraphs below as applicable.

Floor and Roof Systems: AISI S210.

Lateral Design: AISI S213.

Roof Trusses: AISI S214.

Retain "Fire-Resistance Ratings" Paragraph below only if products specified are part of a fire-resistance-rated assembly. Indicate rating, testing agency, and testing agency's design designation on Drawings.

* + - * 1. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Indicate design designations from UL or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

* + - 1. COLD-FORMED STEEL TRUSS MATERIALS
				1. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

Retain minimum grade requirements from options in "Grade" Subparagraph below. If more than one grade is required, indicate location of each on Drawings.

Grade: **[ST33H] [ST50H] [As required by structural performance]**.

Minimum coating requirement for Structural Grade, Type H steel is G60 or equivalent. Retain first option in "Coating" Subparagraph below if ASTM A1003's designation of minimum coating thicknesses is required. This minimum coating designation assumes normal exposure conditions and construction practices. When more severe exposure conditions are probable, for example in coastal areas, consider specifying a heavier coating. Verify availability of heavier-coated steel. If more than one coating designation is required, indicate location of each on Drawings or by inserts.

Coating: **[G60, A60, AZ50, or GF30] [G90 or equivalent]**.

* + - 1. ROOF TRUSSES

Retain "Roof Truss Members" Paragraph below if permitting manufacturer to fabricate trusses from manufacturer's proprietary steel sections. Retain option, usually the exception, if standard C shapes are required.

* + - * 1. Roof Truss Members: Manufacturer's standard **[C-shaped ]**steel sections.

Flange width specified in "Connecting Flange Width" Subparagraph below may vary with application. Flange width in option corresponds to common flange-width designator 162.

Connecting Flange Width: 1-5/8 inches (162), minimum at top and bottom chords connecting to sheathing or other directly fastened construction.

Retain "Minimum Base-Metal Thickness" Subparagraph below if not delegating design responsibility to Contractor. Steel-thickness sequence below corresponds to common thickness designators 33, 43, 54, 68, and 97 and to obsolete 20-, 18-, 16-, 14-, and 12-gauge designations.

Minimum Base-Metal Thickness: **[0.0329 inch** **(20 ga)] [0.0428 inch (18 ga)] [0.0538 inch (16 ga)] [0.0677 inch (14 ga)] [0.0966 inch (12 ga)]**.

Retain "Section Properties" Subparagraph below if not delegating design responsibility to Contractor. If retaining, insert calculated section properties for top and bottom chords and each web member, and indicate whether design is based on gross or effective section properties.

Section Properties: **<Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment>**.

* + - 1. FLOOR TRUSSES

Retain "Floor Truss Members" Paragraph below if permitting manufacturer to fabricate trusses from manufacturer's proprietary steel sections. Retain option, usually the exception, if standard C shapes are required.

* + - * 1. Floor Truss Members: Manufacturer's standard **[C-shaped ]**steel sections.

Flange width specified in "Connecting Flange Width" Subparagraph below may vary with application. Flange width in option corresponds to common flange-width designator 162.

Connecting Flange Width: 1-5/8 inches (162), minimum at top and bottom chords connecting to sheathing or other directly fastened construction.

Retain "Minimum Base-Metal Thickness" Subparagraph below if not delegating design responsibility to Contractor. Steel-thickness sequence below corresponds to common thickness designators 33, 43, 54, 68, and 97 and to obsolete 20-, 18-, 16-, 14-, and 12-gauge designations.

Minimum Base-Metal Thickness: **[0.0329 inch (20 ga)] [0.0428 inch (18 ga)] [0.0538 inch (16 ga)] [0.0677 inch (14 ga)] [0.0966 inch (12 ga)]**.

Retain "Section Properties" Subparagraph below if not delegating design responsibility to Contractor. If retaining, insert calculated section properties for top and bottom chords and each web member; and indicate whether design is based on gross or effective section properties.

Section Properties: **<Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment>**.

* + - 1. TRUSS ACCESSORIES
				1. Fabricate steel-truss accessories from steel sheet, ASTM A1003, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for truss members.
				2. Provide accessories of manufacturer's standard thickness and configuration unless otherwise indicated.
			2. ANCHORS, CLIPS, AND FASTENERS

Retain "Steel Shapes and Clips" Paragraph below if rolled steel shapes and clips are required and are not specified in another Section.

* + - * 1. Steel Shapes and Clips: ASTM A36, zinc coated by hot-dip process according to ASTM A123.

Retain grade of anchor bolt, head type, and type of protective coating in "Anchor Bolts" Paragraph below. Revise if using high-strength, low-alloy anchor bolts.

