UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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SECTION 06 17 19

CROSS-LAMINATED TIMBER
11/16, CHG 1: 11/18

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NOTE: This guide specification covers the requirements for fabrication and erection of cross laminated timber panels for walls, floors, roofs, partitions, and all metal shapes and hardware required for their installation. The term "cross laminated timber" comprises suitably selected and prepared layers of lumber bonded together with adhesives, the grain of which is oriented in accord with engineered wood specifications, typically with every other layer set perpendicularly to each other.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be as a Criteria Change Request (CCR).
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PART 1 GENERAL

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NOTE: Cross laminated timber (CLT) is an engineered wood building system used to complement light-and heavy-timber framing options. Layers of lumber are laminated together in alternating directions to form a solid wood panel with high strength and dimensional stability. Typical lay-ups use an odd number of layers, resulting in a primary and secondary structural axis. Manufactured panels are

typically 2.4 to 3 m 8 to 10 feet wide, up to 510 mm 20 inches thick, and up to 20 m 64 feet long. 75 percent lighter than concrete, they can be used as an economical alternative to concrete slabs, masonry and steel in many building types. The manufacturing process has been standardized, but the panels are fabricated as needed to custom dimensions.

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NOTE: Include in the drawings:

Details of all panels, showing cross sections and dimensions.

Include in designs, engineered wood specifications including F_h and Modulus of Elasticity for Laminated Veneer Lumber, and F_h and grading. Specifications to use National Design Standards.

Assumed loads, including floor live load, roof live load, wind load, and concentrated loads (partitions, and equipment mounted on or suspended therefrom).

Layout, showing location of laminated members and floor elevations, and identification of Appearance Grades.

Details of hangers for suspended ceilings, pipes, light fixtures, or other construction, as required.

Details of metal shapes and hardware required for connections.

Pressure preservative treatment for protection against decay and insects in accordance with AITC 109. It should be incorporated into specification when wet use conditions prevail.

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1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project

specification when you choose to reconcile references in the publish print process.
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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Some referenced standards and criteria for Glued-Laminated Wood are being applied to Cross-Laminated Timber (CLT) as a similar material by reference in this section.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360	(2016) Specification for Structural Steel Buildings

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

AITC 109	(2007) Standard for Preservative Treatment of Structural Glued Laminated Timber

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16	(2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

AMERICAN WOOD COUNCIL (AWC)

AWC NDS	(2015) National Design Specification (NDS) for Wood Construction

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA T1	(2020) Use Category System: Processing and Treatment Standard
AWPA U1	(2020) Use Category System: User Specification for Treated Wood

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

ANSI/APA PRG 320	(2012) Standard for Performance Rated Cross-Laminated Timber
APA EWS S580D	(2013) Technical Note: Preservative Treatment of Glued Laminated Timber
APA EWS T300	(2007) Technical Note: Glulam Connection Details

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A276/A276M	(2017) Standard Specification for Stainless Steel Bars and Shapes

ASTM A666	(2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

FPInnovations (FPI)

SP-529E	(2013) CLT Handbook, Cross-Laminated Timber (U.S. Edition)

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO ISO/IEC 17020	(2012) Conformity Assessment - Requirements for the Operation of Various Types of Bodies Performing Inspection
ISO ISO/IEC 17065	(2012) Conformity Assessment - Requirements for Bodies Certifying Products, Processes and Services

1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required

as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Custom Finishes; G[, [____]]

SD-04 Samples

Exposed-To-View Surfaces; G[, [____]]

SD-05 Design Data

Installation Drawings

SD-07 Certificates

AITC Quality Mark or APA-EWS Trademark

Cross-Laminated Timber Panels

Conformance Certification

SD-08 Manufacturer's Instructions

Erection Procedures

Handling

1.3 QUALITY ASSURANCE

1.3.1 Qualifications for Cross Laminated Timber (CLT) Manufacturer

Provide panels that meet ANSI/APA PRG 320 standards, factory produced by an American Institute of Timber Construction (AITC) or APA - The Engineered Wood Association (APA) licensed manufacturer. Factory mark every panel with AITC Quality Mark or APA-EWS trademark and provide a certificate of conformance. Marks must not be visible in final assembly. Manufacture of the panels must conform to AWC NDS and SP-529E.

