

TIMBER CONSTRUCTION

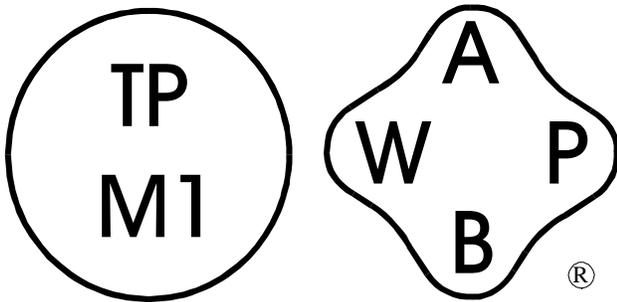
5-393.500

5-393.501 GENERAL

Properly constructed timber structures have a long and useful life and should be erected with this in mind. Thorough inspection and erection in conformance with plans, special provisions, and specifications is required.

5-393.502 MATERIALS

The treated timber to be incorporated in the structure will be inspected at the fabrication plant by independent commercial inspection agencies. Certificate of Compliance, inspection reports and treating reports should accompany each shipment of treated timber. Until these documents are received, treated timber should not be incorporated into the work and any use of such material is considered unauthorized work. Material stamped with the following "Marks" may be used subject to receipt of appropriate documentation.



Untreated timber, hardware and nails or spikes are often delivered without prior inspection and should be field inspected. All materials should be checked against plan dimensions and be given an inspection as to class, soundness and galvanizing. All field inspected materials should be reported on standard inspection forms and a permanent record should be kept of delivery and placement.

Creosote and other preservative oils should be inspected at source. If uninspected materials are delivered, a sample should be transmitted to the Laboratory (see 5-691.219 for sampling schedule) and approval received before the materials are used.

Care should be taken during the process of unloading and placing timber materials so as not to deform or damage the timber. When timbers are moved they should be lifted by methods which will prevent damage.

If timbers are to be stored prior to use, they should be piled in such a manner as to minimize warpage. They should be piled on suitable blocking at least 300 mm above dry ground, and the area should be clear of weeds and debris. If timber is to be stored out of doors for a period of several months, untreated timber should be open stacked and treated timber should be close stacked.

All hardware, nails and spikes should be stored above ground in suitable containers and, unless galvanized, should be kept in a dry, weather proof room or shack.

5-393.503 PILE BENTS

See Section [5-393.158](#) for Timber Pile Driving Details.

5-393.504 FRAMING

The fabricators of the various timbers will, in general, cut and drill them to the dimensions shown on the plans, but some pieces may require cutting or drilling in the field. If the timber is treated, the newly opened surface should be treated with preservative applied in accordance with the manufacturer's directions. See Section [5-393.509](#) for additional information.

Drift bolts holding caps, piles or stringers should be driven with the chisel point across the grain so as not to split the timbers.

The specified lengths of various bolts may be found to be too long or too short. This condition generally occurs where bracing or caps are bolted to piling.

Bolt projections exceeding 25 mm should be cut back to provide just enough projection for the washer and nut, plus approximately 6 mm. The cut ends should then be painted with aluminum paint so that the appearance will harmonize with the galvanized surface. If the bolt projection is so great as to cause the nut to run to the end of the thread without tightening against the timber, an additional washer may be added. It is, however, preferable to require that a shorter bolt be supplied than to stack too many washers, particularly for those connections where the bolts will be exposed to view.

Should it become necessary to cut additional thread on a bolt, the freshly cut surface should be covered with zinc paint before running on the nut.

If the bolts are too short for proper bolting, longer bolts should be used rather than notching into the timbers.

When the plans require that a strut block be placed on the under-side of the pier cap between the end pile at the upstream end of a pier and the next pile, care should be taken in trimming or cutting this strut so that a snug fit is obtained. The purpose of this strut is to transfer part of the ice-flow load from the upstream pile to the adjacent pile, thus giving added assurance against failure. Improper fitting of the strut would defeat its purpose and would tend to promote a hazardous condition.

