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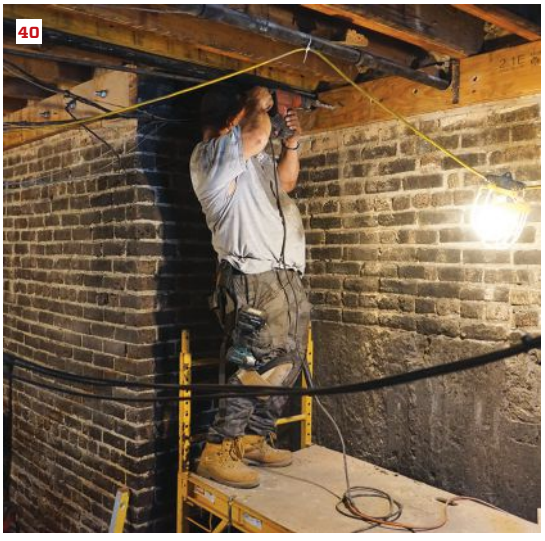

On the cover: Jake Lewandowski and Ernesto Bonilla wrestle a steel beam section into position in a three-story building in the Chicago area. See the story on page 40. Photo by Great Lakes Builders.

FEATURES

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CUTTING HOLES IN BEAMS

A phone call from John Emerson, a long-time *JLC* subscriber in Portsmith, N.H., alerted us to an error in the *Training the Trades* article "Beam Stress and Strain: A Lesson in Statics" (Sep/Oct 2022). The original drawing suggested you shouldn't cut holes along the centerline in the middle third of the length of a beam. In fact, this is an area where shear stresses are lowest and might be the safest place of all to make holes. (Many engineered beam manufacturers even limit holes to this area alone.) What's critical is that the holes be located within the middle third of the beam's depth. The outer edges within the middle third of the beam's length are where compression and tension stresses are highest and where failure from holes and notches is the greatest. The revised illustration, below, clarifies these details, highlighting in yellow the areas of the beam where holes should not be made. Please note this includes the areas at the ends of the beam in the middle third of the beam's depth, where shear stresses are highest.

EV-CHARGER WIRING

An email from Bill Ruck of San Francisco alerted us to another error: In a response to a reader's question about electric-vehicle (EV) chargers (*Q&A*, Nov/Dec 2022), we made reference to the "National Electrical Manufacturers Association (NEMA) specifications for three-phase, 220-volt receptacles," implying that three-phase power is required for EV chargers. NEMA provides specifications on plug types for all receptacles, including those for both single- and three-phase wiring, and for all voltage ratings. Single-phase electrical service is common in homes, and three-phase more common to commercial and industrial electrical systems. The difference is that three-phase systems can deliver power faster. Many Level 2 EV chargers can support both single- and three-phase installations, but three-phase is not required.

A related mistake that we uncovered: The author says he used a "6-gauge, 4-wire cable" to wire the 14-50 receptacle shown in the photo in the article. This error was introduced by our editors, not the author. He used a 6/3 NM-B Romex cable for a 14-50 receptacle that could accept the 4-prong plug on the customer's Gen-1 Tesla mobile charger. This 6/3 cable has a black, a red, and a white wire, as well as an uninsulated ground wire. For cable names, the ground wire, which is found in most modern electrical cables, is not counted.

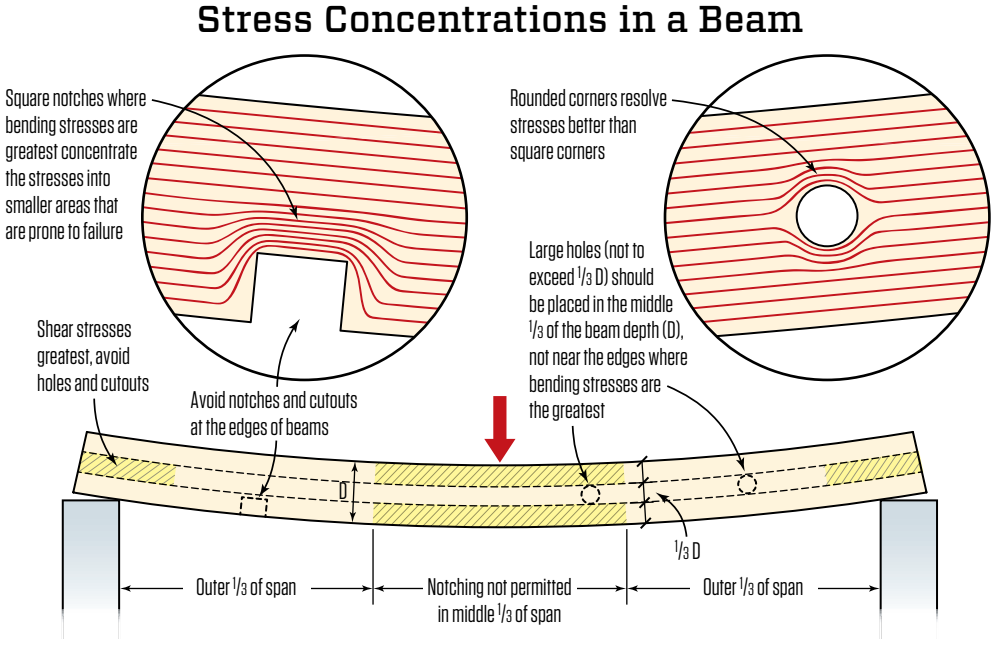

Illustration by Tim Healey

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BY JLC STAFF

Creating an In-House Training Program

In a previous article, "How Can Building Professionals Improve Training?" (Nov/Dec 2021), we surmised that when it comes to training employees, "success will likely come from robust in-house programs." The story was based on responses to an online survey of the *JLC* audience on how to narrow the skilled-trades gap facing our industry. A reply to one survey question in particular caught our attention; when asked, "Does your company have a formal, structured training program for either new hires or existing crew members?," 90% of respondents responded, "No."

This past fall, *JLC* hit the road to visit a company in the 10% outlier "yes" group, DBS Remodel in Poughkeepsie, N.Y. In search of information on how they approach improving their skills training, we met with DBS president Brian Altmann; operations manager Bob Lutz; operations support manager Rich Dutra; project lead manager Mike Whalen; and project lead manager Rob Wheeler. They graciously took time from their busy schedules to sit down for a interview at their office.

After years of striving to recruit, train, and retain new employees, DBS rebuilt its training process, which now features a blend of in-house video training, monitoring the progress of the learners, and getting employee feedback. The following is a condensed version of our conversation.

What made you reassess your approach to training and hiring?

Brian Altmann: Well, for us, we're just not finding kids coming out of trade schools with acceptable skills. The tech programs at the local high school level are not producing qualified candidates. So, we decided a couple of years ago to look into training on our own. We still attend career fairs at local high schools trying to recruit students as well, but we haven't had much luck in this pursuit.