1.3.2 Certifications

Submit certificates for cross-laminated timber panels. Include a product report or laboratory report issued by a U.S. product certification agency accredited under ISO ISO/IEC 17065 or a U.S. product inspection agency

accredited under ISO ISO/IEC 17020. Include the following information in the certification:

a. CLT Manufacturer's Standards

b. CLT stress grade and appearance classification

c. Lay-up of wood, species and grades used

d. Connection Hardware Standards in accordance with CLT Manufacturer's specifications

e. Manufacturer's panel durability tests and testing results

Ensure material tested is typical of a production run of the same material used in the project. Conduct tests on the same production lot(s) for delivery of the panels.

1.3.3 Surfaces

Submit three samples, 100 millimeter 4 inches minimum square by three laminate thickness for industrial grade faced product and 300 millimeter 12 inches square by three laminate thickness sample for visual/architectural grade panels to illustrate the quality and color of exposed-to-view surfaces.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver the panels to the project site in covered or protected systems in accordance with manufacturer's standards or recommended instructions for proper handling and storage. Label and deliver in sequence of construction for the project, equipped with loading straps by the manufacturer, erected by certified crane operators and fabrication handlers and protected for prolonged inclement weather conditions after erected. Replace any damaged or deteriorated panels.

Submit manufacturer's instructions for handling, erection procedures, sequencing, administration of screws and attachments and recommended tools and tolerances. Note applicable safety precautions and standards. Have a copy of all instructions present on the project site.

PART 2 PRODUCTS

2.1 SYSTEM DESIGN

Verify all field measurements prior to preparation of fabrication and Installation drawings to ensure proper fitting of the work.

2.1.1 Drawings

Provide installation drawings for CLT panels showing sequence of placement, location, sizes, overall dimensions, reinforcement, screw and attachment locations, safe handling directions and any special erection instructions. Include any reinforcement necessary for safe handling and erection of panels. Identify each panel and the corresponding sequence and procedure followed during installation, and location and details of anchorage devices that are embedded in other construction on layout drawings.

2.1.2 Conformance Certification

Submit signed and sealed documentation prepared by a licensed professional [engineer] [architect] verifying conformance with ASCE 7-16, AWC NDS and ICC IBC standards.

2.2 MATERIALS

2.2.1 General

Provide CLT Panels fabricated in accordance with ANSI/APA PRG 320.

2.2.2 Lumber

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NOTE: Designer should determine the species and grade based on the design application and use, and delete the non-applicable selections below.

Select the appropriate stress grade from ANSI/APA PRG 320, or describe in detail an alternative grading required. (ANSI/APA PRG 320 grades are not mandatory to meet the standard. Alternative grading is allowed.) When CLT is used as a floor slab, ensure a grade is selected for the span to limit deflection to l/480 or a maximum of 13 mm a half of an inch.

Select one of the following appearance grades:

Architectural grade contains normal growth characteristics such as tight knots and medium seasoning checks. All knot holes and voids over 19mm 3/4 inch are filled.

Industrial grade has a greater number of open defects, including knot holes. Industrial grade is appropriate for industrial installations, floor beams, concealed construction, or other applications where appearance is not an important consideration.

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2.2.2.1 Stress Grade

CLT panels must be [E1] [E2] [E3] [V1] [V2] [_____] stress grade, graded in accordance with ANSI/APA PRG 320.

2.2.2.2 Appearance Classification

CLT panels must meet the [Architectural] [Industrial] appearance classification in accordance with ANSI/APA PRG 320.

2.2.2.3 Moisture Content

Comply with ANSI/APA PRG 320 for moisture content, up to a maximum of 15 percent, and compatible with the criteria of the certified adhesive applied.