5-393.505 WEARING COURSE

Planks that are used for the wearing course should be laid longitudinally. Breaking joints in each longitudinal line should be at least 600 mm from joints in adjacent longitudinal lines. The end of the planks should be squared to keep the joint opening at a minimum.

All planks used for wearing course should be surfaced on at least one side and one edge. Any plank having heart center appearing on one side should be surfaced on the heart side and the plank should be laid heart side (surfaced side) down. The planks should be nailed into place using 40 d galvanized barbed nails, spaced not over 250 mm and staggered across the surface of the plank. Not less than two nails should be used at each end plank. Planks of the same width should be used in each longitudinal line of flooring. For detailed specifications see [2403.3N](#).

Before permanently bolting the curb timbers to the scupper blocks and flooring, they should be laid out for the full length of the bridge so that any adjustment which may be required can be made with a minimum of cutting and/or redrilling. The spacing of the holes for both the scupper bolts and the rail post bolts should be checked for accuracy of alignment. Major changes should be referred back to the fabricating plant. Minor corrections may be made at the site, but care should be taken to make certain that the specifications are complied with regarding preservative coating. Indiscriminate cutting and notching of treated timber should not be permitted.

During the placing of vertical laminated flooring, frequent checks should be made and corrective measures taken to keep the work properly squared. Tight nailing and careful selection of material for uniform thickness in each lamination should prevent unequal gain. The number of nails or spikes required by the plans and specifications is the minimum that should be used, however, it may be necessary to use additional nails or spikes to draw the planks tightly into place.

Flashing is placed under scuppers and edges of bituminous wearing surfaces to protect steel stringers from moisture. Requirements for flashing are given in [2403.3P](#).

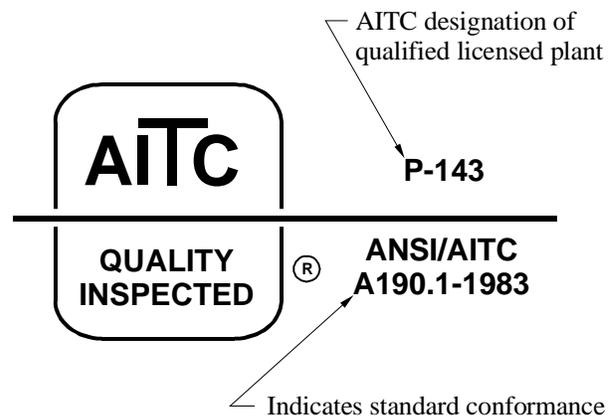
5-393.506 GLUE LAMINATED TIMBER

Glulam is an engineered, stress-rated product of a timber-laminating plant. It consists of selected and prepared lumber laminations that are bonded together on their wide faces with structural adhesive. Glulam has been used successfully as a structural material in Europe since the early 1900's. In the United States, it has been used with excellent performance in bridges since the mid 1940's. An important point about glulam is that it is an engineered timber product rather than simply wood glued together. Laminated beams made with pieces of lumber that are nailed and glued together should not be confused with glulam.

The national product standard for glulam is the American National Standard for Wood Products-Structural Glued Laminated Timber, ANSI/AITC A190.1. This standard, which as approved by the American National Standards Institute (ANSI) in 1983, contains nationally recognized requirements for the production, inspection, testing, and certification of structural glulam. It also provides material producers, suppliers, and users with a basis for a common understanding of the characteristics of glulam. The requirements in ANSI/AITC A190.1 are intended to allow the use of any suitable method of manufacture that will produce a product equal or superior in quality to that specified, provided the methods of manufacture are approved in accordance with requirements of the standard.

ANSI/AITC A190.1 requires that each glulam manufacturer maintain a strict quality control program for the production of glulam. This program must include continuing inspection and evaluation in areas related to manufacturing procedures, material testing, and quality control records. The inspections must be supervised by an independent third party to the manufacturer that meets specific qualification requirements outlined in the standard. The AITC operates a continuing quality program for its members; however, any independent inspection agency may be used, provided it meets the requirements of the ANSI/AITC standard.

