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Eliminating Sub-floor Nail Squeaks in Residential Construction



Executive Summary

Sub-floor squeaks are a major problem in production home construction. They account for a major percentage of complaints from new homeowners, and are the top cause of callbacks in new homes for many production home builders. The repair process that results is costly and time consuming for the builder and can damage their reputation and consumer ratings. A major cause of sub-floor squeaks is the nails used to anchor the sub-floor to the joists. The alternative of floor screws offers higher holding power and reduced floor squeaks, but requires more time—and hence cost—to install. Paslode® has developed a fastening system that eliminates subfloor nail squeaks. The fastener bonds with the lumber and holds like a screw while enabling rapid, lower cost installation since it installs as fast as a nail. Intended for production home builders, this white paper describes the sub-floor squeaking problem and its causes, current practices, and the new solution.

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Costs of Sub-Floor Squeaks

Sub-floor squeaks are a major problem in home builders' line of work. A major reason for complaints from new homeowners, these defects are the top cause of callbacks in new homes for many production home builders.



Figure 1. Sub-floor squeaks are a major percentage of customer complaints and callbacks in new residential construction.

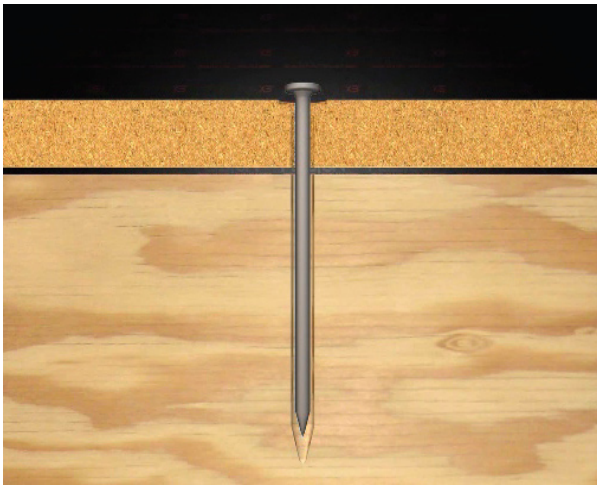


Figure 2. When first installed, moist sub-floors swell and push the nail up, then fail to tighten around the loosened nail when HVAC systems are turned on at move-in, causing sub-floor squeaks.

The repair process that results is costly and time consuming for the builder. This process usually begins with a homeowner call to the customer service department to report the problem. Customer service in turn contacts the service department, at which point a builder service technician becomes involved and schedules a visit with the homeowner. After issuing a work order to their subcontractors, the service technician spends time coordinating repair work with the flooring contractor (carpet, hardwood) and the framing contractor to repair the subfloor. After the repair, the builder then must assess the repair expenses and determine who was at fault and invoice their trades accordingly if applicable. Finally, the builder customer service department records the completed work order. In builder's time and resources alone, this can amount to \$200-\$300 for each occurrence, and this does not account for material costs.

If repaired from the floor below, gypsum board must be removed, and the panels must be re-glued to the joists. Repairing from above the sub-floor involves replacement of flooring such as carpet, tiles, hardwood floors, etc. Therefore squeak repairs can become quite expensive, costing up to a few thousand dollars in some cases. Perhaps more importantly, the overall business implications for the builder include valuable staff time—time that builder personnel could be better spent adding value to the builder operations and focusing on current and future construction projects.

But there is another, hidden, cost to sub-floor squeaks for home builders – a potential adverse impact on their reputation. While a floor squeak may be perceived as quaint in an older home, most homebuyers are upset when the floors in their brand new house squeak. Even if the squeak repair is completed quickly and efficiently, the homeowner suffers from the impression that their new home needed to be repaired soon after they occupied it. This can damage customer satisfaction. And reduced customer satisfaction adversely impacts the builder's JD Power ratings, which can reduce builder revenue.

A hidden cost to sub-floor squeaks for home builders is a potential adverse impact on their reputation.

