SECTION 061800 - GLUED-LAMINATED CONSTRUCTION

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:

Framing using structural glued-laminated timber.

* + - * 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 061000 "Rough Carpentry" for dimension lumber items associated with structural glued-laminated timber.

Section 061300 "Heavy Timber Construction" for framing using [**timbers**] [**and**] [**round wood poles**].

* + - 1. DEFINITIONS
				1. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives and with the grain of the laminations approximately parallel longitudinally.
			2. 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 each type of product.

Include data on lumber, adhesives, fabrication, and protection.

For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

For connectors. Include installation instructions.

* + - * 1. Sustainable Design Submittals:

Usually delete "Shop Drawings" Paragraph below except for high-quality exposed work or where glulam construction is required to comply with structural performance requirements.

* + - * 1. Shop Drawings:

Show layout of structural glued-laminated timber system and full dimensions of each member.

Indicate species and laminating combination.

Usually delete subparagraph below and show connection details on Drawings.

Include large-scale details of connections.

Usually delete "Samples" Paragraph below.

* + - * 1. Samples: Full width and depth, 24 inches long, showing the range of variation to be expected in appearance of structural glued-laminated timber[**including variations due to specified treatment**].

Retain subparagraph below only if a factory finish is required.

Apply specified factory finish to three sides of half length of each Sample.

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

* + - * 1. Delegated-Design Submittal: For structural glued-laminated timber and timber connectors.

Retain "Certificates of Conformance" Paragraph below unless only using stock beams.

* + - * 1. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in AITC A190.1.
				2. Material Certificates: For preservative-treated wood products, from manufacturer. Indicate type of preservative used and net amount of preservative retained.

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.

* + - * 1. Research/Evaluation Reports: For [**structural glued-laminated timber**] [**and**] [**timber connectors**], from ICC-ES.
			1. QUALITY ASSURANCE

Usually retain first option in "Manufacturer Qualifications" Paragraph below unless work is nonstructural or of unusual species and design. Revise if other certification is required. Retain second option if required for LEED. Before retaining, verify that manufacturers comply.

* + - * 1. Manufacturer Qualifications: [**An AITC- or APA-EWS-licensed firm**] [**certified for chain of custody by an FSC-accredited certification body**].
			1. DELIVERY, STORAGE, AND HANDLING
				1. General: Comply with provisions in AITC 111.
				2. Individually wrap members using plastic-coated paper covering with water-resistant seams.
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. PERFORMANCE REQUIREMENTS

Retain "Delegated Design" Paragraph below if Contractor is required to assume responsibility for design.

* + - * 1. Delegated Design: Engage a qualified professional engineer, licensed and registered to practice in the State of New York, to design structural glued-laminated timber and connectors.
				2. Structural Performance: Structural glued-laminated timber and connectors shall withstand the effects of structural loads shown on Drawings without exceeding allowable design working stresses listed in AITC 117 or determined according to ASTM D3737 and acceptable to authorities having jurisdiction.

Retain "Seismic Performance" Paragraph below for projects requiring seismic design. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. If retaining paragraph, show seismic design criteria on Drawings.

* + - * 1. Seismic Performance: Structural glued-laminated timber and connectors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
			1. STRUCTURAL GLUED-LAMINATED TIMBER
				1. General: Provide structural glued-laminated timber that complies with AITC A190.1 and AITC 117 or research/evaluation reports acceptable to authorities having jurisdiction.

Usually retain first subparagraph below if retaining requirement in "Quality Assurance" Article that manufacturer is an AITC- or APA-EWS-licensed firm.

Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that are not exposed in the completed Work.

If retaining more than one species below and if uniform appearance is critical, retain first subparagraph below.

Provide structural glued-laminated timber made from single species.

Retain first subparagraph below if appearance is critical and use of laminated veneer lumber in tension laminations is objectionable.

Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.

Usually retain first subparagraph below, even for dry-use applications, because wet-use adhesive is not affected by wetting during delivery and construction.