In addition to quality marks, straight or slightly curved glulam beams must be stamped TOP at both ends to indicate the proper orientation of the beam. Because the bending strength of glulam beams is often different for the tension and compression zones, this marking is important to ensure that the member is correctly placed. See the following sketch for an example of a product quality mark.



5-393.507 CONNECTORS

Joints in timber can be made much stronger by the use of connectors rather than with conventional bolt and plate fastenings. Several different types of connectors are manufactured and their use varies with the type and purpose of the joint. See [Figure A 5-393.507](#) for illustration of various connectors and information on nails and spikes.

The split ring and toothed ring types are the most common of timber-to-timber connectors. The claw plate and shear plate types are used for timber-to-steel as well as timber-to-timber connection, and they have the advantage of being framed flush with the member. Spike grids are used largely in trestle bracing and are made in different shapes for various types of connections.

The split ring, claw plate and shear plate type connectors require regrooving which must be done accurately to proper depth and close fit. In regrooving for the split ring, the groove is made slightly larger to facilitate installation and provide a slight opening in the ring at the split, resulting in bearing on both sides of the ring. The claw plate is regrooved to the depth of the connector less its teeth.

The tooth ring and spike grid type connectors do not require regrooving of the members and they depend on pressure for embedment. This is often accomplished by means of a high tensile bolt with special long nuts and ball bearing washers. After the connector is embedded, the special bolt is replaced with the regular bolt.

The method of securing the timber deck to the steel or timber stringers will be shown in the plans. Various connection systems are shown in [Figure B and C 5-393.507](#).

5-393.508 HARDWARE

In general, hardware items will be inspected before shipment to the project, when shipments are made from the Twin Cities area. The inspector should check the dimensions of the various hardware items and compare these dimensions with those shown in the plans.

In the event that any item does not equal the dimensions or mass shown in the plans, or if the mass is not shown, the Engineer should be notified. The hardware item in question should not be used in the work until approved. The final hardware quantity should be computed in the field and should be compared with the quantity shown in the plans. If considerable variance is found, the computations should be rechecked before using them in the final estimate.

Hardware is measured by mass based on the unit mass shown in the plans.

5-393.509 FIELD TREATMENT

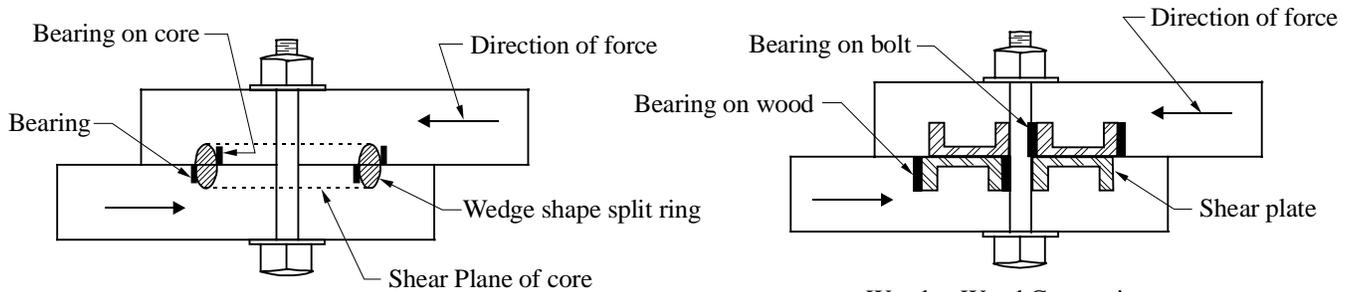
Field cuts in treated timber should be coated with a compatible preservative in accordance with [2403.3E](#). Surfaces which are to be painted, such as railings and rail posts, should not be coated with preservative. Preservatives should be applied to holes using an approved type of bolt hole treater.

5-393.510 PLACING RIPRAP FOR TIMBER STRUCTURES

Particular care should be exercised when placing riprap stone around timber substructure units, to prevent damage to the members. Any members which are damaged should be replaced, when possible, or otherwise repaired and re-treated to the satisfaction of the Engineer. The contractor is responsible for the proper execution of work but advice or warning from the inspector can sometimes avert damage and costly repairs.