Mike Whalen: There's just so much to know about remodeling. That's the challenge. I think trade schools have their own challenges with what they can do with their programs, whether it's with the curriculum, funding, or even having state-of-art tools. So, what we once viewed as a potential "feeder" of talent to our company has slightly shifted to where we're trying to bolster their programs; we're now part of an advisory board at our local tech school.

Rich Dutra: I think that's why trade schools and job fairs have not been great recruitment options for us. It takes time to learn what we do.

Rob Wheeler: We have people coming in with zero experience for laborer positions. For lead carpenters or project managers, we look for someone who owns their own company and has the organizational skills to run jobs but doesn't want to do the paperwork or the business side anymore.

Photos by Tim Healey

Operations support manager Rich Dutra (middle) and project lead managers Mike Whalen (background) and Rob Wheeler (foreground) review the results of an employee's answers to a training video. The 360Learning LMS (learning management system) software has a summation sheet, which displays analytics and results data.

Does your company only do remodeling work?

Bob Lutz: Yes, it's all remodeling. We don't do any new construction or any commercial work. It's all kitchens, basements, bathrooms, additions, and decking. Our average job is four to six weeks. On a big job, we may be on site three to six months. We don't do a lot of handyman-type projects, so our range is $10,000- to $500,000-sized projects.

How big is your company?

BA: We have 22 employees. In the field, we have eight lead carpenters out there now, typically running seven to 10 jobs at any given time, two secondary-tier carpenters, and two laborers. In the office, we have 10 employees, including Bob and myself.

You have more experienced field personnel than entry-level ones. Are you having difficulty finding new entry-level talent?

BA: Yes. You can't always find the right fit when it comes to new hires. Possessing soft skills, in terms of dealing with client expectations, is equally important to us as having technical knowledge. A lot of our training is technical, but in this company, there's just as much, if not more, training on customer service. Training on emotional intelligence, being able to coach each other and our trade partners. We try to improve everything we do all the time. One of our core values is growth. Our company motto is "cleanliness, politeness, and trust."

"The biggest thing was to organize the process, because everyone was kind of training their own way. We had to create a unified voice and commit to the training mission."

You recently revamped your training regimen. What's different now from past years?

MW: Years ago, we started with lead carpenter's training. The lead carpenters would meet and talk about how we're training on the job with new hires, which we still do. Then, as Brian mentioned, we weren't finding the right fit when it comes to new hires: kids with technical skills for entry-level positions or experienced carpenters with soft skills. So, we had to take the initiative to train in-house. Rich reorganized our training around LMS software—learning management system software—so it's much more structured. We refer to our training 2.0 efforts as "DBS University."

BA: There's "Bob's Bootcamp," too, where Bob holds sessions with new employees, ones new to construction. He'll pick a topic and spend an hour talking about it; it could be about kitchens, bathrooms, or installing windows.

RD: Today, it was paperwork because that became a hot topic in our company recently, so we moved that to a priority. He spent a lot of time with two employees going over paperwork, how important that is, and how it affects the bottom line.

MW: Training used to take a lot of our time as leads, and because we were running our jobs, too, we weren't always effective teachers. Now, everyone has a different part to play in it. Rob is doing a lot of the hands-on training with the new employees down at the shop, Rich with the LMS programs, and Bob with "Bob's Bootcamp." The biggest thing was to organize the process, because everyone was kind of training their own way. We had to create a unified voice and commit to the training mission.

So there's "Bob's Bootcamp" and "DBS University." Tell us about the LMS software you use?

RD: We use 360Learning and MT Copeland learning management system software in tandem. Initially, we produced a few in-house training videos without any monitoring or testing capabilities. A little more than a year ago, I started researching different LMS platforms online. Some were $500 a month, $600 a month, $1,000 dollars a month, which I knew was too much of an investment for us. I eventually came across 360Learning and found it to be a good value. It gave us time to develop our training content without breaking the bank at the same time.

MW: With the MT Copeland LMS, we kind of stumbled on it at JLC Live last year. They have a wealth of great video content related to the trades. We visited their booth at the show and thought, "Wow, we were thinking about producing all these video topics in house, but they had already put them together." It would've taken a lot of time for us to produce the video content. So, it was a no-brainer. We could incorporate our own DBS-specific training videos with MT Copeland's more technical ones.

BL: We would have spent thousands of dollars putting together our own videos.

You said you use 360Learning and MT Copeland in tandem. How does that work?

RD: We think the two are a great combo. MT Coleman has done a great job producing videos on a wide range of construction topics, like basic construction math, blueprint reading, and framing roofs. On the 360Learning side, we've produced and uploaded 15 or so jobsite-related videos covering everything from tape measure tricks to protecting the jobsite.

The 360Learning LMS is essentially the "brains" of our training; it's where we monitor and evaluate the test taker's results—or "learners" as we refer to them. I typically organize the test questions—which appear at the end of the videos—and monitor the results with the other leads. Once our employees take our tests on 360Learning, I can track their progress. For instance, if one of the learners said they scored a 50 on a test and it took them four minutes to complete, I can verify the results, see what questions they got right or wrong. There's also a summation sheet displaying the analytics and results data, which you can break down in all sorts of ways.

Project lead manager Mike Whalen and marketing director Andalee Powers review a recently filmed training video "Trucks/Trailers & DOT Safety." The Swiss army knife of DBS Remodel, Andalee produces all in-house videos, which are filmed with a smartphone. Crew members are miked up with Røde wireless mics (rode.com), and the video footage is edited in Final Cut Pro. Some tests—for example, on how to install a ladder properly—require learners to shoot video of themselves, which they submit to the leads for their critique.

Another great thing about this platform is it encourages feedback from the learner. A learner can leave comments saying, "This isn't even what we do anymore in the field" or that something is spelled wrong. So, the feedback is superimportant; you have the ability to constantly modify and bring a test up to date in 360Learning.

With the MT Copeland videos, the process is a little different. I review the MT Copeland videos first, then prepare a test on the 360Learning platform based on their material.

Are some training topics more important than others?

RD: Well, all our in-house videos are important. Company courses, such as "Orientation," "Communication," and "BuilderTrend-Overview," are important. Beginner courses for field personnel, such as "Safety/OSHA-10 Training" and "Cleanliness/Home Protection," are important. Intermediate and advanced courses for field personnel, such as "Jobsite Efficiency/Slippage," "Job Scope and Contract Comprehension," and "Coaching/Leadership" are important as well. We've also made—or plan to make—videos geared to our office staff and sales team.