Provide structural glued-laminated timber made with wet-use adhesive complying with AITC A190.1.

Retain first "Species and Grades for Structural Glued-Laminated Timber" Paragraph below if manufacturer designs glulam.

* + - * 1. Species and Grades for Structural Glued-Laminated Timber: [**Alaska cedar**] [**Douglas fir-larch**] [**Southern pine**] [**Any species**] in grades needed to comply with "Performance Requirements" Article.

Retain "Species and Grades for Structural Glued-Laminated Timber" Paragraph below if structural properties, combination symbols, or beam stress classifications are indicated on Drawings.

* + - * 1. Species and Grades for Structural Glued-Laminated Timber: [**Alaska cedar**] [**Douglas fir-larch**] [**Southern pine**] [**Any species**] that complies with [**structural properties**] [**combination symbols**] [**beam stress classifications**] indicated.
				2. Species and Grades for [**Beams**] [**and**] [**Purlins**]:

Usually retain "Species and Beam Stress Classification" and "Lay-up" subparagraphs below and delete "Species and Combination Symbol" Subparagraph. "Species and Beam Stress Classification" Subparagraph includes examples of typical beam stress classifications. Douglas fir-larch and southern pine are also available in 26F-1.9E; southern pine is also available in 28F-2.1E.

Species and Beam Stress Classification: [**Ponderosa pine, 16F-1.3E**] [**Alaska cedar, 20F-1.5E**] [**Eastern spruce, 20F-1.5E**] [**Any species, 20F-1.5E**] [**Any species, 24F-1.7E**] [**Douglas fir-larch, 24F-1.8E**] [**Southern pine, 24F-1.8E**] [**Douglas fir-larch or southern pine, 24F-1.8E**] [**Southern pine, 30F-2.1E**].

Retain one of two options in "Lay-up" Subparagraph below. Balanced lay-ups are for cantilevered and continuous span applications but can be used for simple spans; unbalanced lay-ups are for simple spans.

Lay-up: [**Balanced**] [**Either balanced or unbalanced**].

If a specific glulam combination is required, delete "Species and Beam Stress Classification" and "Lay-up" subparagraphs above and retain "Species and Combination Symbol" Subparagraph below. Review lay-up combinations in referenced publications and insert acceptable combination symbols if retaining below.

Species and Combination Symbol: <**Insert species and combination symbol**>.

* + - * 1. Species and Grades for Arches:

Usually retain "Species and Beam Stress Classification" and "Lay-up" subparagraphs below and delete "Species and Combination Symbol" Subparagraph. "Species and Beam Stress Classification" Subparagraph includes examples of typical beam stress classifications.

Species and Beam Stress Classification: [**Alaska cedar, 20F-1.5E**] [**Eastern spruce, 20F-1.5E**] [**Any species, 20F-1.5E**] [**Any species, 24F-1.7E**] [**Douglas fir-larch, 24F-1.8E**] [**Southern pine, 24F-1.8E**] [**Douglas fir-larch or southern pine, 24F-1.8E**].

Retain one of two options in "Lay-up" Subparagraph below.

Lay-up: [**Balanced**] [**Either balanced or unbalanced**].

If a specific glulam combination is required, delete "Species and Beam Stress Classification" and "Lay-up" subparagraphs above and retain "Species and Combination Symbol" Subparagraph below, which includes examples of typical combinations. First three options are balanced; last three are unbalanced.

Species and Combination Symbol: [**Alaska cedar, 20F-V13 WS**] [**Douglas fir-larch, 24F-V8 WS**] [**Southern pine, 24F-V5 SP**] [**Alaska cedar, 20F-V12 WS**] [**Douglas fir-larch, 24F-V4 WS**] [**Southern pine, 24F-V3 SP**].

* + - * 1. Species and Grades for [**Columns**] [**and**] [**Truss Members**]:

"Species and Combination Symbol" Subparagraph below includes examples of typical visually graded combinations.