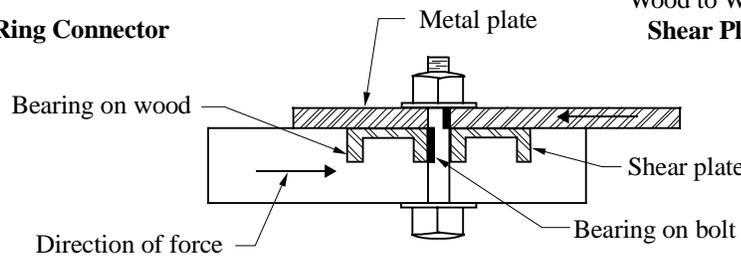
Pennyweight	Length		Wire Box Nails Dia.		Common Wire Nail Dia.		Threaded Hardened-Steel Nails Dia.		Common Wire Spikes Dia.	
	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches
6d	51	2	2.5	0.099	2.9	0.113	3.1	0.120	-	-
8d	64	2 1/2	2.9	0.113	3.3	0.131	3.1	0.120	-	-
10d	76	3	3.3	0.128	3.8	0.148	3.4	0.135	4.9	0.192
12d	83	3 1/4	3.3	0.128	3.8	0.148	3.4	0.135	4.9	0.192
16d	89	3 1/2	3.4	0.135	4.1	0.162	3.8	0.148	5.3	0.207
20d	102	4	3.8	0.148	4.9	0.192	4.5	0.177	5.7	0.225
30d	114	4 1/2	3.8	0.148	5.3	0.207	4.5	0.177	6.2	0.244
40d	127	5	4.1	0.162	5.7	0.225	4.5	0.177	6.7	0.263
50d	140	5 1/2	-	-	6.2	0.244	4.5	0.177	7.2	0.283
60d	152	6	-	-	6.7	0.263	4.5	0.177	7.2	0.283
70d	178	7	-	-	-	-	5.3	0.207	-	-
80d	203	8	-	-	-	-	5.3	0.207	-	-
90d	229	9	-	-	-	-	5.3	0.207	-	-
5/16	178	7	-	-	-	-	-	-	7.9	0.312
3/8	216	8 1/2	-	-	-	-	-	-	9.5	0.375
3/8	254	10	-	-	-	-	-	-	9.5	0.375