With the MT Copeland courses, there are categories that are more important to us than others. We've found their videos such as "How to Read Blueprints," Intro to Wood Materials," "Construction Math," and "How to Build a Freestanding Deck"—which range from beginner to advanced—to be comprehensive content, taught by great instructors. But, courses related to the subtrades, like plumbing and HVAC, we don't necessarily need our employees to know.

BA: Yes. Video courses like "How To Start a Painting Company" we don't need. That said, our employees should know subtrade terminology and be aware that if they see a plumber or HVAC sub starting to cut into a structural beam, that's probably a bad idea.

You mentioned you plan to make videos. Do you plan out a course list? Is there some sort of syllabus you work from?

RD: Collectively, we meet and choose which videos to produce or review. We have a course list with produced videos and ones we want to create. The list is organized by field personnel and office staff, skill level, and in-house 360Learning courses and MT Copeland ones.

Are the courses assigned like homework assignments?

RD: No, we usually have employees come into the office on rainy days or when we have a hole in the schedule to review the course material while they're on the clock. We happen to have a new employee, a laborer, staying home today. He's going to take a course on fasteners and adhesives.

RW: It's an entry-level course MT Copeland offers. They have other general knowledge classes, such as "Intro to Hand Tools" and "Intro to Power Tools." We're trying to build a knowledge base with him, so when he does go on site and we say, "Go get the PL 400," he knows what it is, what it does, and how to apply it. It's a three- to four-hour course.

RD: We think of our paying employees to take the courses as an investment.

MW: As far as employees taking courses at home, which isn't the norm, we can check to see if they're just running the videos and then going in the other room. Also, there are question-and-answer portions after the videos to see if they understood the information.

How do you balance training time vs. field production?

RD: It's a bit of a paradox. We've put a lot of time and energy into thinking about how to reconcile the two. Even taking the time to create videos can cut into field production, because everything has got to stop in order to shoot the video.

RW: Getting the guys in here to train can be a struggle. When you pull them out of the field, they're not producing. This was one of our biggest issues starting out. We just had to discipline ourselves and accept that taking time out to train new hires—even ourselves—is now part of the process.

RD: Portability can help with this issue. The other great thing with 360Learning is that it has an app, which allows for a portable learning experience. Our videos are typically broken up into 10- to 20-minute segments. So, if the learner has 10 to 20 minutes on his or her hands, say they're killing time in a doctor's waiting room, they could review a video segment there.

BA: As an aside, the app also allows our experienced personnel to brush up on their skills on site. For example, when our lead carpenters have to conduct a preconstruction meeting, it's not a bad idea for them to watch our in-house video on how to conduct preconstruction meetings as a refresher just before meeting the clients.

Do you have any success stories where the video training has paid off?

MW: We have Andrew; he's already transitioning to lead carpenter. He's been here a couple of years, right?

BL: Yes. Andrew's in his late 20s, and he was interested in our company. He tried other jobs, but he liked working with his hands. He also had some construction-related experience but not a ton. We ended up hiring him two years ago.

Even before our new training initiative began, we were being a lot more aggressive about the way we were going to approach somebody's employment. We deployed the concept of a career ladder with the goal of trying to escalate his ability to learn and to be able to be a lead carpenter. In a short amount of time, he demonstrated that he can deliver all the things that our company represents. He has the interest and the skill set, which both seem to be growing. And, in a short amount of time, he should be running his own jobs, which will require training on the business side of things—like understanding how to read job scopes, blueprints, and payment schedules. Also, how to conduct preconstruction meetings, working with office staff, understanding what their roles are and how they might help with, say, doing a special order.

RD: Andrew was sort of our guinea pig with the new video training. He was fairly new to construction, but he did have a little bit of experience, like Bob said. He came from the restaurant business. So, it was like, how can we help elevate him to the next level? He's just a very smart kid and a quick learner. And the video training helped.

MW: The video courses have also been great for seasoned guys like myself. They allow us to brush up on a few things, even learn some new techniques and short cuts. For instance, I watched an MT Copeland course on complex roofing, and it helped me out on a recent job. It gets to the point where you've been remodeling kitchens and bathrooms for so long, you have to refresh your memory on things like roof framing, though it comes back quickly.

You mentioned you deployed a "career ladder." How does that work?

RD: Having a defined career ladder is important and we're finding that the video training helps. It's important in terms of employee retention, too. It's so hard to find good help right now. Employees will stay if you train them and give them a clear path to advance themselves. I imagine a lot of business owners like to be vague about promotions and raises. We like to be upfront about this, and we see the course training and testing helping us retain good employees. Also, everybody learns at a different pace. So, some people might be ready to advance in a year, while others might take two or three years.

"The video courses have also been great for seasoned guys like myself. They allow us to brush up on a few things, even learn some new techniques and short cuts."

RW: Before training, it was hard to keep track of and quantify what employees were learning. They'd rotate from my job, to Mike's job, to other leads' jobs; they'd spend a day or two on each person's job. Then, after a year or so, they come and ask, "Where do I stand in this company?" We'd ask, "Well, what have you learned?" It was hard to track what they learned because they moved around so much, and we all did things a little differently. So, the new LMS gives us an organized way of doing that. Especially with Bob's Bootcamp training every week and the 360Learning's tracking, it's easier to see what they've learned over the past year.

BL: The training also allows us to hold employees more accountable—us, too. You can't discipline somebody unless you've provided proper training. Like I told the employees in my Bootcamp session on paperwork this morning, you may be doing things wrong out in the field, and we really can't discipline you, because it's our fault for not teaching you the right way to do it. So, the goal is to provide everybody with the same path. In the end, it's up to them to apply themselves and improve.

Any closing thoughts?

MW: Something I've noticed recently. The parents of high-school-aged kids at recent trade fairs we've attended are keenly interested in our in-house training program. They stayed at our booth a little longer and leaned in more trying to overhear our conversations with other parents. One parent—who was in IT—says he never thought a remodeling company would have its own in-house training program. He thanked us for taking the time to talk to him. The training shows we take our profession seriously and that we'll invest in their child's economic well-being, if hired.

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Q We have had a number of customers ask for energy recovery ventilation (ERV) in their existing homes. Can we use the existing furnace ductwork? If not, what size and type of ducts can be used?

A *M. Walker of Positive Energy, an MEP engineering services firm based in Austin, Texas, responds:* The short answer is yes, you can use the ductwork for the furnace, but you may not want to. The full answer has a number of annoying and important caveats and considerations. Let's take a moment to remember the goal: Adding ventilation to a building is all about introducing fresh air for improved indoor air quality. The strategies you use to implement such a system should align with the goal of providing healthy indoor air in the building for people to breathe. If you can manage to retrofit this into an existing system for little cost, you're very lucky.

