Q&A

Garage Slab Drainage

Q. *How should a garage slab be sloped for drainage toward the overhead door? At 1/4 inch per foot on a 24x26-foot foundation, the height difference from front to back would be more than 6 inches. Do I need to grade the sand and gravel sub-base at the same slope so the slab can have a uniform 4-inch thickness?*

A. *Rocky Geans, president of L.L. Geans Construction Co. in South Bend, Ind., and member of the board of directors for the American Society of Concrete Contractors, responds:* A garage floor does require a slope for drainage so water won't pool on the floor, and 1/4 inch in a foot is typical. But if you do a good tight screed and finish job, 3/16 inch per foot will do. And yes, the gravel sub-base should be graded to the same slope as you intend for the slab surface.

The bigger question is, where do you drain the water to? If you are located in a freeze-thaw climate such as we have here in South Bend, drainage toward the overhead door could be a problem.

When snowmelt or water from washing the car seeps under the door and meets 25°F or colder temperatures, it freezes. Frequent seepage can repeatedly melt and refreeze the existing ice, setting up a continual freeze-thaw cycle that can cause the surface to scale off early in the driveway's service life. One solution is to pitch the slab to the center of the garage and provide drainage into a dry well or, if the elevation allows, to an exterior drain.

But even with drainage through the overhead doorway, many concrete driveways and aprons hold up well under freeze-thaw conditions. The keys are to make sure you have air entrainment in the mix, seal the slab and driveway when new, then instruct the homeowner to maintain it properly.

We seal new driveways and slabs with Kure-N-Seal 30 from Sonneborn (www.chemrex.com/sonneborn/). The frequency of resealing depends on wear patterns for a particular driveway. Basically, as soon as the sealer has worn off, it's time to apply a new coat. A good test is simply to wait until the drive is perfectly dry and apply a few separate drops of water on the drive using an eyedropper. If the drops soak in, you need to seal the surface; if they bead up, you're okay.

If you do install the drain in the center of the garage, be sure to check your local and state building codes. Some may allow a dry well, while others may require connecting to an exterior drain.

Green Board vs. Standard Drywall

Q. *How is "green board" different from regular drywall? Where is it supposed to be used, and what are its limitations?*

A. *Mike Lynn of United States Gypsum Company's Research and Technology Center responds:* Green board, so called because of its green facing paper, is a water-resistant gypsum panel intended as a base for the application of ceramic tile and plastic-faced wall panels. Its face and back paper are chemically treated to combat moisture penetration, while the gypsum core utilizes a special moisture-resistant composition. Panels are available in 1/2-inch and 5/8-inch thicknesses, as well as in fire-resistant formulations. You can finish green board just as you do traditional wallboard, but when you use it on ceilings, space the framing no farther apart than 12 inches o.c. for 1/2-inch board or 16 inches o.c. for 5/8-inch board.

Green board is ideal for humid areas such as bathrooms, powder rooms, kitchens, and utility rooms. It is not intended for use in areas subject to frequent water exposure, such as shower and tub surrounds, indoor pools, and gang showers. For those wetter areas, choose a cement board product such as Durock, whose aggregated Portland cement core will not deteriorate when wet. Cement board is an excellent substrate for ceramic tile, slate, and quarry tile and can be used on both walls and floors.

Keeping Attics Cool

Q. *A two-story house I'm working on has a zoned air-conditioning system with ductwork running through the hot attic, and the A/C can't keep the upstairs zone cool on hot, sunny days. What's the best way to cool that attic space down — add gable vents to the existing soffit and ridge vents setup, insulate between the rafters, or apply a radiant barrier foil under the rafters?*

A. *Danny Parker, research scientist at the Florida Solar Energy Center, responds:* We've done instrumented studies of all those options in Florida test houses and test cells, as well as a fourth option you didn't mention: a reflective roof (white tile or white metal, for instance). Here's how the choices compare:

Insulated roof deck. Insulation between the rafters (roof-deck insulation), often advocated without attic ventilation, is an effective way to control heat transfer at the roof itself and to get the duct system into a more hospitable environment. We've measured cooling energy savings of about 9% overall when compared to a standard ventilated attic with an identical roofing system.

But since all the heat transfer is halted at the roof line, it is important to try to control the roof surface temperature to substantially reduce cooling loads (typically by choosing lighter tile or more reflective metal or white shingle roofing systems). With dark shingles, our measurements indicate that insulating the deck will elevate peak shingle temperatures by about 7°F and increase peak decking temperatures by about 20°F.

Although that temperature rise is less than the difference one will see geographically from, say, Detroit to Las Vegas, shingle manufacturers may not warranty their products when installed that way. And remember, those who have studied insulated unvented roof-deck systems do not recommend their use in climate zones where the average monthly outdoor air temperature is lower than 45°F, because of the potential for condensation within the roofing system.