NAIL AND SPIKE SIZES

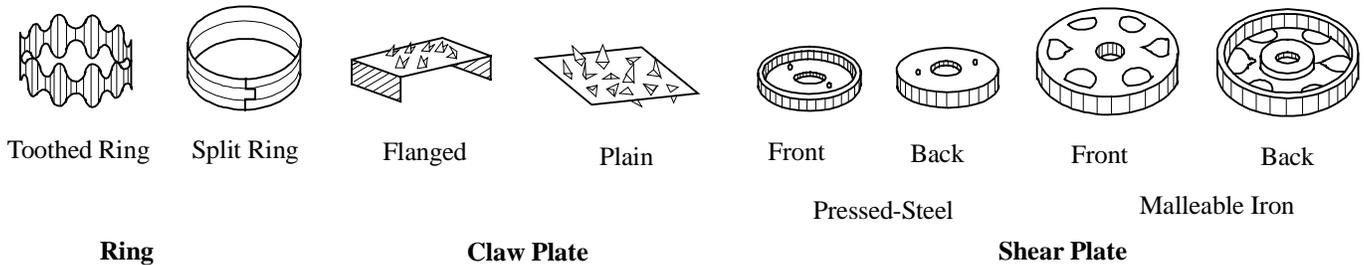


Split Ring Connector

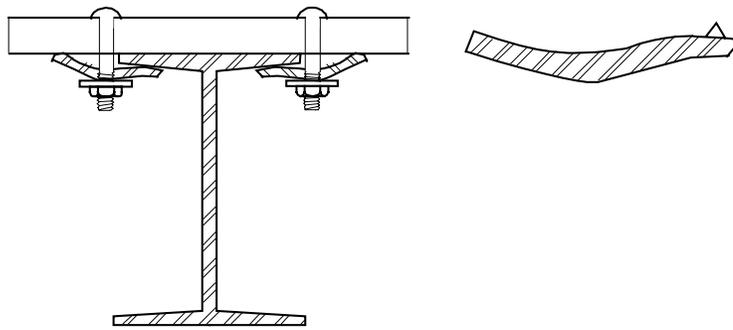
Wood to Wood Connection Shear Plate Connector



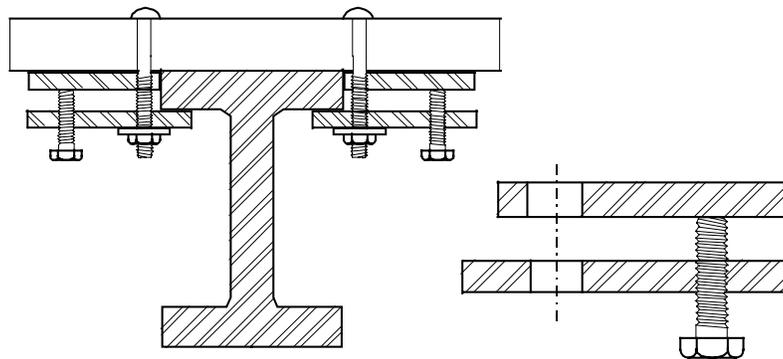
Wood to Metal Connection Shear Plate Connector