It is also crucial that the hygrothermal gradient—meaning how hot/humid it is on either side of the ERV core—be considered in your approach. An ERV will not effectively exchange enthalpy if there is not a dry/cool air mass on one side of the core media. In humid climates, this means you'll need a dedicated dehumidifier to handle latent load, especially in shoulder seasons where there isn't much dry-bulb load to deal with. Beyond the obvious implications for poor indoor air quality and material durability, I'll explain why else this is important later.

BEST OVERALL STRATEGY

The best distribution strategy for a balanced ventilation system with enthalpy (heat and moisture) recovery (such as an ERV) is an independently dedicated duct system that meets the equipment manufacturer's installation requirements. This setup allows you to leverage efficiencies of the ventilation device's designed fan performance, ensure ventilation is delivered to every room, and control locations from which your system returns. If you're trying to be careful about how much new ductwork you're adding, focus on getting fresh air supply in bedrooms and living spaces (den, kitchen, and such).

HOW BIG ARE VENTILATION DUCTS

As far as duct sizing, generally ERV/HRV collars are designed for standard 5- or 4-inch ducts. You may find it difficult to reduce the size from these diameters for several reasons (supply-house inventory, product availability for the American market, among others). You could technically reduce the standard-diameter ERV/HRV ducts down to 3 inches and run those in a wall cavity, but you have to be careful not to undersize the ductwork. There are ERV/HRV manufacturers who make flexible ductwork at this smaller scale and have some pretty slick multiport terminal devices. If you're not a mechanical engineer with calculations fresh in hand, I recommend leaning on the manufacturer for support.

WHEN NEW DUCTS WON'T WORK, USE EXISTING ONES

New ductwork is not always an option in retrofit situations, and it is possible to leverage existing ductwork as long as you're careful about how new equipment will impact the overall system performance. Positive Energy's general approach to retroactively adding an ERV/HRV into an existing system is to supply ventilation air into the air handler's return plenum (a caveat is that you'll need to move a return-air temperature sensor upstream).

Most ERVs like this one (upper piece of equipment) have ports for standard 4- or 5-inch ductwork. Note that this system includes the indoor coil (lower piece) for a dedicated dehumidifier, which will be needed in most locations to address latent loads.

Photo: Tom Dugan

Generally, ERV/HRVs aren't moving a tremendous volume of air (50 to 100 cfm is common), so adding this volume into an HVAC system's return doesn't necessarily cause fan-to-fan issues or significantly increase system pressure. However, to deliver that air to the existing diffusers, you'll need to rely on the air handler's fan, which is much larger than an ERV/HRV fan and will use more energy even when you don't need heating/cooling. There is plenty of nuance we could get into regarding operational strategies in this configuration that can greatly impact energy use, but that's beyond the scope of this article. You'll also need to figure out where you're going to get return air from for the ventilation system and ideally return from foul-smelling areas like bathrooms and the kitchen. This is where the challenges of coordinating with other trades really kick in.

Remember the dehumidifier consideration from earlier? If you need a dedicated dehumidifier (and in most places, you probably do) and are trying to leverage existing ductwork for both the humidity control and the ventilation, it is crucial to understand the pressure that will be created in the system. Adding too much pressure to a duct system will prevent it from delivering the needed airflows to the terminal devices (registers) and can cause serious comfort issues, among other performance deficiencies.

There are other potential cost-saving strategies. Leaving existing in-line bathroom fans in place may be a convenient way to repurpose existing opportunities for an ERV/HRV return where foul-smelling and high-humidity events regularly occur (that's the stuff we want to get rid of the quickest) if you can intercept that exhaust ductwork. Obviously, this is not an easy thing to do if you're up against spatial constraints with inaccessible existing ductwork. If you're clever about it, decommissioned flues may also be repurposed for ERV/HRV exhaust out of the building, but please be discerning about their condition before doing so. Again, refer to the ERV/HRV manufacturer specifications for specific details.

IT'S ABOUT HEALTH

Ventilation is a necessary function of buildings and can make a tremendous impact on health outcomes in the spaces where we spend time. Ventilation is crucial to good indoor air quality. When buildings are constructed with more airtight assemblies, we need to reliably introduce outdoor air—filtered and within a reasonable temperature and humidity range—via mechanical means, and we want to exhaust old, fouled air. Compared with the old method of random ventilation or exhaust-only, this strategy adds cost and requires architectural accommodation. It's unfortunate, but most often, it'll be costly and inconvenient to retrofit buildings with existing equipment that wasn't originally designed to meet our new goals. We can't walk into the next 50 years of construction with the same budget expectations and practices that existed in the previous half-century. As our knowledge of building performance evolves with research, especially health research, so too should our approach to every aspect of creating new living space.

Q A few years ago, I used Type 304 stainless steel trim screws to face-fasten composite decking to pressure treated framing for a new back porch. My clients reported that the screws had rusted after one season, during which deicing salts were used on the deck (we work in the upper Midwest). We replaced the fasteners with Type 316 stainless-steel screws from the same manufacturer, and the same thing happened the next season. Is this typical for stainless steel, or is something amiss with the manufacturer's version of "stainless steel"?

A *Foster Lyons, an engineer and building-science consultant, responds:* If the fasteners are truly rusty, they aren't stainless steel. If they are just stained (dark), or streaking a dark stain, that's to be expected in the presence of salt. My guess is that is what you are seeing—stain, not rust.

Here's the thing with stainless steel: It's stain *less*, not *never*-stain steel. The 304 and 316 alloys of steel are known to stain in the presence of chloride salts, whether from exposure to salty air at the beach or from salty deicers. This is a common irritation for homeowners who build on the oceanfront, who believe they are buying a material (for railings, for example, as well as for fasteners) that will never stain and then are surprised when it becomes blotchy and stained after the first storm.

While 317LMN or 904L alloys won't stain as much, I doubt that you'll have much luck finding a fastener manufacturer that makes screws using these higher-priced alloys. A better option is to educate your clients about the difference between stain and rust and suggest the use of a chloride-free ice melt. You could also recommend replacing the face-mounted screws—which create a small recess that allows salty snow melt to puddle around the fastener heads—with plugged screws. The fastener heads might still stain, but they won't corrode, and they won't be visible underneath the plugs.