Species and Combination Symbol: [**Alaska cedar, 70**] [**Douglas fir-larch, 1**] [**Douglas fir-larch, 3**] [**Southern pine, 47**] [**Southern pine, 50**].

Usually retain "Appearance Grade" Paragraph below. Premium grade is the best for appearance and may require longer lead time, Architectural grade is for transparent or painted finish, and Industrial and Framing grades are for use where appearance is unimportant. For Architectural grade, voids on the surfaces of members larger than 3/4 inch are required to be filled with wood-tone filler or wood inserts. For Premium grade, all voids on the surfaces are required to be filled. Typically, manufacturers use the wood-tone filler unless wood inserts are specified. Wood filler may not stain the same as the rest of the beam. The use of wood inserts, which are to be specified only with Premium-grade beams, typically increases the cost of the laminated timbers. For timbers that are stained and if unfilled voids on the surfaces are not objectionable, Industrial-grade beams may be specified. Framing grade is hit or miss, surfaced on two sides only so it is the full width of lumber used for laminations. A complete description of appearance grades is given in AITC 110, available from AITC. Appearance grades do not determine number or size of knots and other defects allowed; these requirements are determined by combination symbol or structural properties specified. Special surface-treatment requirements such as rough-sawn surfacing are available from most manufacturers.

* + - * 1. Appearance Grade: [**Premium**] [**Architectural**] [**Industrial**] [**Framing**], complying with AITC 110.

Retain option in subparagraph below only with Premium grade and only if putty-type filler is unacceptable for larger holes. Verify availability with manufacturers.

For Premium and Architectural appearance grades, fill voids as required by AITC 110.[**For Premium appearance grade, use clear wood inserts, of matching grain and color, for filling voids and knot holes more than 1/4 inch wide.**]

* + - 1. PRESERVATIVE TREATMENT

Use Categories 1 and 2 are for interior aboveground applications; Use Category 1 is where only protection from insects is required and Use Category 2 is for damp conditions. Use Categories 3A and 3B are for exterior applications; Use Category 3A is where the wood is painted or coated, and Use Category 3B is where it is not painted or coated. Use Category 4A is for ground contact in other-than-severe environments.

* + - * 1. Preservative Treatment: Where preservative-treated structural glued-laminated timber is indicated, comply with AWPA U1, Use [**Category 1**] [**Category 2**] [**Category 3A**] [**Category 3B**] [**Category 4A**].

Usually retain first subparagraph below if glued-laminated timber is to receive a finish. Water repellents and oil-borne treatments may interfere with application of water-based finishes.

Use preservative solution without[**water repellents or**] substances that might interfere with application of indicated finishes.

Retain subparagraph below only for southern pine. Incising is not required for southern pine but is required for other species.

Do not incise structural glued-laminated timber or wood used to produce structural glued-laminated timber.

Consult fabricators for available treatments. In addition to those preservatives listed, AWP U1 also allows the use of creosote.

* + - * 1. Preservative:[**One of the following:**]

Oxine copper is listed in AWPA U1 for aboveground use with southern pine, western hemlock, and hem-fir, but not coastal Douglas fir; is a water repellent; does not discolor wood; and can be used in contact with agricultural food products.

Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.

Pentachlorophenol is listed in AWPA U1 for ground contact and aboveground use with southern pine, coastal Douglas fir, western hemlock, and hem-fir; it does not discolor wood but can only be used on the interior of a building where it is in ground contact and then it requires two coats of urethane, shellac, latex epoxy enamel, or varnish sealer.

Pentachlorophenol in light petroleum solvent.

Copper naphthenate is listed in AWPA U1 for ground contact and aboveground use with southern pine, coastal Douglas fir, western hemlock, and hem-fir; it discolors wood.

Copper naphthenate in a light petroleum solvent.

ACZA is listed in AWPA U1 for ground contact and aboveground use with southern pine, coastal Douglas fir, western hemlock, and hem-fir; it contains arsenic and discolors wood.

Ammoniacal zinc copper arsenate (ACZA) in a water solution.