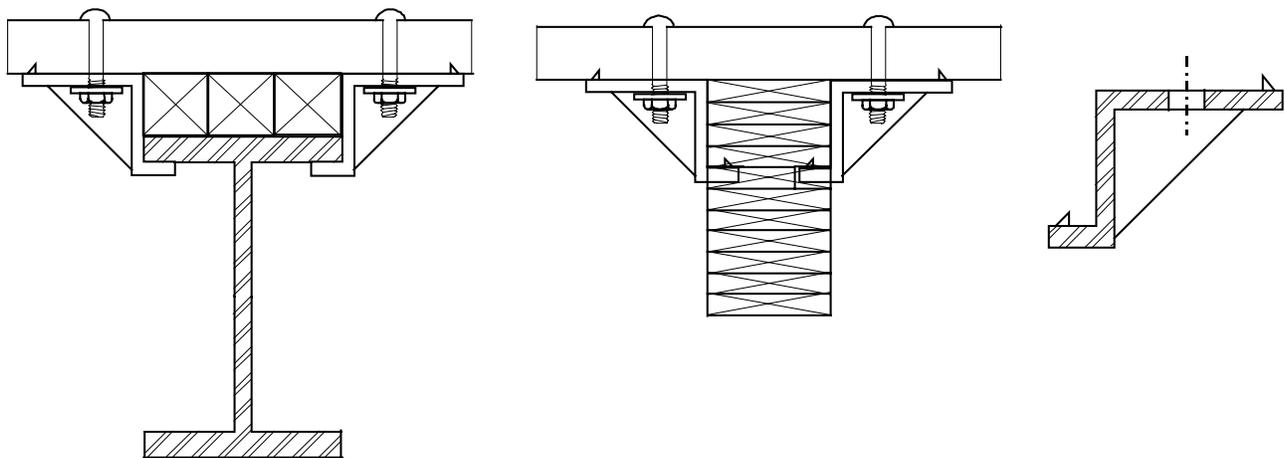
CONNECTORS



"C" clip for fastening deck to steel stringers

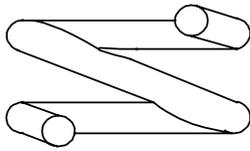


Adjustable bracket for fastening deck to steel stringer

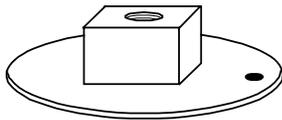


Bracket for fastening deck to wood or steel stringer

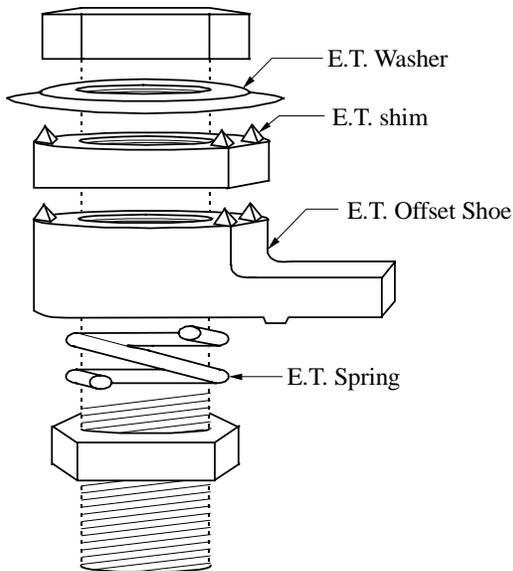
CONNECTORS - DECK TO STRINGERS



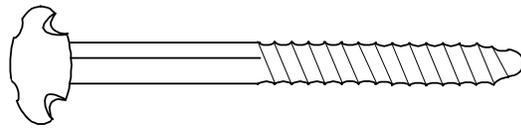
SPRING LOCK
Maintains tension on Hook Bolts and bracing bolts even as timber changes by weather or wear. Thackery crimp distributes load evenly.



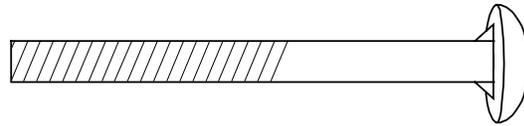
WASHER NUT
One-piece washer-and-nut. Eliminates separate washer. Seals water out of bolt hole. Hole in washer for nail to prevent loosening.



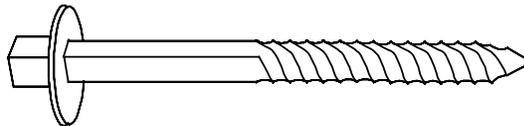
EVER TIGHT DECKING ASSEMBLY
Decking assembly fastener for wherever rail ties or timbers are secured to steel beams.



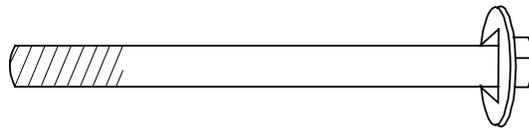
DOME HEAD DRIVE SPIKE
Fastens timbers and plank decking on bridges. Wide, smooth head eliminates counter boring, seal openings, wears well.



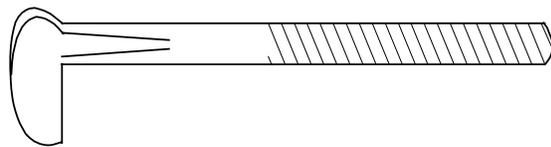
GUARD RAIL DOME HEAD BOLT
Wide, smooth head for bridges, fender systems and docks. No counter-boring to weaken timbers. Fins prevent turning. One person can install.



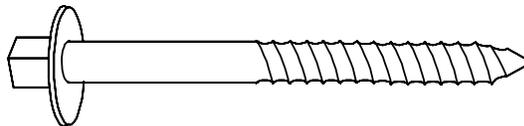
WASHER HEAD TIMBER DRIVE SPIKE
Fastens highway crossing planks, bridge guard rails and general timber construction. One-piece head.



WASHER HEAD TIMBER BOLT
For all timber construction. One-piece forged head helps prevent rot and rust. Fins prevent turning for one-person installation.



HOOK BOLT
Fastens timbers and ties to steel beams. Easy to install, long life. Fins prevent turning. Spring lock holds tension.



WASHER HEAD LAG SCREW
For all timber construction. One-piece head incorporates washer to seal out moisture and prevent rotting.

TYPICAL TIMBER CONNECTION SYSTEM