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SECTION 061900 – METAL PLATE CONNECTED PRE-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.
- B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK:

- A. Definition: Prefabricated wood trusses include planar structural units consisting of metal plate connected members which are fabricated from dimension lumber and which have been cut and assembled prior to delivery to the job site. Work to include anchorage, blocking, curbing, miscellaneous framing and bracing.
- B. Types of fabricated wood trusses are indicated on the drawings.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 6 - Rough Carpentry

1.04 QUALITY ASSURANCE:

- A. TPI Standards: Comply with applicable requirements and recommendations of the following Truss Plate Institute (TPI) publications, Latest Edition:
 - 1. ANSI/TPI 1 “National Design Standard for Construction. Metal Plate Connected Wood Truss.”
 - 2. ANSI/AF&PA (American Forest & Paper Association) – NDS National Design Specification for Wood Construction – Latest Edition
 - 3. “Commentary and Appendices to ANSI/TPI 1 for Bracing Wood Trusses.”
 - 4. “Building Component Safety Information, BCSI 1”
 - 5. DSB-89 “Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses.”
 - 6. “Quality Assurance Procedures Manual for In-Plant Inspections, QAP-90.”

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7. "Quality Control Manual."
 8. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- B. Wood Structural Design Standard: Comply with applicable requirements of "National Design Specification for Wood Construction", published by American Forest and Paper Association.
- C. Lumber Standard: Comply with PS 20 and with applicable rules of the respective grading inspecting agencies for species and grade of lumber indicated.
- D. Connector Plate Manufacturer's Qualifications: Provide truss connector plates manufactured by a firm which is a member of TPI and which complies with TPI quality control procedures for manufacture of connector plates published in TPI "Quality Control Manual."
- E. Fabricator's Qualifications:
1. Provide trusses by a firm which has a record of successfully fabricating trusses similar to type and length indicated.
 2. TPI Inspection Program: Fabricator shall participate in the TPI Quality Assurance Inspection Program, and maintain a copy of the Quality Assurance Procedures Manual, QAP-90. All trusses fabricated for this project shall bear the TPI Registered Mark to indicate compliance with this program.
- F. Uniformity of Manufacturer for Connector Plates: Provide metal connector plates from a single manufacturer.

1.05 SUBMITTALS:

- A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. Incomplete submittals will not be reviewed.
- E. Submittals not review by the General Contractor prior to submission the Engineer will not be reviewed. Include on the submittal a statement or stamp of approval by the Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in sections Division 1 have been complied with.

- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.
- G. **Truss design calculations without the appropriate signature and seal indicated below will be rejected and returned without review.**
- H. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.
- I. Electronic Submittals:
1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
 2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
 3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
 4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
 5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.
- J. Product Data: Submit fabricator's technical data covering lumber, metal plates, hardware, fabrication process, treatment (if any), handling and erection.
1. Submit certificate, signed by an officer of fabricating firm, indicating that trusses to be supplied for project comply with indicated requirements.

2. Submit evidence of participation in the TPI Inspection program.
 3. LEED Documentation: Refer to paragraph 1.07 of this section.
- K. Shop Drawings: Submit shop drawings, showing species, sizes and stress grade of lumber to be used; pitch, span, camber, configuration and spacing for each type of truss required; type size, material, finish, design value and location of metal connector plates; and bearing and anchorage details.
1. Electronic files of structural drawings **will not** be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned without review.
 2. **Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility. Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.**
 3. Truss Placement Plan: Provide drawings indicating truss layout.
 - a. Include all trusses and components, including girder trusses, piggyback trusses, and hangers.
 - b. Provided dimensions for layout, including bearing locations & widths, and truss spacing
 4. Design: Design shall be in accordance with the applicable provisions of the latest edition of the American Forest & Paper Association's (AF&PA's) National Design Specification for Wood Construction, ANSI/TPI 1, and all applicable legal requirements. Submit the following information in the calculation submittal for each truss or truss component. Calculations shall be signed and sealed by a Professional Engineer Registered in the State of Maine. Truss designer is responsible for the design of the entire truss assembly, including permanent lateral bracing. Lateral loads shall be resolved into the building lateral load resisting system.
 - a. Loading: Include all loadings applied to the truss, including uniform, concentrated loads and locations. Include effects of mechanical equipment, drifted and unbalanced snow. Indicate distribution of loads to top and bottom chords. The calculations shall clearly show these loads and their application to the trusses.