* + - * 1. Anchor Bolts: ASTM F1554, **[Grade 36] [Grade 55]**, threaded carbon-steel **[hex-headed bolts,] [headless, hooked bolts,] [headless bolts, with encased end threaded,] carbon-steel nuts, and flat, hardened-steel washers; zinc coated by [hot-dip process according to ASTM A153, Class C] [mechanical deposition according to ASTM B695, Class 50]**.

ICC-ES AC01 and ICC-ES AC193 are for expansion anchors in masonry and mechanical anchors in concrete respectively, and ICC-ES AC58 and ICC-ES AC308 are for adhesive anchors in masonry and concrete. Do not use expansion-type anchors where expansion can cause damage to the substrate material.

* + - * 1. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on **[ICC-ES AC01] [ICC-ES AC193] [ICC-ES AC58] [or] [ICC-ES AC308]** as appropriate for the substrate.

Uses: Securing cold-formed steel trusses to structure.

Retain "Type" Subparagraph below to restrict type of anchor if required.

Type: Torque-controlled expansion anchor or torque-controlled adhesive anchor.

Material in "Material for Interior Locations" Subparagraph below protects against corrosion in an indoor atmosphere.

Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

Alloy Group 1 (A1) refers to Type 304 and similar alloys, and Alloy Group 2 (A4) refers to Type 316 and similar alloys.

Material for Interior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1] [Group 2]** stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

Material for Exterior Locations: Alloy Group 2 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

Retain "Power-Actuated Fasteners" Paragraph below if power-actuated fasteners are acceptable. Verify with Project's structural engineer.

* + - * 1. Power-Actuated Fasteners: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
				2. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

* + - * 1. Welding Electrodes: Comply with AWS standards.
			1. MISCELLANEOUS MATERIALS
				1. Galvanizing Repair Paint: **[ASTM A780] [MIL-P-21035B] [or] [SSPC-Paint 20]**.
				2. Shims: Load-bearing, high-density multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as truss members supported by shims.
			2. FABRICATION
				1. Fabricate cold-formed steel trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

Fabricate trusses using jigs or templates.

Cut truss members by sawing or shearing; do not torch cut in the field.

Fasten cold-formed steel truss members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator.

Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

Fasten other materials to cold-formed steel trusses by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

* + - * 1. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift fabricated trusses by means that prevent damage or permanent distortion.

Revise "Tolerances" Paragraph below to suit Project.

* + - * 1. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

Spacing: Space individual truss members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

Squareness: Fabricate each cold-formed steel truss to a maximum out-of-square tolerance of 1/8 inch.

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine substrates, areas, conditions, and abutting trusses and framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
				2. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. PREPARATION

Retain two paragraphs below if sprayed fire-resistive materials are required.

* + - * 1. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
				2. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed steel trusses without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
			1. INSTALLATION
				1. Install bridge, and brace cold-formed steel trusses according to AISI S200, AISI S202, AISI S214, and manufacturer's written instructions unless more stringent requirements are indicated.

Retain first subparagraph below if trusses bear on load-bearing, cold-formed wall framing.

Coordinate with wall framing to align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure.

Anchor trusses securely at all bearing points.

Install continuous bridging and permanently brace trusses**[ as indicated on Drawings.] [ as indicated on Shop Drawings and designed according to CFSEI's Technical Note 551e, "Design Guide: Permanent Bracing of Cold-Formed Steel Trusses."]**[.]

* + - * 1. Install cold-formed steel trusses and accessories true to line and location, and with connections securely fastened.

Erect trusses with plane of truss webs plumb and parallel to each other. Align and accurately position trusses at required spacings.

Erect trusses without damaging truss members or connections.

Fasten cold-formed steel trusses by welding or mechanical fasteners.

Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

Retain subparagraph below if using mechanical fasteners.

Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

* + - * 1. Install temporary bracing and supports to secure trusses and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to trusses are secured.
				2. Truss Spacing: **[16 inches] [19.2 inches] [24 inches] [32 inches] [48 inches] [As indicated on Drawings]**.
				3. Do not alter, cut, or remove truss members or connections of trusses.
			1. ERECTION TOLERANCES

Revise paragraph below to suit Project. Coordinate with limitations of subsequent structure and finish materials.

* + - * 1. Install cold-formed steel trusses level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

Space individual trusses no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

* + - 1. REPAIR

Retain "Galvanizing Repairs" Paragraph below if applicable.

* + - * 1. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel trusses with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
			1. FIELD QUALITY CONTROL
				1. Special Inspections: Director’s Representative will engage a special inspector and a qualified testing agency to perform tests and inspections in accordance with the requirements of BDC 406 Summary of Special Inspections and BDC 406.1 Statement of Special Inspections and as directed by the Code Compliance Manager
			2. PROTECTION
				1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel trusses are without damage or deterioration at time of Substantial Completion.

END OF SECTION 054400