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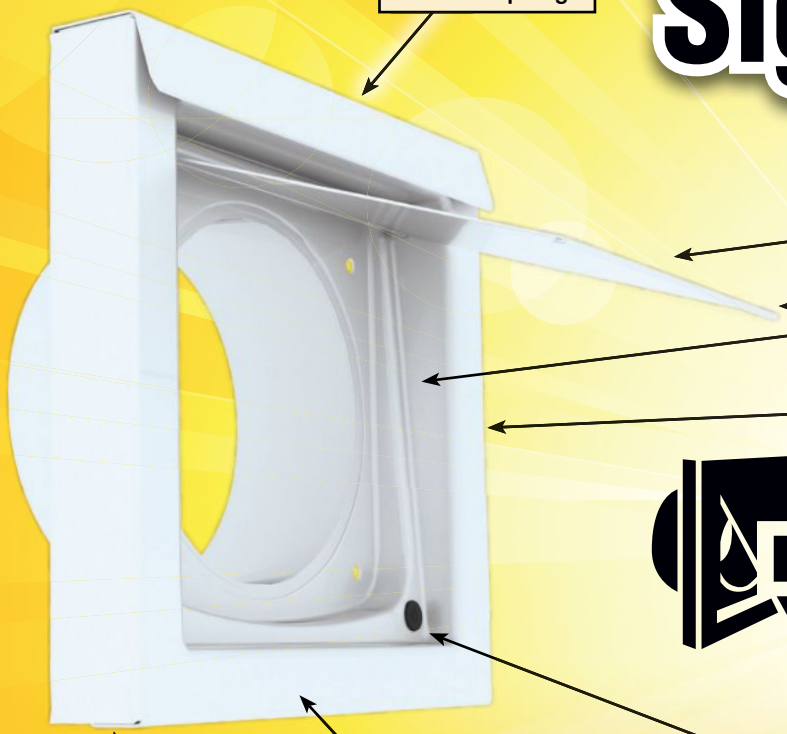

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Rebuilding a Box Bay Window

BY EMANUEL SILVA

The clad windows in the existing box bay were in good condition, but there were signs of water damage to the trim on the exterior **(1)**. More signs of water stains and rot were visible on the subsill once the stool was removed **(2)**.

Photos by Emanuel Silva

A homeowner recently contacted me about repairing some siding on his house. That work led to a discussion about his box bay window, which a contractor had installed about 10 years before. Though the clad Andersen windows in the box bay appeared to be in good shape, my client explained that they were difficult to open and close and that he had noticed some water leakage on the interior.

Based on experience, I suspected that the leakage problem was worse than it appeared. My hunch was confirmed as I started pulling off the interior and exterior trim to look at the framing. On the interior, water stains were visible above and below the windows, and when I removed the windows' stool, it looked like mice and ants had taken up residence in the space between the stool and the subsill—never a good sign. Still, the worst of the damage remained largely hidden until I started removing the exterior trim and uncovered extensive rot in the 2x12s that had been added to the rough opening in the home's 2x6 wall to create the box bay.

The box-bay framing had a number of problems, such as a lack of sheathing, inadequate flashing, and no structural support for the 2x12 subsill other than the 2x6 wall that it was resting on. But the main problem was that water from the roof flowed down the fascia and behind the exterior head casing used to trim the windows. From there, it worked its way down the 2x4 jack studs separating the windows and collected on the 2x12 subsill. As a result, the subsill was rotted and split, and the bottoms of the 2x4 studs were rotted. At both sides of the opening, the 2x12 trimmers had virtually disintegrated, so once I removed the trim, nothing was holding the windows in place.

Reframing the box bay. After removing the windows from the opening and stripping the siding from the wall, I dismantled what remained of the box-bay framing. I made some minor repairs to the existing framing and sheathing where there was rot damage, then reframed the opening with new 2x12s, capping the 2x12 subsill with a layer of 3/4-inch plywood to give the assembly a little more strength and keep the subsill from splitting.

Originally, we had planned on reinstalling the existing windows, as they were still in good condition. But after discussing options with the homeowner and code requirements with the building inspector, we opted for new windows. Though the inspector assured us that the box bay window didn't require tempered glass—and despite the fact that the wait time for the new windows would add considerably to the project's timeline—we concluded that new windows and the $35 upgrade per sash would give my client some peace of mind and provide better resale value if the decision was ever made to sell the house.

While carefully checking Andersen's sizing chart for its stock 200 series windows, I divided the 10'-2" x 4'-6" rough opening into four window "bays" with double 2x4 jack studs. I felt that doubled studs would be more stable and less likely to twist or bow than the single studs used in the original design. This required reducing the size of the rough openings slightly, with two larger windows in the center flanked on either side by slightly narrower ones.

Better water management. At the top of the box, a strip of aluminum flashing had been installed to cover the gap between the soffit and the box-bay framing and help divert water away from the window. It was securely tucked between the fascia and soffit and overlapped the box-bay frame, so even though it hadn't done a very good job of water management, I left it in place temporarily, covering it with a wide strip of Vycor Plus flashing

The extent of the rot damage to the framing was clearly visible once the windows were removed **(3)**. The author stripped the siding and window trim from the wall **(4)**, then reframed the box bay with new 2x12s **(5)**. After reinforcing the subsill with a layer of 3/4-inch CDX plywood, he framed the individual window openings with double 2x4 jack studs **(6)** and used cripple studs to fill in the gap between the flat 2x12 "header" and the soffit **(7)**. The author then completely covered the opening with sheathing to make it weathertight while he waited for the new windows to arrive **(8)**.

tape to better seal the flashing to the soffit. While I was working, I could fold the flashing back and out of the way; at the end of the day, I could bend it down over the opening.

Simply eliminating the gap between the upper 2x12 "header" and the soffit would help prevent water from running underneath the fascia and into the framing projecting out from the wall. Here, I installed 2x4 cripple studs, then sheathed the upper part of the assembly.

Structural support. To provide better structural support for the box bay, I cut away a 2-foot-high section of sheathing below the 2x12 subsill, removed the existing fiberglass insulation from the stud bays, then sistered 18-inch-long 2x12 blocks to the 2x6 wall framing below the window opening using structural screws. To reinforce the connection and prevent the blocks from splitting, I added a 3/4-inch plywood layer to each block, again with plenty of structural screws. I notched the blocking to fit snugly around a 2-by strongback that I had installed beneath the subsill over the existing wall sheathing to stiffen the opening. While installing the blocks, I set

Reinforced with plywood and notched to fit, 2x12 blocks were installed to provide support for the 2x12 subsill, which cantilevers out over the 2x6 wall framing **(9)**. A string line keeps the bottoms of the blocking aligned **(10)**. The author notched the new sheathing to fit around the blocking **(11)**, nailed it in place, then insulated underneath the subsill with rigid foam and filled the gaps with spray-foam insulation **(12)**. After sheathing the entire box bay, he flashed it with self-adhering butyl tape **(13)**. Once the windows arrived on site, the author cut out the window openings, installed a section of cedar clapboard ripped to 4 inches wide at the bottom of each opening, and then completed flashing the openings **(14)**.

up a string line to ensure that the bases of the blocks were aligned.