[2.2.3 Preservative[and Fire-Retardant] Treatment

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NOTE: Include heading and following paragraphs when fire-retardant treatment is required to achieve a specified flame spread rating. Fire-retardant treatment is intended and recommended only for interior use and in locations not subject to alternate wetting or drying action. AITC 109 and APA S580 are for preservative treated wood exclusively.

Typically, do not use CLT members in humid locations or project locations with Environmental Severity Classifications (ESC) of C4 and C5. Humid locations are those in ASHRAE climate zones 0A, 1A, 2A, 3A, 3C, 4C and 5C (as identified in ASHRAE 90.1). See UFC 1-200-01 for determination of ESC for project locations. If unavoidable, fabricate CLT members from treated lumber.

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Wherever CLT is in the exterior of the conditioned building envelope; or in direct contact with the ground, building foundation, or concrete; or in damp or humid service conditions, use preservative treated wood.[Treat exposed structural panels with a fire retardant to attain a UL flame spread rating not greater than 25.] Pressure impregnate [preservative] [fire-retardant] treated wood with an approved process for the location in accordance with AITC 109 or APA EWS S580D, AWPA T1, and AWPA U1. Any strength or stiffness reduction due to treatment must be provided by the treater. Kiln dry all wood after treatment to remove the moisture added during treatment. Moisture content throughout material after drying must be less than 15 percent.

]2.2.4 Adhesive

Adhesives must be certified by test for use with the species to which it is applied in accordance with ANSI/APA PRG 320. Apply and allow set times as required by the adhesive manufacturer's instructions. Also, apply pressure on the panels and for the duration during manufacture as required by the adhesive manufacturer's instructions.

[2.2.5 Finishes

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NOTE: Delete this when finishes are not required.

The blank set of brackets allows specification of color.

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[No protective coating of the base panels is required.] [Submit custom finishes as specified by the designer and applied by the factory or on site.] [Provide cross-laminated timber members with standard factory wiped stain and clear varnish finish [as indicated by manufacturer's designations] [match sample] [as selected from manufacturer's full range] [_____]]

][2.2.6 Timber Hardware

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NOTE: Delete this paragraph when timber hardware is not required.
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Design connections to AWC NDS, and AISC 360 unless specifically detailed by the Engineer of Record, to resist shears, moments and forces indicated. Fabricate connective hardware in accordance with AISC 360.

Clean oil, dirt, rust, and foreign matter from all metal surfaces.

[2.2.6.1 Structural Steel

Provide structural steel shapes, plates, and flat bars as indicated for assembly and connection of members conforming to ASTM A36/A36M.

][2.2.6.2 Hot-Rolled Steel Sheet

Provide hot-rolled steel sheet complying with ASTM A1011/A1011M, structural steel, Type SS, Grade 33.

][2.2.6.3 Stainless Steel

[Provide stainless steel bars and shapes complying with ASTM A276/A276M [Type 304] [Type 316].

][Provide stainless steel plate, flat bars, and sheets complying with ASTM A666 [Type 304] [Type 316].]

]]PART 3 EXECUTION

3.1 PREPARATION

Clean oil, dirt, rust, and foreign matter from all metal surfaces.

3.2 INSTALLATION

Conform to spacing and placement of panels and installation methods in accordance with the manufacturer's instruction and APA EWS T300. Provide close fits and neat appearance of joints without binding or adding additional stresses to the panel. Hoist panels in place in accordance with the manufacturer's instructions using non-marring straps and connectors. Brace erected member so as to maintain a safe working environment and stable structure.

Avoid on-site cuts; however, if neccessary, only with the approval of the designer or engineer of record, except for fastener drilling and other minor cutting. Coat all cuts and inside surfaces of drilled holes with end sealer.

3.3 PROTECTION

After installation, cover each panel with temporary waterproof protection to maintain the low moisture content of the wood. Protect panels against excessive and repeated water deposits and standing water at all times. Maintain protection until members are enclosed within the building and final coats are ready for application. Take precautions to closely

maintain the manufacturer's standard for moisture content. Elevate initial building heating/cooling gradually to the desired level. Do not reduce the relative humidity of the building rapidly.

-- End of Section --