- b. Wind & Seismic Loading Criteria: Include all appropriate information wind & seismic loading criteria. Including design code, wind speed and exposure. Design code and wind speed shall be as indicated in the drawings.
 - 1. Provide uplift calculations and truss uplift reactions as appropriate.
- c. Load Combinations: The calculations shall list all load combinations including all factors that apply.
- d. Adjustments to lumber and metal connector plate design values for conditions of use. Adjustment of value for duration of load or conditions of use shall be in accordance with AF&PA's National Design Specification for Wood Construction.
- e. Truss-to-Truss Connections: Provide hanger designs where applicable. Provide design of connectors in multi-ply trusses. Provide connection design for piggyback trusses.
- f. Stress and Deflection calculations: Provide member stresses and joint displacement for each load and load combination, and displacement to span ratio. Indicate camber independently from displacement calculations. Provide bearing stresses at supports.

Deflection Limits: Design trusses to limit deflection under design live or snow loads to $L/360$ for roof trusses, $L/480$ for floor trusses.

- g. Reaction: Provide minimum and maximum reactions, including uplift as applicable. Indicate the load combination that produces these reactions.
 - h. Net Section at Hanger Connections: Design shall account for the net section loss to truss members from hung mechanical, electrical, plumbing and fire protection systems. General contractor shall coordinate hanger systems with the truss designer. Hanger systems are not designed by the Engineer of Record. See the "Execution" portion of this specification for additional requirements.
- 5. Field built trusses: To the greatest extent possible, trusses are to be prefabricated. Truss field fabrication is subject to the approval of the Structural Engineer. Additional design, quality assurance and quality control procedures may be necessary based on the requirements of the Structural Engineer.
 - 6. Truss Assembly Drawings: Provide drawings depicting how each truss is to be constructed. Provide all geometry, including length, height, joint locations, slope, camber, overhangs, metal plate connectors, and lumber grades
 - 7. Permanent Member Bracing: The truss manufacturer shall specify all permanent bracing required for lateral support of tension and compression members, both webs and chords. Gable end wall bracing shall also be specified. Permanent bracing loads shall be resolved to the building lateral load resisting system. Provide strong back locations for parallel chord floor trusses.

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8. With all copies of drawing submittal provide “BCSI 1 (latest edition) Guide to Good practice for Handling, Installing & Bracing of Metal Plate Wood Trusses”, Jointly produced by the Wood Truss Council of America and the Truss Plate Institute.

1.06 DELIVERY, STORAGE, HANDLING:

- A. Handle and store trusses with care, and in accordance with manufacturer's instructions and TPI recommendations to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure.
- B. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.
- C. A copy of the BCSI (latest edition) Summary Sheet, “Guide for Handling, Installing and Bracing of Metal Plate Connected Wood Trusses” shall be provided to the installer at delivery.

1.07 LEED Requirements:

- A. Regional materials, regional manufacturer: Use dimensioned lumber manufactured within 500 mile radius of project.
- B. Regional materials, regional extraction: Use dimensioned lumber extracted, harvested or recovered within 500 mile radius of project.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal connector plates which may be incorporated in the work include, but are not limited to, the following:

Gang Nail Systems, Inc.
Hydro-Air Engineering, Inc.
Inter-Lock Steel Co., Inc.
Link-Wood Construction Systems
Robbins Manufacturing Co.
Tee-Lok Corp.
Truss Connectors of America
Truswall Systems Corp.

2.02 MATERIALS:

- A. Lumber:

1. Factory mark each plate of lumber with type, grade, mill and grading agency.

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2. Provide actual sizes as required by PS 20 for dressed lumber, S4S, unless otherwise indicated. Minimum member sizes (nominal) are as follows:
 - a. Chord members, parallel chord trusses: 4x2 (“flat” orientation)
 - b. Web members: 2x4
3. Provide seasoned lumber with a maximum moisture content of 19% at time of dressing, and the moisture content of lumber shall be no less than 7% at time of manufacturing.
4. Lumber Species: Eastern Woods (Spruce) graded by NLGA, NELMA or NHPMA. Southern Pine graded by SPIB. Douglass Fir Larch graded by NLGA.
5. Lumber Grade:
 - a. Chord Members: MSR 1650f-1.5E lumber for all chords.
 - b. Web Members: No. 2 or better visually graded lumber for all webs. MSR lumber is acceptable in lieu of visually graded lumber for web members.
6. Stress Rating: Provide lumber which has been either graded or tested and certified, at indicated moisture content, to have the following minimum values:
 - a. MSR: $F_b = 1650 \text{ psi}$, $F_t = 1020 \text{ psi}$, $F_c = 1700 \text{ psi}$, $E = 1,500,000 \text{ psi}$
 - b. No.2: $F_b = 875 \text{ psi}$, $F_t = 450 \text{ psi}$, $F_c = 1150 \text{ psi}$, $E = 1,400,000 \text{ psi}$
7. Pressure treated lumber shall not be used.