After refilling the wall cavities with fiberglass insulation, I resheathed the wall with Zip panels ripped to size and notched to fit around the blocking. Then I cut blocks of rigid foam to fit snugly underneath the 2x12 subsill between the blocking and sealed all of the joints with canned spray-foam insulation. Finally, I completed sheathing the box bay so that it was enclosed on all sides and taped the seams with Blueskin butyl flashing tape so that the box would be weathertight until the new windows arrived.

Window installation. Once the new windows were on site, I cut out the openings, added a beveled clapboard at the base of each one for positive drainage, and prepped the openings with flashing tape. As I installed each window, I bedded the top and side nailing flanges in sealant and left the bottom flange unsealed to allow for drainage. Then, before trimming the box bay with PVC trim, I taped the top and side flanges to the wall with flashing tape.

Underneath the windows, I installed a 2 1/2-inch-wide sill extension made up of two layers of 3/4-inch PVC ripped with 15-degree

The window flanges were bedded in beads of sealant at the tops and sides of each opening and nailed through the sheathing into the framing **(15)**. The author trimmed the box bay with PVC, replaced the water-damaged roof fascia with PVC trim, and installed an angled PVC kick-out cap to cover the gap between the window trim and fascia and to divert water out and away from the windows **(16)**. On the interior, he filled gaps with sealant or spray foam depending on the size of the gap **(17)** before installing new trim **(18)**. After completing the window installation, the author re-sided the wall with cedar clapboards **(19)**.

bevels on the edges. A shallow kerf underneath the outer edge of the sill creates a drip edge that directs water out and away from the windows. A water-table detail across the base of the box bay serves a similar function.

At the top of the box bay, I screwed and glued together a triangular kick-out cap that covers the joint between the window trim and the fascia. I had replaced the existing wood fascia with one made from PVC, added a nailer to make it easy to screw the cap to the fascia, and bedded the cap to the fascia in sealant. If for some reason any water does penetrate the box bay, a series of 1/8-inch-diameter holes drilled 12 inches on-center through the bottom from underneath will allow it to drain out.

On the interior, I filled all of the joints between the windows and the framing with low-expansion spray foam. Then I trimmed the windows with new S4S clear pine, giving the stool a bullnose profile. At his request, I left it up to the homeowner to prime and paint the completed box bay window.

Emanuel Silva, a contributing editor for JLC*, owns Silva Lightning Builders in North Andover, Mass. Contact him at silvalightningbuilders@gmail.com.*

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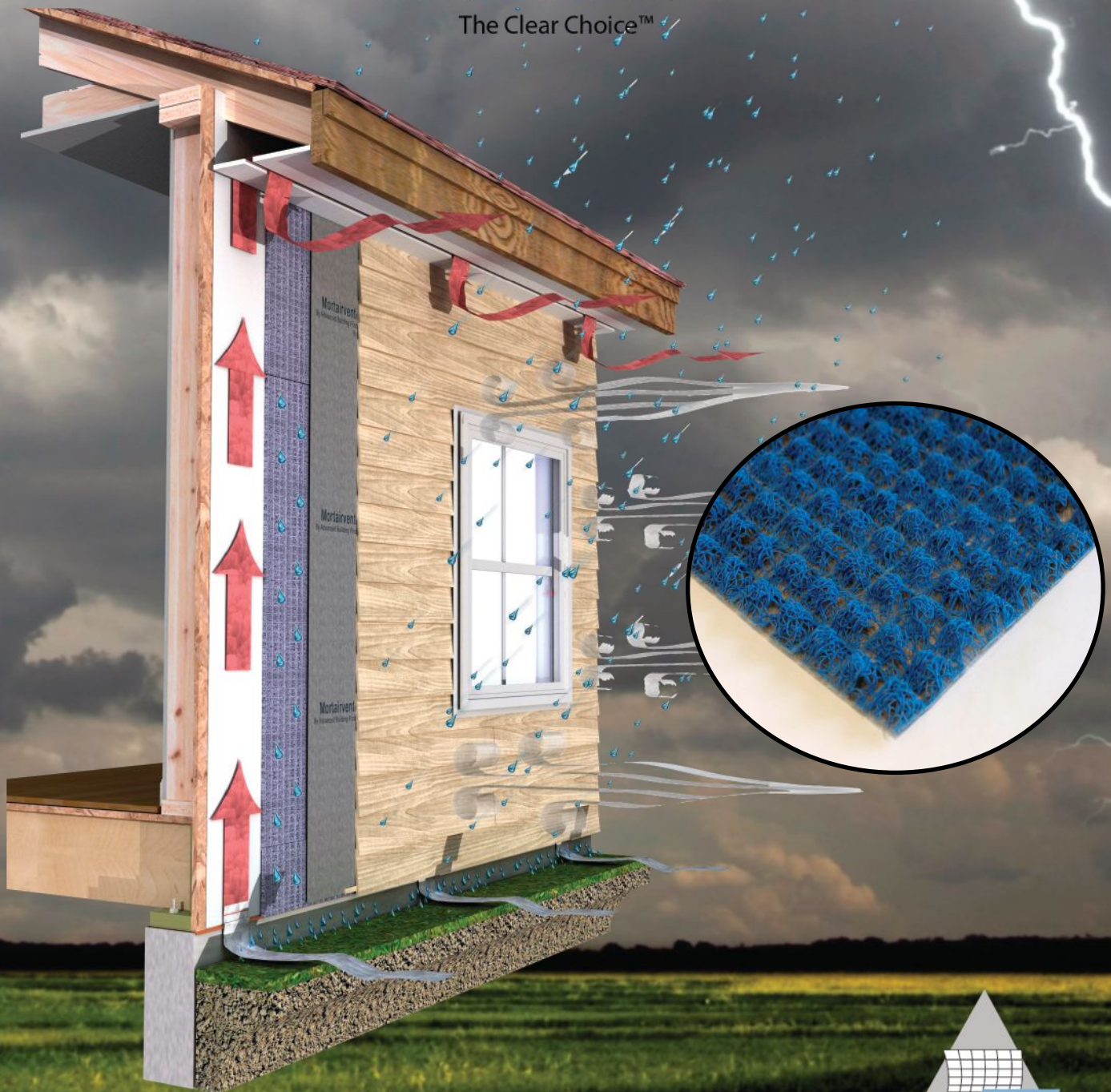

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Pumpkin-Cut Drywall Repair

BY THOMAS DUGAN

During remodeling projects, it's frequently necessary to cut holes in drywall in order to add or modify plumbing or electrical components buried in a wall. I'm retired now, but for my company, a very common request was to add a ceiling fan to a bedroom, which requires opening up several holes in the ceiling and a wall to run wires to a switch.