Causes of Sub-Floor Squeaks

Often, floor squeaks are the fault of hardware used during installation, not the installer. A major cause of sub-floor squeaks is the nails used to

anchor the sub-floor to the joists. The sound of the squeak is the smooth shank of the nail rubbing against the sub-floor panel, which is usually constructed of OSB or plywood. For several possible reasons, the nail becomes loose and rubs against the sub-floor as weight is applied to the floor. The primary reason is the change in moisture content of the lumber from installation to homeowner occupancy. Sub-floor panels often remain at least partially exposed to the elements at construction sites for days or even weeks after their installation. During this period, the panels become moist, either from rain or simply by absorbing moisture from the air. This moisture causes the panels to swell, pushing the nail out of its tight position. Later, when construction is completed and the home is occupied, air conditioning and heating systems dry out the air in the home and dry out the subfloor. In the sub-floor, wood fibers do not solidify around the nail, but instead further retract, which decreases holding power. With the nail now loosened, weight on the floor causes the sub-floor to rub against the loosened nail, causing an audible squeak.

A second cause of sub-floor squeaks is poor application of glue that attaches the sub-floor panel to the joists. Consistent application in real jobsite conditions is difficult, which causes some portions of the panel to not adhere to the joists. Also, failure to install the panel on the joists soon after glue application can reduce the glue's holding power. What's more, glue application on humid, frozen, or dirt covered lumber may compromise the performance of the adhesive. These complexities cause some panels to dislodge from the joist in some cases, contributing to the loosening of nails and subsequent squeaks.

Other causes of sub-floor squeaks include installation of warped joists, nails that miss joists or "shiners," or other jobsite variables. These conditions cause a gap between the sub-floor panel and the joists, which can lead to flex in the sub-floor panel and induce nail squeaks. Shiners occur when the nail missed the joist and is rubbing against the side of the joist, causing a squeak.

Current Practices

Sub-floor installation today typically consists of gluing in combination with either ring shank nails, floor screws, or both (see Table 1). Ring-shank nails are installed quickly and thus keep labor costs down, but their lower holding power coupled with their smoother shank contribute to sub-floor nail squeaks. That is why many builders and installers started using screws to alleviate floor squeaks. Floor screws offer higher holding power and reduced floor squeaks, but require more time – and hence cost – to install. A subfloor installation using collated floor screws can take up to three times longer than when using nails. This translates into additional labor cost, reduced efficiencies, and longer building cycles for the framer and ultimately for the builder.

In many cases, installers use a combination of these fasteners. In these cases, they apply glue to the floor joists, initially secure the panel in place with a few ring shank nails on the edges, and then return later to complete the process with floor screws. For example, the installer may use nails on the perimeter of the panel and screws in the field (the interior of the panel). This two-step approach can compromise the proper adhesion of the glue because the panels are not fully fastened to the joists and they do not make contact with the full length of the joists as the glue sets. Furthermore, this combination approach often requires two passes to secure the panel. In some cases, the builder hires a separate crew to screw down the sub-floor after the framer fastens it initially. This requires the builder to coordinate yet another trade, incur additional costs, and extend the build timeline. More importantly it can still lead to sub-floor squeaks since nails are present in the subfloor assembly.

Current Fasteners	Ring Shank Nails	Floor Screws
Holding power	-	+
Speed of Installation	+	-
Reduced labor cost	+	-
Elimination of fastener induced subfloor squeaks	-	-

Table 1. Advantages and Disadvantages of Current Fasteners Used to Secure Sub-Floors

A New Solution for Sub-Floor Installation

Paslode® has developed a fastening system – an alternative to traditional nails and screws – that eliminates sub-floor nail-induced squeaks. This TetraGRIP™ fastener uses a barbed-helix geometry (see Figure 3) all the way to the head in its shank design. Because the fastener has no smooth surface, it cannot squeak.

At the same time, the fastener has the holding power of a traditional #8 2-inch floor screw. The optimized barbed helix of the shank creates high rotational forces, while minimizing friction.



Figure 3. The barbed helix geometry of the Paslode TetraGrip fastener bonds with the lumber to increase holding power.

This patent-pending design ensures that the fastener rotates into the floor boards and floor joists smoothly as it is driven and does not destroy the lumber. The threads and barbs bond with the lumber to provide superior holding power. By comparison, traditional ring-shank nails bore a hole through the lumber when they are driven, but do not bond effectively with the lumber.

In addition, this fastener drives like a nail, enabling rapid, low labor cost installation. TetraGRIP works in a pneumatic coil tool that performs like a framing nailer. The fasteners are held in a high-capacity magazine and are installed three times faster than a screw. The fastener and tool work together to form Paslode's new sub-floor fastening system.

The result is a new category of fastener that eliminates nail-induced subfloor squeaks, drives like a nail, and holds like a screw.

