



Issue Date:	January 2019
Code/Section:	2018 IBC Section 2302.1; 2018 IRC Section R507; 2018 American Wood Council (AWC) National Design Specification for Wood Construction (NDS) Sections 12.1.4 and 12.2.1
Developed By:	John-Jozef Proczka, Ed Lyscas

Purpose:

To update the existing plan review and inspection policy for the use of lag screws, also called lag bolts, for uses in structural applications related to stair, balcony and guardrail connections.

Use Policy:

This policy does not apply to products with approved code evaluation reports, e.g., screws.

- Lag screws used in interior and exterior structural connections shall not be screwed into the end grain of wood.
- The exterior structural connections for stair or ramp landings, deck or balcony floors, guards or guardrails, and stair stringers shall not be constructed using lag screws, unless they meet an exception below.

Exceptions:

1. For projects within the scope of the IRC with City of Phoenix amendments, lag screws may be used in structural connections if both of the following are met:
 - The connections are prescriptive or designed by a registered design professional;
 - The initial installation is placed under special inspection that verifies the items identified by the installation information required below. The special inspector must verify the initial installations of each size and application of lag screw. Any change in the lag screw application, size, or personnel performing the installation requires this initial special inspection.
2. Lag screws may be used for guards or guardrails where not loaded in withdrawal.

Design and Installation Policy:

Lag screws used in structural applications, shall conform to the following limitations:

1. The construction documents shall include the following installation information required by the 2018 AWC NDS Section 12.1.4:
 - The lead hole diameter for the threaded portion pilot hole, where pilot holes are required;
 - The clearance hole diameter and length for the shank pilot hole, where pilot holes are required;
 - The statement: "The threaded portion of the lag screw shall be inserted in its lead hole by turning with a wrench, not by driving with a hammer."

2. The structural calculations shall take into account the design criteria found in the 2018 AWC NDS Section 12.2.1 and all other building code requirements, but shall specifically include the following:
 - The withdrawal resistance shall be based on the length of the threaded portion penetrating the main member, excluding the tapered tip length;
 - The withdrawal resistance shall take into account fastener head pull-through in accordance with the 2018 AWC NDS Section 12.2.5;
 - The 2018 AWC NDS table 12J values shall be reduced for penetration less than 8D;
 - Combined lateral and withdrawal loading per the 2018 AWC NDS Section 12.4.1;
 - Local failures per the 2018 AWC NDS Section 11.1.2. Appendix E methods are acceptable.

Background:

Lag screws have been observed to loosen over time and as a consequence they lose capacity with more severe capacity loss in withdrawal loading. This is very likely due to moisture loss of the wood into which the lag screws are installed outside in Phoenix, and to a lesser degree inside. Lag screws have also been observed to cause failures by inducing splitting where incorrect installation procedures are used. It is very difficult to verify correct installation. Lag screws are typically used in connections where very little redundancy exists, and as such an individual fastener failure can readily lead to global failure.

The connections for stair or ramp landings, deck or balcony floors, guards or guardrails, and stair stringers are considered critical life safety components. These items were identified by the original City of Phoenix policy "Code interpretation regarding the use of lag screws on stairs and guardrails" dated June 11th, 1985.

The 2018 AWC NDS commentary states that "Because of the greater possibility of splitting when subject to lateral load, it has been recommended that insertion of lag screws in end grain surfaces be avoided." This recommendation is followed in this policy. End grain insertion occurs where the screw length is parallel with the wood grain.