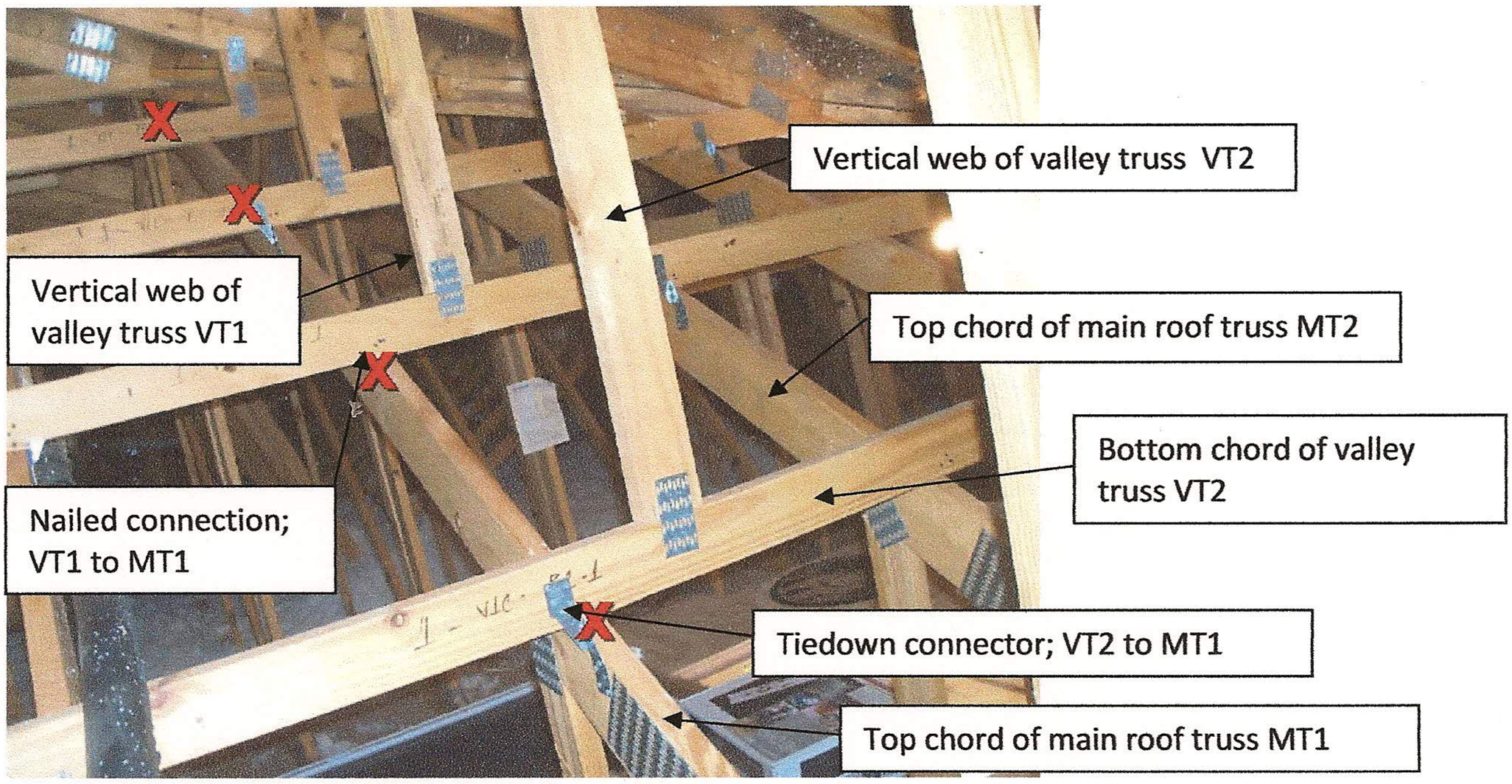
Photos

Digital photos of as-built construction have been provided (via email) by Professional Home Inspections. Text annotations have been made for this report.

Photo 1 - Valley Trusses On Main Roof Trusses (2010)



Bottom chords of valley trusses are seen running (left to right in photo) across top chords of main roof trusses. Date of construction is not available.

Designations for two valley trusses (VT1, VT2) and two main trusses (MT1, MT2) are made for this discussion only.

Red Xs were added by Professional Home Inspections to identify connection locations between four valley trusses and one main roof truss (MT1).

Valley trusses and main roof trusses are spaced at 24 inches.

Only one (upper) edge of each valley truss bottom chord bears on the main roof trusses, such that there is a variable-width gap between valley truss bottom chord and main truss top chord. This gap can not be seen in the photo (see connection diagram attached to this report).

Note that there is no plywood roof sheathing on the main trusses. Therefore, since no other bracing has been provided, bottom chords of valley trusses must provide essential lateral bracing for top chords of main trusses. This means that there must be a secure connection at every intersection (valley truss & main truss).

Light-gage steel tiedown connectors have been installed at every other intersection where a valley truss is supported by each main roof truss. However, for adjacent valley trusses, tiedown connectors have been staggered (not on same main truss). This arrangement is not consistent with the Truswal connection drawing, although the Truswal drawing did not show requirements for this condition, with vertical webs between main trusses instead of being directly over one main truss.

Wind uplift force (applied to roof surface above) is distributed to vertical webs of valley trusses. Note that vertical web of each valley truss is not directly over a main truss. For this condition, wind uplift force (from each vertical web) must be resisted by the nearest two adjacent connections for that valley truss (along valley truss bottom chord). Since the vertical web (of any specific valley truss) is much closer to the MT1 truss than the MT2 truss, connections with the MT1 truss must resist much greater force than connections with the MT2 truss.

- ➡ This photo demonstrates one of the key flaws with analysis performed by engineer for builder, which is based on the incorrect assumption that all connections resist wind uplift force equally.

However, if (as shown by the photo) all or some of the valley truss connections with MT1 are made with nails, design capacity for the nailed connections is likely to be much less than required capacity for design windspeed, and perhaps even less than required for much lesser windspeed.

In Photo1, design capacity of the nailed connection between valley truss VT1 and main truss MT1 is likely not adequate.

Failure of any weak connection results in redistribution of uplift force to adjacent connections, greatly increasing force on remaining (intact) connections. If the remaining connections do not have adequate additional capacity, a cascading ("zipper") type failure of all connections for that valley truss can occur. If all connections are made with nails, the risk of such progressive failure is unacceptably high.

Tiedown connectors very likely have adequate capacity. However, all required nails must be installed and nails must not be excessively close to the edge the wood members. Installing connectors on the "gap" side of the valley truss (as seen in Photo 1) results in risk that some nail holes can not be filled with nails.

For conditions shown in Photo 1, valley trusses will remain connected to main trusses even if nailed connections fail, since tiedown connectors have more than adequate design capacity and overload capacity. However, when nailed connections fail, lateral bracing of main trusses (currently provided by valley truss bottom chords) becomes deficient.