Traditional thinking is to blast your way in to do the work, then call a drywaller to come in and patch everything later, but this takes time and expense that we wanted to avoid. Traditional methods of repair involve cutting away the rough edges of the hole in the drywall, cutting a new piece to fit, then adding backing and screwing the patch in place. Next, the patch has to be taped and mudded, then sanded, then get more coats of mud that need to dry before the patch can be sanded and primed and painted to match. The process generally requires several trips by the drywaller, followed by the painter, making the cost unreasonable just to add a fan.

Angled cutout. We decided that to remain profitable, we would have to limit ourselves to four hours for a fan project, including painting and cleanup. To do this, we had to speed up the patching process.

One day it dawned on me that we could cut more carefully and save the original cutout piece to make the repair. Next, we asked why we needed to tape around the patch if there is no possibility of movement and cracking? Eliminating the tape would reduce buildup and thus the size of the patch to make it smooth. Finally, we needed to figure out how to hold the patch in place to reduce time. Enter the pumpkin cut **(1, 2)**.

As children, most of us carved out pumpkins for Halloween, first cutting around the top at an angle to make a lid that would not fall inside the hollowed-out pumpkin. Making our needed cuts in the drywall on an angle—as for a pumpkin top—turned out to be the key to making rapid drywall repairs. Our rule became: "Never let

Draw an outline for the access hole, then cut to the line while holding the blade at about a 45-degree angle **(1)**. A little less angle is better than too much as the mud buildup can make it hard for the piece to fit in flush with the surface **(2)**. Prep the cutout by trimming any fuzzy edges off with a razor knife or scissors **(3)**, then apply joint compound to both the edge of the hole **(4)** and the edge of the cutout **(5)**. Either a setting compound or regular joint compound can be used, in which case a heat gun or hair dryer will speed up drying **(6)**.

Photos by Thomas Dugan

another trade open up a hole in the drywall for you." If they needed access, they had to come to us first.

We taught dozens of electricians and plumbers this technique. Many would make the cut and save the piece for us to reinstall when we arrived on site later. When we had to patch a hole that we didn't make, with a little effort, I could trim around the rough hole, shaping and beveling the edges to simulate the pumpkin cut, then carefully trim a new piece with beveled edges to fit the reshaped hole. To fine-tune the new piece to the hole, use a keyhole saw or just the blade from a reciprocating saw inserted in the space between the hole and the new piece and gently cut away whatever spots are touching and preventing the piece from slipping in flush **(3)**.

You can use either a fast-drying setting compound or regular joint compound to "glue" the patch in place **(4, 5)**. With regular mud, we used a heat gun to speed up the process **(6)**. Then skim coat, lightly sand to just reveal the edges of the patch, and apply a second skim coat, after which the patch is ready for primer and paint.

Patching an existing hole. But what about those times you didn't cut the hole? The same process applies, but it starts out a little differently. First, straight-cut (no bevel cut yet) a new piece of drywall at a size and shape that will cover the damaged area **(7)**. When sizing the drywall patch, be generous to allow for blowout on the back of the existing drywall, as it needs to be sound. A square or rectangular patch can be a little easier to cut, but as with the previous example, shape doesn't really matter.

Next, place this piece over the damaged area and trace around it with a pencil. When you cut out this traced area along the pencil line, hold the blade of the tool that you are using to make the cut at a 30- to 45-degree angle **(8)**. Then bevel the edges of the patch at the same angle **(9)**.

At first, the patch most likely won't fit the hole exactly. While holding the piece in place, use your saw at an angle to clean out areas of contact that are preventing the new piece from matching the hole **(10)**. The goal is to be able to recess the patch into the hole a little bit, so that the patch will be flush once the edges have been buttered with joint compound.

From here on, finishing is the same as before. To help with alignment, you can add a couple of coarse-thread screws if needed **(11)**. Just remember to take them out before applying the skim coat. If we did it correctly, we found that we could complete a drywall patch in a single trip and spend less than an hour doing it.

Thomas Dugan is a retired general contractor in coastal North Carolina who specialized in building hurricane-resistant homes.

To repair an existing hole, cut out the patch first, place it over the hole, and trace its outline **(7)**. Cut to the line with the blade at a 30- to 45-degree angle **(8)**, then bevel the edges of the patch to the same angle **(9)**. Fine-tune the fit by pressing the patch into the opening and shaving off high spots with the blade fitted between the patch and the cutout **(10)**. A few drywall screws will help hold the patch in place while the mud dries **(11)**.

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SIDING & ACCESSORIES TRIM & MOULDINGS ROOFING STONE WINDOWS OUTDOOR LIVING

BY CHRIS WEST

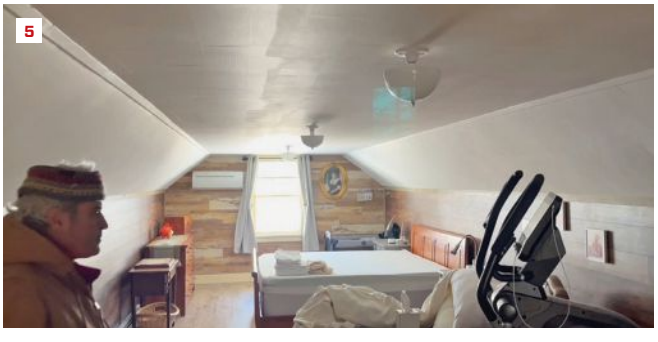
Air-Sealing an Ice-Prone Home

Last December, I was contacted by a couple in their mid-60s who were having repeated ice damming issues on their home. The husband noted that he'd been diligent about raking the roof's perimeter after snow events over the years, but it was becoming too hard for him to manage. In addition to raking, he said he'd often get up on a ladder and attempt to knock the ice dams off as a last resort—a dangerous task at any age.

Their modified Cape-style home, built in 2006, was situated on a fairly exposed lot in central Vermont. The homeowners said the ice damming seemed worse on the roof sections above the home's garage wing. (The garage wing's roof planed into the main house, forming an L-shaped roof with two valleys). Ice would form along both eaves of the wing, in the bottom of the valleys, and along portions of the north-facing cantilevered eaves of the main house, which served as a covered entry **(1, 2)**.

Some like it hot. We started with the garage. I inspected the "unheated" space and found it relatively warm (the outside temperature was in the mid-30s). In a corner of the room was a Modine gas heater, which the homeowners said was used intermittently. The garage wing was 26 feet wide by 34 feet long. The unheated garage comprised roughly two-thirds of the wing, while the remaining third was conditioned space. The homeowners mentioned that a bonus room ran the length of the second floor above. I surmised that warm air exfiltrating from the conditioned space and the garage was finding its way to the underside of the roof sheathing and melting the snow, causing icicles and ice dams to form along the entire garage wing and in the two valleys.

