Description of Engineer Documents

Based on available information, Charles G Thom, Jr, PE, apparently performed engineering services as the structural engineer for the Sun City project, working for the developer. However, complete information about the design responsibility of Mr. Thom has not been available.

Address for Mr. Thom (Roswell, Georgia) and his professional engineer stamp (South Carolina 13111) is on each letter.

On available design plan sheets, Mr. Thom is identified as "Consulting Engineer", without the usual "PE" designation for professional engineer. His South Carolina license number is not included with printed information.

Subject of letters and calculations by Mr. Thom is "valley" trusses installed to form part of the roof for various houses in the Sun City development.

Letter of July 7, 2005

In letter of July 7, 2005, Mr. Thom briefly discusses evaluation of a truss drawing by "Truswall Systems Corporation" that specifies connection requirements for valley trusses;

> *"This detail seems to imply that both Simpson connectors and nails are used at each indicated connecting point on each valley truss.*
>
> *I have spoken with a truss vendor who has advised me that the referenced Truswall detail is generic in nature and is intended to be applicable for "all codes and loading conditions" for locations where they fabricate trusses. The vendor went on to say that the detail means to indicate that the Simpson connectors are to be used at "every other" intersection or the 2-16d nails at every intersection."*
>
> *"Drawing that we prepared indicate this attachment being made using 2-12d nails at each location where the valley set truss bottom chord crosses a supporting truss."*
>
> *"Application of the enclosed generic detail would result in valley set truss connections profoundly in excess of maximum stipulated code loadings."*

Letter of February 13, 2007

Purpose of letter dated February 13, 2007, addressed to Del Webb Communities, Inc., is explained;

> *"As requested, enclosed are calculations which are the basis for connecting valley set trusses to the underlying principal roof trusses."*

The following statements are included in brief explanation for the main 3-page section of the calculation set dated 2-12-07 (underline made for this report);

> *"Eleven (11) Roof Framing Plan drawings that have been annotated with calculation of uplift loads acting on the valley set trusses. These loads are developed to indicate uplift acting on each 4 square foot connector tributary area. We have also indicated the total uplift load acting on a group of valley set trusses and the total estimated uplift capacity of all connections of the valley set. "*

A numbered listing of five (5) "summary observations" includes the following;

1. *Typically Zone 2 loading encompasses most of a valley set roof area, with Zone 1 loading area having a lesser influence. Smaller valley set areas are more influenced by Zone 2 loads than larger valley set areas.*
2. *Most valley set areas encompass more than 100 square feet thus generally a lower uplift load value for each zone is used.*

Different from the other two letters relative to this issue, Mr. Thom is identified as "Principal" of "Southland Services Inc.".

Calculations For Nail Connections (2-12-07)

Calculations dated 2-12-07 consist of three hand-written pages (8-1/2 x11) and the following attachments (all 8-1/2 x 11);

- Copies of 4 pages from NDS-2005, the governing code for wood construction
- Copies of 2 pages from IRC-2003, the general building code
- Markups (8 pages) of roof truss framing plans for various models, with hand-written notes showing calculation of wind uplift forces and valley truss connection capacity

Top of each main calculation page includes typed name and address for Charles G Thom, Jr.. PE. There is also a standard title block at upper right that is only partially filled in with date and page number. There is no name or initials listed to identify the person responsible for calculations.

Copies of roof truss framing plans have "Del Webb Corporation" and "Sun City - Hilton Head" in a title block, along with a four-digit number and various dates.

One page with "8305" designation has the following dates;

Issued	1 / 21 / 02
Issued for const.	2 / 4 / 02

Another "8305" page also has a revision date of 9-20-03.

Pages of roof framing plans with other designation numbers list dates from 2002, 2003 and 2004. Charles G Thom, Jr (without PE identification) is identified as the responsible "Consulting Engineer" at bottom right of each plan sheet.

First page (sheet 1) of calculations includes a large-scale illustration showing valley truss bottom chord (oriented vertically) connected to sloping top chord of main "supporting" roof truss with a nail installed through the low-side face of valley truss bottom chord.

Specified 12d nail (3-1/4 inches long) is shown to be installed as follows;

- ☑ At angle of 30 degrees with respect to longitudinal axis of valley truss vertical web member
- ☑ Head (top) of nail to be 1.08 inches (L / 3) above bottom edge of valley truss bottom chord, with L equal to length of nail.
- ☑ Depth of penetration into main truss top chord to be 1.65 inches

Only one edge of valley truss bottom chord is shown to bear on the main truss top chord. The nail is therefore shown to pass through a gap under valley truss bottom chord.

Calculation for nail withdrawal capacity, including "Wind Load Factor" of 1.6 and "Toe Nail Factor" of 0.67, results in design capacity of 74.29 pounds for one nail and 148.58 pounds for two nails.

Sheet 2 includes a table showing calculation of "Net Uplift" pressures for 130 mph wind speed, 6 on 12 roof slope. Lines are shown for standard roof surface locations ("Wind Zone") and tributary areas ("Area") applicable to a connection. Gross wind uplift pressure are taken from standard table in NDS-2005 (attached) for components and cladding wind pressures.

Resistance from uniform dead load (increased for "projected area") is then calculated as 5.36 pounds per square foot, using 60% factor specified by the building code.

A simple force diagram shows an unidentified force line perpendicular to sloped roof surface along with vertical and horizontal force components. "Not Effect" is noted along with horizontal component.

Sheet 3 includes a table showing "Net Uplift" pressures for a roof slope of 7.5 on 12 and 130 mph wind speed.

Hand-written calculations on the various roof framing plan markups show total net wind uplift force to be resisted by a "set" of valley trusses that forms a triangular area in plan. If applicable, uplift force is listed for Zone 1 and Zone 2 separately, along with area for each zone. Calculations for some valley sets include uplift force to be resisted by each connection, using tributary area of 4 square feet.

