Description of Truss Manufacturer Drawings

Truswal Connection Drawing

Truss connection drawing by Truswal, attached to letter of July 7, 2005 by Mr. Thom, includes the following identifying information;

Title	Valley Truss To Base Truss Connection Detail
Drawing Number	TX07060001-001
Revision Date	3/1/2007

Various conditions for use of this drawing are described under "General Notes", including the following limits;

Maximum Wind Speed	130 mph
Maximum Mean Roof Height	20 feet
Exposure Category	B

The following requirement is included in General Notes;

Purlins required 2'-0" OC in absence of roof sheathing.
Valley truss bottom chords are considered purlins when nailed according to purlin requirements.

Vertical rise for slope of top chord is noted to range from "3 to 8" over 12.

The following two details are included on the drawing sheet;

"Valley Roof Plan"
"Section Cut Parallel To Valley Rafter"

The plan shows several valley trusses (with standard "VT" designation) running across underlying "base" trusses. Circled numbers (1 & 2 or just 2) point to every location where the longest valley truss (VT1) intersects with each underlying base truss, as follows;

Connections 1 and 2 at each end of the valley truss (shown on a base truss, with no overhang) and at the adjacent intersection.

Connections 1 and 2 at every other interior intersection

Connection 2 only at every other interior intersection that does not have connections 1 and 2 specified.

The following note is also included with the Plan;

NOTE: Connections are required for each valley truss
Typical connection shown

Meaning of each circled number is explained under "Connection Requirement Notes" as follows;

① *Simpson H4 Hurricane Tie [(4) 8d Common Wire Nails to each member]*
② *Truss to Truss connection [(2) 16d Common Wire Toe-nails] (Every intersection)*

Connections based on So. Pine lumber and 2x4 valley truss bottom chord and 2x4 lower truss top chord.

In the Section view, and in a small untitled perspective detail showing the H4 tiedown, bottom chord of the valley truss is shown in complete contact with top chord of the underlying base truss.

There is no explanation or detail showing intended positions of the two 16d nails specified.

The Section view clearly shows one or both of the circled number symbols at each location where valley truss is over a base truss, consistent with how these symbols are show in the Plan. However, end of the valley truss is shown to overhang the base truss by a small amount.

Of key importance is that, in the Section view, vertical webs of the valley truss (noted to be spaced at 4'-0" maximum) are shown to be directly over a base truss, which are noted as "Typical commons spaced at 24" oc". The H4 tiedown connector is only shown under the valley truss vertical web.

Various other details and notes are included that are not relevant to the valley truss connection.

Roof Truss Placement Plan; Builders FirstSource / MiTek

On the roof truss placement plan, truss V06 is the longest valley truss of a set of six valley trusses, within the interior of the roof.

Title block includes only the following information to identify the development;

Pulte Homes
Cumberland Hall - 33
01144
Haven - Reserved

Valley Truss Diagram; Builders FirstSource / MiTek

Valley truss diagram (V06) by Builders FirstSource is based on design software provided by MiTek. Seal of responsible truss engineer (Xuegang Liu; South Carolina 22333) is on the copy.

Standard information found of many truss diagrams is provided, including wind uplift reaction forces.

However, slope of top chord is noted as 11 (vertical) on 12 (horizontal) which does not appear to match roof slopes for valley trusses as specified on available building design plan details.

At the two interior vertical webs, design uplift reaction forces are listed as 357 pounds and 360 pounds. Note 6 specifies that proper connections are required for these uplift forces.

Note 2 explains design criteria, including 130 mph wind speed, and includes the following statement;

This truss is designed for C-C for members and forces and for MWFRS for reactions specified.

Taken as written, this statement means that the wind uplift reaction forces listed are based on MWFRS wind pressures, which are typically much less than C-C (components & cladding) pressures.

Evaluation of Truss Manufacturer Drawings

Truswal Connection Drawing

Truswal connection drawing is generally adequate for the intended purpose of showing basic requirements for connecting valley trusses to underlying main (base) trusses that support the valley trusses.

Connection requirements are relatively simple to understand. Any qualified professional engineer should be able to understand the specified connection instructions, even if such engineer does not specialize in structural engineering.

However, there are deficiencies with the Truswal drawing.

Valley truss is shown with vertical webs directly over main support trusses. This position results in the greatest uplift force to be resisted by the H4 tiedown connectors, with tiedowns only at every other base truss. An explanatory note would have been useful for understanding the design intent.

The problem with this representation is that vertical webs may very likely not be located directly over main support trusses.

If valley truss verticals are positioned between base trusses, there is no explanation as to whether each connection should then have the H4 tiedown. Of course, for such case, the conservative interpretation must be that an H4 tiedown is required at every intersection, along with the specified nailed connection.

Maximum design uplift force should have been specified and shown at each valley truss vertical. A simple arrow to identify the uplift forces would emphasize the purpose of the H4 tiedowns and help with understanding connection requirements for the case of valley truss web members located between base trusses.

For the range of roof slopes (3:12 to 8:12), wind pressures for slope up to 6:12 govern design for connectors. Based on calculations performed for this report, capacity of the H4 tiedown (360 lbs) exceeds required capacity (322 lbs) for Exposure Category B. However the H4 capacity is less than required capacity (395 lbs) for Exposure Category C.

Showing the valley truss bottom chord in full contact with the base truss top chord at least implies that the valley truss bottom chord must be beveled. Clear explanation as to the assumptions (or requirements) of the truss designer should have been noted.

Lack of any detail to show how the nails were to be installed (from one side only or from both sides) is a deficiency.

Maximum allowed overhang (past a base truss) should have been specified.

Roof Truss Placement Plan; Builders FirstSource / MiTek

Further information is required to verify that the roof truss placement diagram provided by PHI is applicable for houses in Sun City.

Valley Truss Diagram; Builders FirstSource / MiTek

Taken as written, the statement at end of Note 2 means that the wind uplift reaction forces listed are based on MWFRS wind pressures, which are typically much less than C-C (components & cladding) pressures. However, uplift reactions listed are actually greater than calculated using applicable C-C wind pressures.

- Most important is that relatively large uplift design forces are specified on the diagram. Uplift force (360 lbs) under vertical webs is much greater than design capacity of 2-12d nails (160 lbs) for installation conditions specified on design plans (S4.1) per calculations made for this report.

- Design uplift capacity of specified nailed connections is grossly inadequate compared to design uplift resistance specified on the truss diagram.