TetraGRIP is manufactured with ITW WERCS™ technology, which uses innovative, proprietary die processes to manufacture fasteners with special thread patterns.

Testing of the New Fastener

The fastener's unique barbed helix-to-wood engagement creates high holding power that rivals that of a floor screw (see Figure 4).

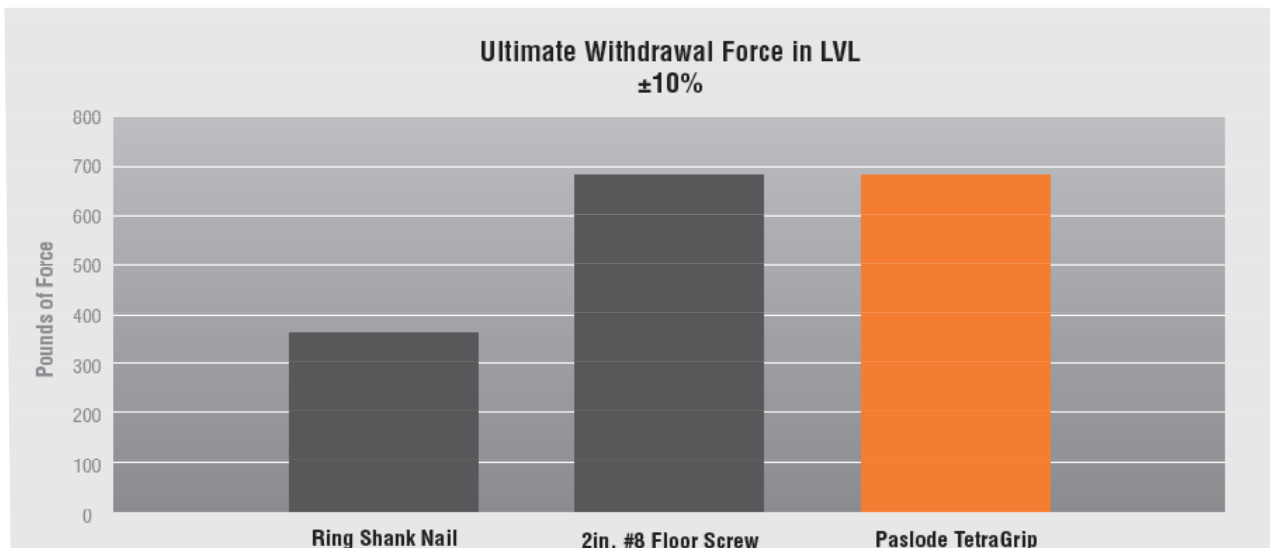


Figure 4. Internal testing of the Paslode sub-floor fastener in laminated veneer lumber (LVL) shows its superior holding power compared to a ring shank nail, and comparable holding power to a floor screw.

While the holding power of a nail decreases as the moisture content decreases (i.e., as the lumber is dried by the home's HVAC system), the holding power of the Paslode TetraGRIP fastener increases as moisture content decreases. In this way, the Paslode fastener behaves like a screw (see Figure 5).