CCA is listed in AWPA U1 for ground contact and aboveground use with southern pine, coastal Douglas fir, western hemlock, and hem-fir; it contains arsenic and chromium and discolors wood.

Chromated copper arsenate (CCA) in a water solution.

ACQ-C is listed in AWPA U1 for ground contact and aboveground use with southern pine, coastal Douglas fir, western hemlock, and hem-fir; it discolors wood and promotes corrosion of fasteners.

Ammoniacal copper quat Type A (ACQ-C) in a water solution.

PTI is listed in AWPA U1 for aboveground use with southern pine, coastal Douglas fir, western hemlock, and hem-fir.

Propiconazole tebuconazole imidacloprid (PTI) in a water emulsion.

Retain paragraph below for ground contact applications. Treatment is oil borne and discolors wood.

* + - * 1. After dressing members, apply a copper naphthenate field-treatment preservative to comply with AWPA M4 to surfaces cut to a depth of more than 1/16 inch.
			1. TIMBER CONNECTORS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=7577) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Cleveland Steel Specialty Co](http://www.specagent.com/Lookup?uid=123457137976).

[Simpson Strong-Tie Co., Inc](http://www.specagent.com/Lookup?uid=123457137977).

USP Structrual Connectors, Inc.

Or equal.

Paragraphs below are example descriptions of typical timber connectors. Delete types not required and revise descriptions to suit products selected. Thicknesses of steel sheet and plate may have to be adjusted for connector sizes. Show details of connectors on Drawings.

* + - * 1. Fabricate beam seats from [**steel**] [**stainless steel**] with [**0.239-inch**] [**3/16-inch**] [**3/8-inch**] bearing plates, 3/4-inch- diameter-by-12-inch- long deformed bar anchors, and 0.239-inch side plates.
				2. Fabricate arch base shoes from [**steel**] [**stainless steel**] with 1-inch baseplates and 3/8-inch side plates.
				3. Fabricate beam hangers from [**steel**] [**stainless steel**] with 0.179-inch stirrups and 0.239-inch top plates.
				4. Fabricate hinge connectors from [**steel**] [**stainless steel**] with 0.179-inch side plates and [**3/4-inch**] [**1-inch**] top and bottom plates.
				5. Fabricate strap ties from [**steel**] [**stainless steel**], [**2-1/2 inches wide by 0.179 inch**] [**3 inches wide by 0.239 inch**] thick.
				6. Fabricate tie rods from round steel bars with upset threads connected with forged-steel turnbuckles complying with ASTM A668.
				7. Provide bolts, 3/4 inch unless otherwise indicated, complying with ASTM A307, Grade A; nuts complying with ASTM A563; and, where indicated, flat washers.
				8. Provide shear plates, [**2-5/8 inches**] [**4 inches**] in diameter, complying with ASTM D5933.
				9. Materials: Unless otherwise indicated, fabricate from the following materials:

Structural-steel shapes, plates, and flat bars complying with ASTM A36.

Round steel bars complying with ASTM A575, Grade M 1020.

Hot-rolled steel sheet complying with ASTM A1011, Structural Steel, Type SS, Grade 33.

Type 304 stainless steel is usually standard; use Type 316 where subject to salt spray or immersion in salt water. Type 316 is more expensive and cannot be distinguished from Type 304 except by chemical tests.

Stainless steel flat bars complying with ASTM A666, [**Type 304**] [**Type 316**].

Stainless steel bars and shapes complying with ASTM A276, [**Type 304**] [**Type 316**].

Stainless steel plate, sheet, and strip complying with ASTM A240 or ASTM A666, [**Type 304**] [**Type 316**].

* + - * 1. Finish steel assemblies and fasteners with rust-inhibitive primer, 2-mil dry film thickness.

Usually retain last paragraph above for dry use and mild moisture exposure. Delete above and retain paragraph below for more severe wet use.

