

## Recommendations

Evaluation that results in criticism of design and construction should of course include recommendations for improvements.

### Valley Truss Connections

- If any party seeks to demonstrate that valley truss connections made with two nails or single screw have adequate design capacity, such party should have load testing performed (by independent testing agency) so that accurate values of failure load (and allowable capacity) can be obtained.

Cost of load testing by qualified testing agency should be quite modest, especially considering the relatively large potential cost savings (avoidance) if testing shows favorable results. However, even if testing shows unfavorable results, resulting in the need for extensive remedial work, the eventual savings from preventing severe damage during a hurricane will be well worth the effort for homeowners.

Before plans for remedial work are developed, the following additional engineering evaluation should be performed;

1. Determine extent of houses for which Exposure Category C is applicable. Remedial work should be focused on such houses (if any) first.
2. Determine if published research exists to show that Zone 2 pressures are not required along valley lines. If so, design uplift force for some connections could be reduced, which might reduce number of connections to be upgraded.

### Further Structural Analysis

Defects such as inadequate valley truss connections are often an indication of additional deficiencies with design and construction ("tip of the iceberg").

- Further structural analysis should be performed to evaluate complete wind resistance capacity of as-designed and as-built houses.

Further structural analysis would have to be obtained by homeowners from qualified professional engineer licensed in South Carolina.

Brief review of limited building design plan details obtained for this report indicates that overall design for wind resistance (for houses that were built according to available design plans) is most likely adequate, at least for houses where Exposure Category B is applicable. Plans specify various necessary details, such as tiedown connectors for main roof trusses and header beams supporting roof trusses. Interior shearwalls are also specified.

However, considering the potential cost of inadequate design when a hurricane occurs (which will certainly happen at some time), the cost of double checking design is more than worthwhile.

- For any houses that should have been designed for Exposure Category C wind pressures, overall design for wind resistance may not be adequate if Exposure Category B was assumed (similar to design for valley truss connections).

For this evaluation, it was not feasible to determine when design plan details (made available for this report) were issued. It is conceivable that houses built several years ago were built according to some other design plans.

#### Evaluation of As-Built Construction

Just as important as checking design is evaluation of wind resistance capacity for as-built construction.

Newspaper articles report a variety of defects and potential defects with roof truss construction.

Home inspection firm PHI has found a range of construction defects in numerous houses.

Available photos show missing nails in key tiedown connectors and (apparently) missing tiedown connectors along segments of exterior walls.

- Detailed evaluation of inspection reports should be performed by qualified professional engineer.

Inadequate design and construction of permanent lateral bracing of roof trusses is often a major problem in developments, especially when several different truss configurations are used for each house. Truss diagrams (and placement plan) for the specific house must be reviewed to determine which truss web members must have bracing according to design requirements of the truss designer.

Inadequate bracing of gable endwalls is another common problem when roof trusses are installed. Lack of proper bracing could easily result in risk of complete failure of gable endwalls during high windspeed event.