B. Metal Connector Plates, Fasteners and Anchorages:

1. Connector Plate Material: Metal complying with following requirements, unless otherwise indicated: Not less than 0.036" thick, coated thickness, and shall meet or exceed ASTM A653/ASTMA653M grade 33. Working stresses in steel are to be applied to effectiveness ratios for plates as determined by test and in accordance with ANSI/TPI 1.
 - a. Galvanized Sheet Steel: ASTM A924/924M, Coating G60.
 - b. Electrolytic Zinc Coated Steel Sheet: ASTM A 591, Coating Class C, with minimum structural quality equivalent to ASTM A 446, Grade A.

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- C. Hangers and Uplift Anchors: Hangers are to be designed and supplied as part of the truss package, and shall be manufactured by Simpson StrongTie. Preliminary uplift anchors are indicated on the Contract Documents. Final uplift connector type and/or quantity will be selected based on truss reactions. G.C. coordinate with engineer's marks on approved truss shop drawings.

2.03 FABRICATION:

- A. Trusses shall be fabricated to meet the quality requirements of ANSI/TPI 1.
- B. Cut truss members to accurate lengths, angles and sizes to produce close fitting joints with wood-to-wood bearing in assembled units.
- C. Fabricate metal connector plates to size, configuration, thickness and anchorage details required for types of joint designs indicated.
- D. Assemble truss members in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with close fitting joints. Position members to produce design camber indicated.
- E. Connect truss members by means of metal connector plates accurately located and securely fastened to wood members by means indicated or approved.
- F. Permanent web member bracing locations shall be marked on the truss members by means of a paint mark or tag of contrasting color. Tags shall not be removed without the permission of the Architect.
- G. All trusses shall bear the TPI Registered Mark, The TPI Quality Stamp, indicating current participation with the in-plant inspection program per the standards established in QAP-90.

PART 3 EXECUTION

3.01 GENERAL:

Erect and brace trusses to comply with recommendations of manufacturer and the Truss Plate Institute. Erection shall comply with current Occupational Safety & Health Administration (OSHA) requirements.

- A. Inspect trusses for damage prior to erection. Apparent damage to trusses, if any, shall be reported to Truss Manufacturer prior to erection.
- B. Truss Submittals and any supplementary information provided by the Truss Manufacturer shall be provided by the Contractor to the individual or organization responsible for the installation of the Trusses.

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- C. Erect trusses with plane of truss webs vertical (plumb) and parallel to each other, located accurately at design spacing indicated. Where applicable, insure bearing wall studs and trusses are aligned. The maximum out-of-true plumb tolerance shall be the depth of the truss in inches divided by 100. The maximum bow tolerance from true straight shall be the length of the truss in inches divided by 400, at any point considering multiple curvature when applicable.
- D. Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- E. Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated. Temporary bracing during construction is the responsibility of the contractor and the installer, as part of the contractor's "Means and Methods". TEMPORARY BRACING MUST BE PROVIDED IN THREE DIFFERENT PLANES OF THE TRUSS. BRACING SHALL BE INSTALLED ALONG THE BOTTOM CHORD, ALONG THE TOP CHORD AND WITHIN THE WEB MEMBERS. CONTRACTOR SHALL FOLLOW THE RECOMMENDATIONS OF SUMMARY SHEETS BCSI-B1/B2 FOR HANDLING, INSTALLING AND BRACING METAL CONNECTED WOOD TRUSSES. TEMPORARY BRACING SHALL BE LEFT IN PLACE AND BECOME PART OF THE PERMANENT BRACING FOR THE BUILDING. MAXIMUM BRACE SPACINGS INDICATED IN THIS DOCUMENT SHALL NOT BE EXCEEDED.
- F. Modifications required to the temporary bracing to comply with permanent bracing requirements, if any, shall be noted on the Structural Contract Documents. Install necessary supplemental permanent bracing and related components to enable trusses to maintain design spacing, withstand live and dead loads including lateral loads, and to comply with other indicated requirements.
- G. Anchor trusses securely at all bearing points to comply with methods and details indicated.
- H. Do not cut, notch, bore, drill or remove truss members.
- I. Hanging Loads: Hangers for mechanical, electrical, plumbing and fire protection systems, including but not by limitation, piping, conduit, ducting and mechanical equipment, shall be made to top of the bottom chord of the truss. Connections that require fasteners to penetrate the chord longitudinally shall not be utilized. Hanger loads shall be placed at truss panel points where required by the truss design.
- J. Metal plates shall not be removed and/or be replaced. Plates that are not fully pressed into the wood shall not be repaired without the direction of the Truss Manufacturer. The Architect and Truss Manufacturer shall be notified of deficient metal plate installation. Repairs shall be submitted to the Architect for review prior to implementation.

END OF SECTION