Considerations in the Selection and Specification of a Commercially Produced Hanger for Truss to Truss Connections

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Introduction

TPI-95 now makes the designer of Metal Plate Connected Wood Trusses also responsible for all truss to truss connections. A professional engineer or architect is referred to as the "truss designer" in the Standard. This short article reviews some of the considerations necessary to properly specify hangers for truss to truss connections.

Overview of Hanger Design Values and Basic Requirements

Most truss to truss hangers are commercially available stamped products. They are manufactured in dies or from standard blanked parts. Typically, they are tested to ASTM specifications and rated to model code specifications. The specifications require testing to determine an ultimate load and a load at 1/8 inch deflection for the product. The calculated value for the hanger is normally the sum of the allowable loads for the wood fasteners used with the hanger. Ultimate results with a strength divisor and the deflection limit are compared to calculated values, and the lowest value is used for the basic capacity of the hanger.

The published design capacity is usually based on the requirement that every nail hole in the hanger has a nail into solid wood. All nail holes are filled in both the supported and the supporting members (refer to Figure 1). This results in the maximum capacity of the hanger for downward and uplift loads.

Maximum Load Values Cannot Be Assumed for All Truss to Truss Connections

Trusses may be manufactured with a variety of end shapes and configurations, although a standard nominal heel height is the most common. It consists of the top chord butting on the scarf cut of the bottom chord. The bottom chord typically has a ¼-inch butt cut for controlling the accuracy of the joint. Overall height of the heel varies based on the height of the butt cut, size of the top chord, and pitch of the top chord. The end condition influences the area of solid wood available for nailing into the supported truss.

Since there is a wide variety of truss end configurations, a condition may exist where all nail holes may not have solid wood for a nail to penetrate. This lack of nailing may reduce the design capacity of the hanger. Figure 2 illustrates some of the variety of end conditions.

The Truss Designer Must Evaluate the Wood Available in Both the Supported Truss Heel and the Supporting Truss

The truss designer must evaluate the area of solid wood of the truss end height in the contact area of the hanger. If all nail holes can be filled with nails into the heel of the truss, the maximum rated capacity for the hanger may be used. If the heel area of the truss will not provide sufficient area for all nail holes, the maximum rated capacity for the hanger may not be used.

The reduction in hanger capacity when sufficient nail area is unavailable depends on the hanger configuration. For some hangers, this will only reduce the uplift capacities. For other hangers both downward capacity and uplift values may be reduced. There are additional considerations that must be evaluated as a result of this reduced nailing.

Because of these factors, the specifier must obtain design capacities for the hanger from the hanger manufacturer for conditions when the heel height will not allow the full nailing required to develop the maximum values. The specifier should not attempt to ratio or calculate these capacities without proper guidance from the hanger manufacturer.

The Number of Plies on the Supporting Truss Member Influences the Design Capacity of the Hanger

Truss girders may be 1 to 5 plies depending on the requirements. Normally the design values for the hanger are based on the nail achieving a minimum penetration of 12 diameters into solid wood. For example, a 16d wire common nail which is 0.162 inches in diameter requires 1.92 inches penetration to achieve full design value. For a typical truss application, this requires 2 plies to provide sufficient wood for the 16d nail used to connect the hanger to the supporting member. If only a

single ply is used, the maximum hanger capacity must be reduced.

Suggested Steps in the Selection of a Commercially Available Hanger

1. Have the completed truss designs.
2. Based on the truss designs, determine the most critical reaction for downward reactions.
3. Based on the truss designs, determine the most critical wind uplift reaction.
4. Determine the lumber size and species of the supporting truss member.
5. Determine the available lumber area and species of the supported truss member.
6. Review the hanger manufacturer's capacities for downward and uplift, for the lumber sizes and species used in the trusses and verify that the supported and supporting members provide solid wood for the required nail quantities.
7. If the framing condition does not meet the nailing requirements of the manufacturer, contact the manufacturer for appropriate design values to be used. Do not attempt to ratio a reduced load capacity.

Conclusion

Specifying truss to truss connections is now the responsibility of the "truss designer." Prior to TPI-95, the selection of the hanger was performed by others. A selection based on maximum code listed values without consideration of the available nails or number of truss plies could result in a situation where a hanger may not be acceptable because it does not pass the additional requirements for truss connections.

Alpine TrusCad Hanger Selection Feature Is Accurate and Simplifies the Hanger Selection Task

When you use Alpine's hanger selection feature, there is no need to refer to charts, look up reactions or uplifts, calculate the heel height of trusses, or make adjustments for the number of supporting members. You need not be concerned about whether the proper hanger is being selected. The design conditions and parameters are easily entered into the software, and if a hanger in the Hanger.inv file works for the condition being evaluated, the selection process is easily and accurately completed.