How to Read a Truss Design Drawing

Before trusses are assembled in the manufacturer's plant, they are built conceptually on paper. These conceptual trusses become Truss Design Drawings. Although the primary use of Truss Design Drawings is to aid in the manufacture of trusses, they are a valuable resource for anyone building with or inspecting trusses. The purpose of this brochure is to highlight the important information that can be found on a typical Truss Design Drawing. The drawing shown below has color coded areas that are referenced and described in detail inside this document.

A. GEOMETRY:
Truss Design Drawings usually contain the following geometrical information about the truss that it represents:

A1. Span
A2. Heel Height
A3. Overhang Length
A4. Truss Spacing
A5. Pitch
A6. Overall Height
A7. Joint Locations

Note: Dimension notations are feet-inches-sixteenths

B. BEARINGS:
Details of the truss bearings are specified on the Truss Design Drawing:

B1. Bearing Locations
B2. Required Bearing Widths
B3. Mechanical Connection Details (i.e., hangers)
B4. Magnitude & Direction of Support Reactions

C. LUMBER:
Each drawing specifies the properties of every wood member of the truss. The following information will be shown:

C1. Nominal Cross Section Dimensions
C2. Lumber Species
C3. Lumber Grade

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D. PLATING INFORMATION:

Metal plate connected wood trusses are generally designed using proprietary software provided by the manufacturer of the connector plates. As a result, the plate design specified on truss design drawings is only valid for plates supplied by a particular plate manufacturer.

For example, it is not acceptable to substitute one brand of plate for another brand of plate unless the substitution is approved by the engineer responsible for the truss design. Most Truss Design Drawings will specify:

D1. Plate manufacturer
D2. Size of plate for each joint
D3. Gauge of plates (corresponds to thickness)
D4. Dimensioned locations of plates

E. PERMANENT TRUSS MEMBER BRACING:

Individual truss members are often subjected to compression forces. To prevent these members from buckling, permanent truss member bracing is sometimes required. Continuous lateral bracing and T-reinforcement are common techniques.

Required permanent truss member bracing locations and/or spacing, will be specified on the Truss Design Drawing.

See BCSI-B3 “Web Member Permanent Bracing/ Web Reinforcement” for more detailed information.

F. TRUSS MEMBER FORCES:

Truss Design Drawings will specify the maximum axial force expected in each truss member. This information is required for the building designer to specify the details of the permanent continuous lateral bracing. The maximum axial force is usually expressed in two formats:

F1. Magnitude & Direction:
This is the actual, numerical value of the truss member axial force (usually in pounds). It assumes positive values for members in tension and negative values for members in compression.

F2. Combined Stress Index (CSI):
The combined stress index is a ratio of the maximum axial and bending forces expected in a member to the forces that the member should be capable of resisting. It has a maximum value of 1.00 and can be thought of as a measure of structural efficiency. A member with a CSI close to 1.00 is subject to forces approaching its maximum design capacity.
G. MULTI-PLY GIRDER CONNECTION:
A girder is a truss that supports loads from other structural members framing into it. The girder may be a single truss or made up of identical trusses attached together to act as one. Multi-ply girder connections ensure that the load is transmitted equally between all plies.

Two and three-ply trusses are usually connected using nails. For trusses that are four plies or more, bolts must be used to fasten the plies together. The type of fasteners used, as well as the appropriate pattern and spacing of those fasteners, will be specified on the Truss Design Drawing.

H. DEFLECTION:
The maximum deflection of a truss under design load is specified on the design drawing. It is usually shown using two formats.

H1. Magnitude & Direction:
This is the actual, numerical value of the truss deflection (usually in inches). It assumes positive values for upward deflection and negative values for downward deflection.

H2. Deflection Ratio:
The deflection ratio is the ratio of the truss span to the maximum expected deflection. For example if a 60' truss deflects 2", the deflection ratio would be L/360 \((720" / 2" = 360)\).

Truss deflections are calculated assuming that all truss supports do not contribute to truss deflection. In situations where this is not the case, such as when support is provided by a beam or girder truss, additional deflection should be expected.

I. DESIGN LOADS:
Every Truss Design Drawing must specify the loads that have been accounted for in the design. This includes:

1. Top chord live loads (may include snow or construction loads)
2. Top chord dead loads
3. Bottom chord live loads
4. Bottom chord dead loads
5. Controlling wind and earthquake loads

The Truss Design Drawing will show specific locations and magnitudes of concentrated or uniform loads applied to girder trusses.

J. CONDITIONS OF USE:
The design values used for lumber and plates are dependent upon the conditions under which trusses will be used. For example, if the trusses are expected to function in wet or corrosive conditions, design values will have to be changed accordingly. Any factors that are applied to the design values for lumber and plates are usually stated on the Truss Design Drawings.

Spacing: 2-0-0
Lumber Increase: 1.15
Plate Increase: 1.15
Rep Member: YES
Code: IRC2000
Avoid errors by taking the time to review your Truss Design Drawings.

TRUSS INSTALLATION TIP:
Trusses may have symmetrical profiles but the loads they carry may not be symmetrical. Trusses that are mistakenly installed backwards or upside down cannot support the same amount of load as a correctly installed truss.

BACKWARDS
If the truss is designed to be installed this way...

DO NOT INSTALL THIS WAY!

UPSIDE DOWN
If the truss is designed to be installed this way...

DO NOT INSTALL THIS WAY!

WATCH FOR THE FOLLOWING:
• Is the web configuration symmetrical? If not, check your Truss Design Drawing to see that you have oriented the truss correctly.
• If the web configuration is symmetrical, are the plates and lumber symmetrical as well?
• Is the truss carrying any substantial point loads (beams, girders, etc.)? A major point load will usually coincide with the location of a truss joint.
• Is there a cantilever or interior bearing? If there is, the truss will usually be designed such that the bearing points line up with truss joints.

For more information see WTCA's TTB How to Read a Truss Placement Diagram