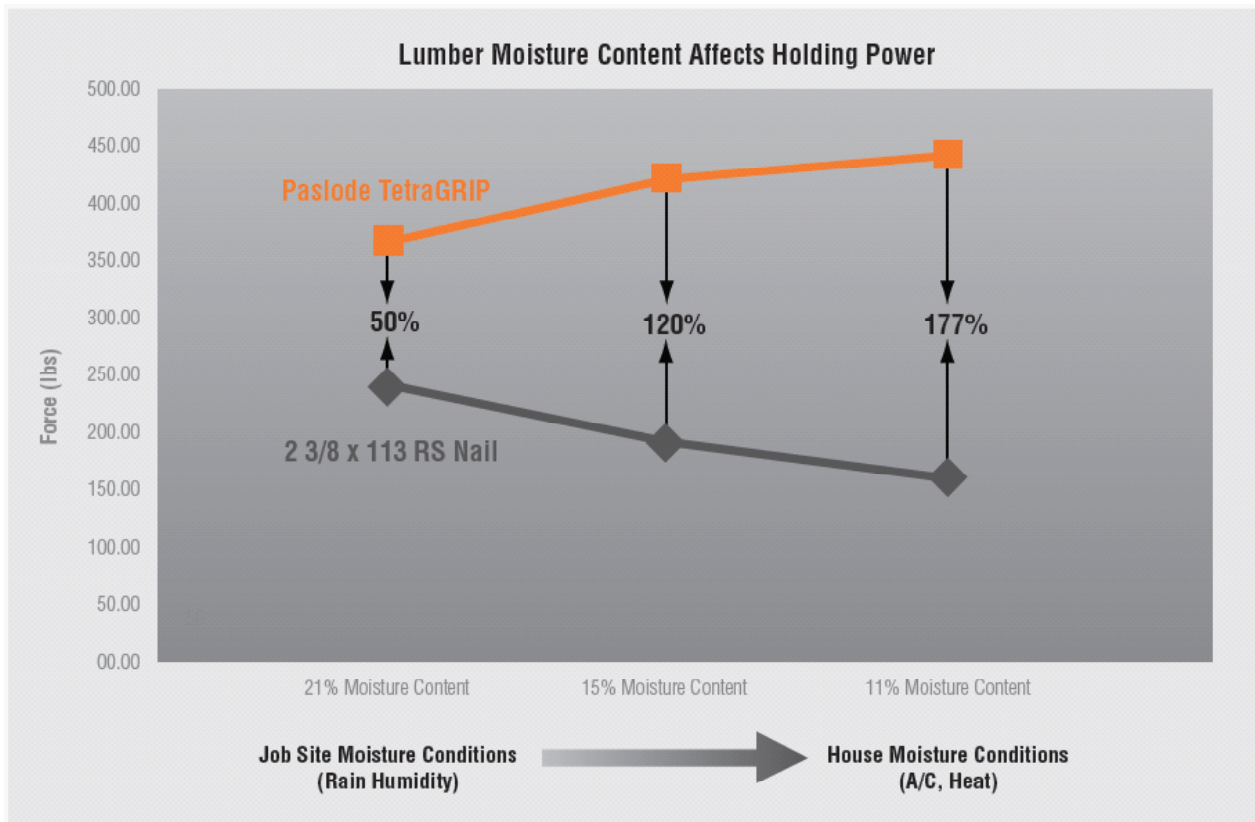


Figure 5. Internal testing confirms that the Paslode TetraGRIP fastener increases its holding power as moisture content decreases (like a screw, but unlike a nail).

The new Paslode fastener is ICC-ES recognized under ESR 3071.

The new Paslode fastener complies with all applicable standards. The fastener is International Code Council (ICC) recognized under ESR 3071 and complies with American Society for Testing and Materials (ASTM) standard F1667.

The TetraGRIP fastening system requires no special handling or training, nor does it pose any climatic restrictions. The fastening tool operates in similar fashion to existing pneumatic air nailers that construction crews are accustomed to using.

Business Benefits of the New Sub-floor Fastener System

In summary, the new Paslode fastener provides the advantages of floor screws without their disadvantages (see Table 2).

Fasteners	Paslode TetraGRIP	Floor Screws	Ring Shank Nails
Holding power	+	+	-
Speed of installation	+	-	+
Reduced labor cost	+	-	+
Elimination of fastener induced subfloor squeaks	+	-	-

Table 2. The new Paslode fastener combines the holding power of screws with the speed of installation and low labor cost of nails while eliminating squeaks.

Benefits of the new system include consistent high quality in sub-floor installation and hence, fewer call backs related to floor squeaks. The system promotes efficiencies by enabling fast reliable installation, which results in high productivity on the job site, less rework and repair,

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and better use of resources. The fastening system helps reduce overhead and personnel costs – resources that are already stretched to the limit at most builders. The fewer call backs boosts customer satisfaction, which can increase JD Powers ratings and enhance revenue.

For More Information

To learn more about this system call 1-800-669-5228.

About Paslode

Paslode, a division of Illinois Tool Works Inc., is a leading manufacturer of cordless and pneumatic nailers, staplers, and fasteners. The company's products are widely used by professional contractors and carpenters for framing, sheathing, trim and finish applications, fencing, floor and roof decking, siding, and insulation. For more information, visit **Paslode.com**.

About Illinois Tool Works (ITW)

With \$13.9 billion in 2009 revenues, ITW is a multinational manufacturer of a diversified range of value-adding and short lead-time industrial products and equipment. The Company consists of approximately 840 business units in 57 countries and employs approximately 59,000 people. More information is available at **www.itw.com**.



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