Ventilation. Adding additional attic ventilation will reduce the upstairs cooling load a bit but is likely the least effective option, since the incoming ventilation air is hottest just when you need cooling of the attic. Our experience suggests that adding attic ventilation may produce a 5% reduction to the cooling load. Be aware, too, that attic ventilation can be a double-edged sword. In humid locations during nighttime, it can make the attic more humid. Finally, using powered attic vent fans can further decrease attic temperatures, but the fans typically consume more electricity (300 to 500 watts) than they save on reduced air-conditioning power.

Radiant barrier insulation. A foil radiant barrier material stapled under the rafters can be effective in a case such as yours. The radiant foil's not too expensive (maybe $500 for materials, depending on the roof), and we have measured a 26% reduction in heat flux with the application of radiant foil below a dark-shingled roof. You can increase ventilation at the same time: The heat flux reduction was 36% when we increased the attic ventilation ratio from 1/300 to 1/150 in addition to the foil retrofit. The greatest benefit from a radiant barrier comes when you most need it, with a 16% reduction in A/C demand during the hottest hours from the radiant barrier alone. Again, watch out for excessive ventilation in humid climates, where it can lead to condensation problems on duct systems.

Reflective roof. In new construction, or if you are contemplating a reroof anyway, your best bang for the buck is to install a more reflective roofing system than dark shingles. Within any category (asphalt, metal, or tile), a lighter color can substantially reduce cooling loads with no price penalty. Compared to dark shingles, white-colored asphalt shingles give a modest reduction in attic heat and about a 4% reduction in space cooling. However, a highly reflective light-colored tile or metal roof can cut the heat flux through the roof dramatically. We have measured a greater than 30% reduction to the space cooling load during the hottest afternoons with reflective roofing systems.

Tiling Over Old Linoleum

Q. *Is it okay to tile over an old linoleum floor? I'm concerned that the tiles might contain asbestos.*

A. *Tile consultant Michael Byrne responds:* There may be advantages to tiling over some existing flooring materials that contain asbestos, provided that the existing structure and its subflooring can be identified and confirmed as adequate for the additional weight of a tile installation. More and more communities are giving the okay to covering existing asbestos-bearing flooring materials with ceramic or stone tiles, provided the structure is up to the task of bearing the weight. If so, the common practice is to install 1/4-inch-thick tile backerboards over the asbestos material, perhaps add awaterproofing–crack isolation system over the backerboard, then install the tiles over the boards with latex thinset mortar and a grid of movement joints filled with a resilient sealant instead of grout. The movement joints should extend from the top surface of the tile to the bottom of the underlayment, but they should not extend down into, or penetrate, the suspect material. The width, number, and placement of movement joints (which are necessary in every tile installation, without exception) are too complicated for a brief explanation, but the TCA *Handbook for Ceramic Tile Installation* contains a thorough discussion, under Detail EF171 (Tile Council of America, 864/646-8453, www.tileusa.com).

Are Hidden Deck Fasteners Strong Enough?

Q. *I was hoping someone could shed some light on EB-TY. I use this product on 80% of the decks I build, and many are one or more stories high. I also live in a heavy snow area. The clips in that system hold the decking to the framing with pressure, not with mechanical fasteners, and I'm concerned that the detail may not be strong enough. I have been taking extra steps by letting cross bracing into the joist system. Am I wasting my time?*

A. *Frank Woeste, P.E., professor of wood construction and engineering at Virginia Tech University in Blacksburg, responds:* You certainly are not wasting your time to be cautious in building a deck. Like roofs, decks don't experience their full design load (such as a heavy snowfall or a large party) every day or every year. But you must build them to handle that extreme design load when it does occur, because a failure can be catastrophic (see "Deck Disasters Spotlight Faulty Connections," *Notebook*, 9/02).

I don't know of any engineering numbers on the type of fasteners you're talking about, but they may not be designed to resist the forces a deck can experience. And we haven't had 40 years of experience with the product to learn from, as we have with traditional 8d or 10d threaded nails that would typically be used with 5/4 decking boards. It's safest in this case to disregard any bracing effect of the decking and fasteners and build the structure to stand up without them.

However, the diagonal let-in bracing you mention, whether it's installed within the floor frame or between the posts and the deck framing, probably is not going to do the job. There are two important issues to consider: twisting of the deck joists and racking of the deck in plane. Even with the joists secured against any rotation at each end, they'll tend to twist within the span when a load is placed on top if they're not restrained somehow. Assuming no help from the decking, you'd be wise to install PT solid blocking at 2 feet on-center. That probably sounds like a lot to most carpenters, but that spacing is borne out by experience with long-span truss chords that are held with 2x4 purlins at 2 feet on-center. If you wanted to space the blocking farther apart, you'd need engineering for the specific span, joist spacing, and lumber size, grade, and species.

As for racking, one solution when earthquake loads aren't involved is to firmly attach the deck to the house and to its carrying posts (which should be minimum 6x6 posts treated for a structural application in ground contact) and to embed the posts firmly into the earth at least $3\frac{1}{2}$ feet deep. Then the supports can hold the deck in place without the need for racking resistance from the deck boards in the plane of the deck itself. However, diagonal bracing of the posts might be required to "stiffen" the system, depending on deck height, post size, and deck size.

Got a question?

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