High Heel Roof-to-Wall Connection Testing

Phase III – Evaluation of extended wall OSB sheathing connection under combined uplift and shear loading for 24-inch-heel trusses

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RESULTS

Analysis presented in Figure 16 and Figure 17 shows that the capacity of the energy truss heel connection exceeds the adjusted design values in Exposure B wind regions for all analyzed building configurations at basic wind speeds up to 140 mph, and in the case of the shorter roof spans at basic wind speeds up to 180 mph. Accordingly, the analysis indicates that the tested energy truss heel connection can provide a factor of safety of 2.0 in Exposure B wind regions for nearly all typical building layouts across the majority of the country. The applicability of the tested system is also extensive when comparing peak capacities to design values in Exposure C wind regions (Figure 17); the system capacity yields a factor of safety of 2.0 or greater at basic wind speeds of up to 120 mph. A basic wind speed of 120 mph encompasses the greater majority of the continental US, excluding only the coastal regions in the eastern half of the country.

(Full Report available upon request)

SUMMARY AND CONCLUSIONS

This testing program was designed to further evaluate the performance of OSB wall sheathing panels extended over the roof heel in resisting combined uplift and shear forces. The results of this study provide guidance towards further expanding prescriptive solutions for high-heel truss attachment optimized for performance from the structural, energy, and constructability standpoint. The following is a summary of the conclusions based on the results of this testing program:

1) The tested system using extended wood structural panel (Norbord TallWall/Windstorm OSB) wall sheathing as the primary connecting element (without additional connecting hardware) at the roof-to-wall interface of energy trusses can provide a continuous load path in both the shear and uplift directions and can be considered a viable option for residential construction in most areas of the country.

2) The overturning effects caused by increased energy truss heel heights can be offset by additional face nails attaching the extended wood structural panel wall sheathing to energy truss heel. This conclusion has been validated for trusses with heel heights up to 24 inches. (Results of Phase II testing validated performance for trusses with heel heights up to 15¼ inches). The number of nails used in these testing programs for attaching wall sheathing to the truss heel is based on a maximum nail spacing of 4 inches on center at the heel member.

3) The uplift-shear capacity interaction curve for the energy truss heel connection system is nonlinear, with capacities for all uplift to shear ratios measured in this testing program exceeding the capacities predicted based on a linear interaction. In design applications, a linear relationship may be a simplified and conservative representation of the response under combined loading for energy truss heel connection system using extended wood structural panel sheathing.

Table 2 – Specimen Materials and Construction

Roof Dimensions:	24 foot roof span (plus 1 foot 4 inch overhang on each end) 8 feet deep (a total of 5 trusses)
Truss heel height:	24 inches - measured from the top of wall to the top of the truss (underside of roof sheathing). Measured along the exterior of the wall framing.
Roof Pitch:	7/12
Roof Framing Members	Metal plate connected wood trusses fabricated with No. 2 SPF lumber; Heel heights 15¼ inches
Truss Spacing:	24 inches on center
Truss-to-Wall Plate Connection:	Trusses toe-nailed to top plate of wall w/ two (2) 16d box (3¼" x 0.131") nails
Fascia Board:	1x6 nominal lumber face-nailed to each truss end w/ two (2) 8d common (2½" x 0.131") nails
Roof Sheathing Materials:	7/16-inch-thick OSB sheathing installed perpendicular to framing member w/ steel edge clips and unblocked edges parallel to the ridge
Roof Sheathing Fasteners:	8d common (2½" x 0.131") at 6 inches on center on panel perimeter and 12 inches on center in the panel field
Ceiling Material:	1/2-inch-thick gypsum panels installed perpendicular to truss bottom chord members, joints in the panel field taped and mudded
Ceiling Fasteners:	1-5/8 inch Type W drywall screws at 8 inches on center w/ first rows of fasteners 8 inches in from side walls (i.e., floating edges)
Supporting Wall Dimensions:	8 feet long by 4 feet in height
Supporting Wall Framing (including top plates):	2x4 nominal SPF STUD or No. 2 grade lumber
Supporting Wall Sheathing:	7/16-inch thick Norbord TallWall/Windstorm OSB sheathing attached with 8d common (2½" x 0.131") nails