* + - * 1. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A123 or ASTM A153.
			1. MISCELLANEOUS MATERIALS
				1. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
				2. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.
			2. FABRICATION

It is often advisable to allow Contractor to order glulam beams slightly long, cut them to length, and machine them for connections at Project site to ensure a proper fit. Delete first paragraph below if Project-site fitting is allowed.

* + - * 1. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.

Dress exposed surfaces as needed to remove planing and surfacing marks.

* + - * 1. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.

First paragraph below may be deleted for southern pine used in aboveground applications.

* + - * 1. Where preservative-treated members are indicated, fabricate (cut, drill, surface, and sand) before treatment to greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWPA M4.

If retaining last paragraph above, usually retain one or both subparagraphs below; standard referenced above also allows creosote. Treatment in first subparagraph below is waterborne and does not discolor wood; treatment in second is oil borne and discolors wood.

Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

Usually retain "End-Cut Sealing" Paragraph below.

* + - * 1. End-Cut Sealing: Immediately after end cutting each member to final length[**and after preservative treatment**], apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.

Usually retain "Seal Coat" Paragraph below regardless of whether glulams are to remain unfinished or are factory or job finished.

* + - * 1. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit[**except for preservative-treated wood where treatment included a water repellent**].
			1. FACTORY FINISHING

Finish in "Wiped Stain Finish" Paragraph below is an example of a typical general-use stain finish. Consult manufacturers for other types; use caution in selecting transparent coatings, particularly for exterior and wet-use exposures.

* + - * 1. Wiped Stain Finish: Manufacturer's standard, dry-appearance, penetrating acrylic stain and sealer; oven dried and resistant to mildew and fungus.

Color: [**As indicated by manufacturer's designations**] [**Match Director’s Representative's sample**] [**As selected by Director’s Representative from manufacturer's full range**].

Finish in "Clear Finish" Paragraph below is an example of a typical general-use clear finish. Verify availability with manufacturers. Clear coatings are not recommended for exterior and wet-use exposures.

* + - * 1. Clear Finish: Manufacturer's standard, two-coat, clear varnish finish; resistant to mildew and fungus.
1. EXECUTION
	* + 1. EXAMINATION
				1. Examine substrates in areas to receive structural glued-laminated timber, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of the Work.
				2. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. INSTALLATION
				1. General: Erect structural glued-laminated timber true and plumb and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

Retain subparagraph below for glued-laminated timber that is exposed to view.

Handle and temporarily support glued-laminated timber to prevent surface damage, compression, and other effects that might interfere with indicated finish.

* + - * 1. Framing Built into Masonry: Provide 1/2-inch clearance at tops, sides, and ends of members built into masonry; bevel cut ends 3 inches; and do not embed more than 4 inches unless otherwise indicated.

Retain "Cutting" Paragraph below if glulams are shop fabricated.

* + - * 1. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

Delete first paragraph below if glulams are shop fabricated.

* + - * 1. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing[**and finishing**].

Predrill for fasteners using timber connectors as templates.

Finish exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.

Coat cross cuts with end sealer.

Subparagraph below may be deleted for southern pine used in aboveground applications.

Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.

If retaining last subparagraph above, usually retain one or both subparagraphs below; AWPA M4 allows creosote. Treatment in first subparagraph below is waterborne and does not discolor wood; treatment in second is oil borne and discolors wood.

Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

* + - * 1. Install timber connectors as indicated.

Usually retain one or both subparagraphs below unless not using bolts.

Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.

Install bolts with orientation as indicated or, if not indicated, as directed by Director’s Representative.

Insert specific erection tolerances and procedures here to suit Project.

* + - 1. ADJUSTING
				1. Repair damaged surfaces[**and finishes**] after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by Director’s Representative.
			2. PROTECTION
				1. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, sunlight, soiling, and damage from work of other trades.

Coordinate wrapping removal with finishing work. Retain wrapping where it can serve as a painting shield.

Slit underside of wrapping to prevent accumulation of moisture inside the wrapping.

END OF SECTION 061800