Understanding Bearing Size at a Wall or Beam.

The first thing to consider with bearing sizes is the minimum required by the building codes.

Per 2021 IRC, International Residential Code for One- and Two-Family Dwellings, Sec. R802.6 - When a ceiling joist is supported directly on wood or metal the minimum bearing size required is 1-1/2 inches, when supported directly on masonry or concrete then 3 inches is the minimum bearing size.

Per 2021 IBC, International Building Code, Sec. 2308.7.3.1 - When a ceiling joist is supported directly by the top wall plate, wood, the minimum bearing size required is a 1-1/2 inches.

Per ANSI/TPI 1-2022 Section 7.4.1 - Except where supported by mechanical fasteners such as nails or screws, or framing hardware such as hangers, all bearing supports that are at the end of a Truss shall provide no less than 1.5 in. of bearing length on wood or metal and no less than 3 in. of bearing length on masonry or concrete unless approved by any Registered Design Professional.

The next factor to consider is the material used at the bearing. Note there are two members at this location, the truss member and the wall plate. Both members are critical in the calculations for the bearing size needed, although we typically only consider the truss material. The lumber design property used in most applications is the $F_{C\perp}$ – Compression Perpendicular to Grain. Example values of $F_{C\perp}$ include SPF (spruce-pine-fir) – 425 psi (pounds per square inch), DFL (douglas-fir-larch) – 625 psi, HF (hem-fir) – 405 psi and SP (southern pine) – 565 psi. Note, that these values are the typical, and there are grades of material that can have higher values.

To check the reaction capacity of a single ply truss on a 2x4 wall:

$$Bearing\ Area\ = Truss\ Width \times Bearing\ Width = 1.5\ in\ \times 3.5\ in\ = 5.25\ in^2$$

$$Reaction\ Capacity = F_{C\perp} \times Bearing\ Area$$

$$For\ SPF\ this\ works\ out\ to\ 425\ psi\ \times 5.25\ in^2 = 2231\ lbs$$
$$For\ DFL -\ 625\ psi\ \times 5.25\ in^2 = 3281\ lbs$$
$$For\ HF -\ 405\ psi\ \times 5.25\ in^2 = 2126\ lbs$$
$$And\ for\ SP -\ 565\ psi\ \times 5.25\ in^2 = 2966\ lbs$$

Or to find the bearing width required of a single ply truss with SPF and a maximum gravity reaction of 1975 lbs.:

$$Bearing\ Area = \frac{Reaction}{F_{C\perp}} = \frac{1975\ lbs}{425\ psi} = 4.65\ in^2$$

$$Bearing\ Width = \frac{Bearing\ Area}{Truss\ Width} = \frac{4.65\ in^2}{1.5\ in} = 3.1\ in$$

For DFL required bearing width = 2.1 in, for HF = 3.25 in and for SP = 2.33 in.

Note that these results differ by a considerable amount. Where this is important is that trusses are typically manufactured with better grades and or species of material than the wall framing. So, as a general rule MiTek recommends that you design your truss components using the lowest expected material for the bearing. If you know that in your market area wall framing is done using SPF material or your company provides the wall panels built with SPF, that is the material you should have as a default bearing material. When upgrading the bearing material during truss design process, the owner/contractor/framer must be notified that the top plate of the supporting member must be sized accordingly.

MiTek engineering software gives you many options when it comes to determining the required bearing size. It calculates minimum bearing size, based on default bearing material and compares it with bearing size input by the Truss Designer. So, it is important to specify the actual bearing sizes for the truss. When the minimum required bearing size exceeds the input bearing size, the warning "***Required bearing size at joint(s)… greater than input bearing size***" in the general note section of the Truss Design Drawing is displayed. This warning should not be neglected by the Truss Designer. This warning is due to the bottom chord and/or top plate crushing from the reaction of the truss. Sometimes making changes, in a repair scenario, to the bearing area can be very challenging.

For additional information, or if you have questions, please contact the MiTek Engineering department.