Table 3 – Wall Sheathing Fastening Schedule

Location / Connection	Fastener Schedule
Extended Wall Sheathing to Energy Truss Heel	Face-nailed with seven (7) 8d common (2½" x 0.131")
Wall Sheathing to Vertical Wall Framing (Nailing for shear)	8d common (2½" x 0.131") at 6 inches on center around perimeter, 12 inches on center in the field
Wall Sheathing to Top Plate (Increased nailing for additional uplift load)	8d common (2½" x 0.131") at 4 inches on center along top plate
Wall Sheathing to Bottom Plate (Increased nailing for additional uplift load)	8d common (2½" x 0.131") at 3 inches on center along top plate

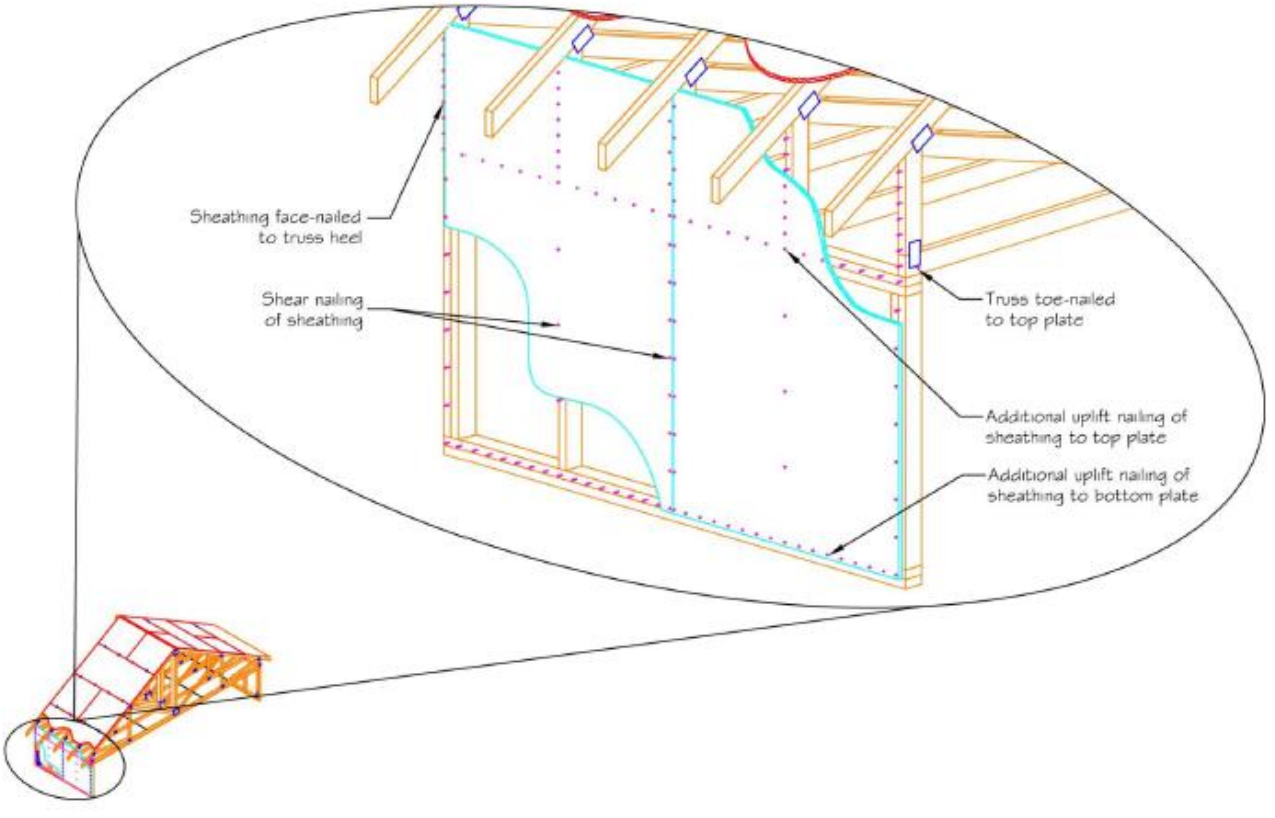

Figure 3 – TallWall/Windstorm OSB sheathing connection detail