Total uplift capacity is calculated for all the nailed valley truss connections that occur for that set of valley trusses.

Where listed, roof slope of each valley set is noted as 6 on 12, 7 on 12 or 7.5 on 12.

Largest total net wind uplift force of 6,200 pounds is listed for one valley set with the 8352 designation. Roof areas are listed as 56 square feet (Zone 1) and 168.75 square feet (Zone 2). Net wind uplift pressures are listed as 17.18 psf (Zone 1) and 31.04 psf (Zone 2). Design capacity is listed as 8,310 pounds for 57 connections.

Net wind uplift pressures are taken from lines in the table (sheet 2) for tributary area of 100 square feet.

For roof framing plan with designation 8306 (roof slope 7.5 on 12), net wind uplift pressures are also taken (from table on sheet 3) for tributary area of 100 square feet.

Letter of March 8, 2007

In letter of March 8, 2007, Mr. Thom describes problems with as-installed nailed valley truss connections in "*Model 8304*" (underline emphasis made for this report);

> *"The problem pointed out by the City's representatives is that in many cases the trusses were damaged at the connection point at the time the connection nails were installed. This damage appears to be caused by the careless use of the air powered nail driver which evidences itself as split wood or nails projecting out of the supporting truss top chord."*

Mr. Thom recommends installation of *"one (1) 10 gage x 3-1/2 inch long wood screw"* to *"restore the connection uplift capacity"*. He also contends that the calculation for wood screw capacity was performed *"Following the same line of analysis"* as for the nail calculation.

For existing conditions (with nailed connections) of the 8304 model at that time, Mr. Thom recommended installing the (apparently single) wood screw "*essentially at alternate connections*".

For *"other models"*, the initial recommendation is to install two wood screws at *"alternate truss crossing points"*.

However, in the final paragraph, the recommendation is to continue using nailed connections if *"it can be done without damaging the wood"* or to use one of the following alternate connection methods;

> Single 10 gage x 3-1/2 screw *"at each crossing point"*
> *"Simpson valley truss clip.....at each alternate crossing point"*

<u>Calculations For Screw Connection (3-7-07)</u>

Mr. Thom developed additional calculations (4 pages) for design capacity of a single wood screw connection, apparently in response to discovery of extensive problems with toenail connections, as noted in his letter of March 8, 2007.

Wood screw is specified as 10 gage with a length of 3-1/2 inches. Diameter is noted to be 0.138 inches (sheet 1).

Product sheet for (apparently) the proposed wood screw is attached, although available copy is difficult to read. All dimensions are (apparently) in millimeters. "Pull-Out" value of 451 (units not legible) is listed for "Plywood".

On sketch showing the wood screw connection (sheet 1), wind uplift force from valley truss is shown parallel to the vertical web. Force components are shown parallel-to and perpendicular-to the wood screw, which is shown with the same orientation as the toenail in the previous calculation.

Force diagram on sheet 1, applicable at location of the screw connection, is different than the force diagram shown on sheet 3 of the nail connection calculation, which is applicable only at top of the valley truss.

Design "pullout" capacity is first calculated as 456 pounds, based on standard withdrawal values from NDS, but without using the 0.67 "toenail factor" used for nails.

A detailed calculation for allowable combined forces (tension & lateral) is included (sheets 3, 4), using standard provisions of NDS-2005.

- However, effect of the gap between valley truss bottom chord and main truss top chord is not addressed.

"Maximum allowable uplift load" is listed as 225 pounds (sheet 2), based on "working backwards" from the calculated maximum lateral load of 130 pounds, which was calculated for a withdrawal load of 285 pounds (sheet 3).

Design Plan Details

Very limited information about building design plans has been available for this report.

Details most relevant to this evaluation are described.

Design Plan Details; S2.0

Copy of plan sheet S2.0 includes the following identifying information (based on best reading);

Plan Name	Chestnut Garden
Current Release Date	8-29-09
Hand-written date (with PE stamp)	8-28-09

This sheet includes Roof Framing Plan and the following schedules in separate boxes;

Roof Framing Legend / Notes
Reference Drawings
Roof Truss Connection Exceptions

Symbol 3 under "Roof Framing Legend / Notes" specifies the following;

Valley set trusses / Roof sheathing optional on main roof trusses shown below

Under "Roof Truss Connection Exceptions" are the following circled-number symbols and note;

1. *H10 truss anchor only*
2. *H10 + H2.5A truss anchors*
3. *H2.5 truss anchors*
4. *(2) H10 truss anchors + H4 stud to plt. Conn.*

See Sh S4.1 for typ conn details [not] specifically noted

Design Plan Details; S4.1

Copy of plan sheet S4.1 includes the following identifying information (based on best reading);

Plan Name	Details
Current Release Date	8-30-09
Hand-written date (with PE stamp)	9-16-09

Basic detail for valley truss connection ("Valley Set To Roof Truss Connection") shows a valley truss on top of sloped top chord of main truss (at slope of 5.5 to 12). Note pointing to bottom chord of valley truss specifies connection requirements. With the phrase "at each roof truss bearing point" taken as being applicable for nails or screw, one of the following three options is specified;

(2) 12d nails "at each roof truss bearing point"
(1) 10 gage x 3-1/2 inch wood screw "at each roof truss bearing point"
(1) Simpson H2.5 "at alternate roof trusses"

Nail connection is depicted, with the nail angled at 30 degrees from vertical. Top of nail is specified to be 1-1/4 inches above bottom edge of valley truss bottom chord.

Type (common, box, sinker) of nails is not specified.

Position of the H2.5 (high side or low side of valley truss) and nailing requirements are not specified.