Walking the first-floor interior with the couple, I noticed it was warm; roughly 75°F. When asked about their heating habits, they informed me that they liked it warm and didn't use temperature set-backs at night or when the home was unoccupied. I suggested that the temperature differential between the above-average warm interior and the cold exterior may be exacerbating heat drive out of the home through unwanted ceiling leaks and recommended



The main house of the L-shaped Cape is in the background, and the garage with the bonus room is on the right **(1)**. Ice damming was worst on the garage wing and in valleys abutting the main roof **(2)**. The main house was insulated on the slopes **(3)**, while the garage wing was insulated on the ceiling flat and bonus-room knee walls **(4, 5)**.

Photos by Chris West and Tim Healey; illustration by Tim Healey

lowering the thermostat and using set-backs to help reduce the ice damming, though this would not eliminate the problem.

Dueling insulation methods. Typical of a Cape, the second-floor interiors had knee walls on either side; the walls sloped inward from the top of the knee walls following the 9:12-pitch roof lines to a narrow, flat ceiling.

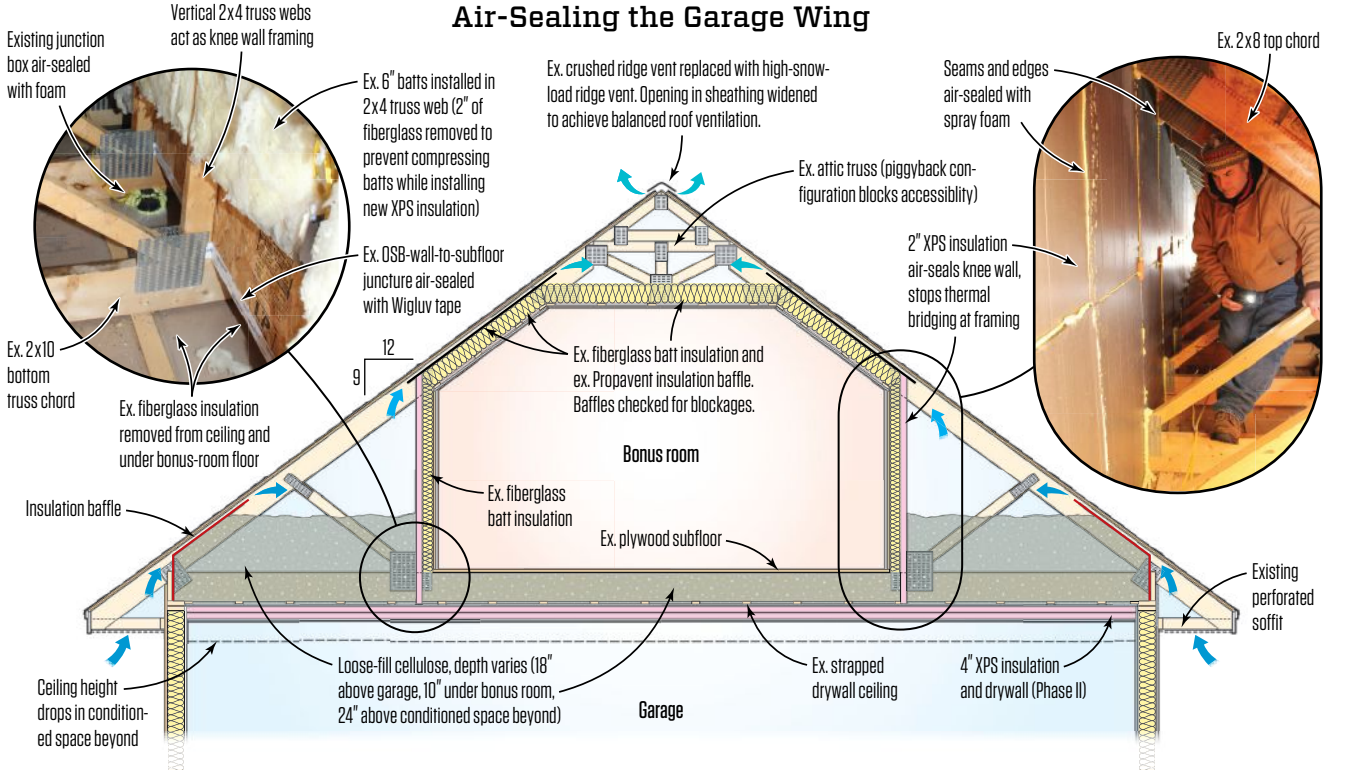
In the main house, the homeowners used the triangular-shaped space behind the knee walls for storage, which they accessed via well-sealed but uninsulated hatches. I crawled into the storage spaces and found that the original builder insulated on the slopes (the kraft-faced fiberglass batts were exposed to the interior) **(3)**. In the rafter bays, he ran insulation baffles and fiberglass insulation from the soffits to the small attic space above the narrow, flat ceiling. The Propavent baffles provided a channel for airflow from the soffit to the ridge vent.

Conversely, the garage wing was insulated on the ceiling flat and the bonus room's knee walls **(4, 5)**. After squeezing into the space behind the bonus-room knee wall via the adjoining storage space under the inside corner of the L-shaped roof, I was surprised to find that the builder had used two different insulation methods for the home. Typically, builders choose one installation method or the other when insulating Cape-style homes in the area where I work. He may have decided it would be easier to insulate the garage wing's 2-foot-on-center attic trusses on the flat and knee walls.

A phased solution for a leaky house. We detected numerous air bypasses at wall and ceiling locations during the energy assessment, forming a clearer picture of where targeted improvements could be made. I sent the homeowners the results of the energy audit and my recommendations. They chose to just focus on work related to eliminating the sources of warm air escaping the house and heating the underside of the sheathing in the garage wing. The client's budget and their desire to avoid, if possible, any interior demolition were factors in their decision.

Work on the main house, such as properly sealing the existing Propavent baffles to prevent wind washing of the insulation and covering the exposed kraft-faced batts (a potential fire hazard) with drywall would be done at a later date, in warmer weather. I also recommended installing 4 inches of XPS insulation on the bottom of the garage ceiling to act as a thermal break and increase air-sealing. This too was pushed to the "Phase II" portion of the energy retrofit work.

Phase I. Ideally, I would have preferred to move the thermal envelope to the slopes and triangular cheek walls in the garage area, but after analyzing the attic trusses, I determined the 2x8 top truss chords were too shallow to easily vent and insulate on the slope. Also, two-thirds of the garage wing space was located over a cold garage, so I reluctantly proposed keeping the insulation layer on the flat and the knee walls (see illustration, below).



A layer of 2-inch gray DuPont XPS insulation serves as the primary air barrier between the bonus room and cold space behind the knee wall. The bonus room runs the length of the second floor (section taken through garage portion of the garage wing).

A crew member replaces a length of 4-inch flex duct run from a bath fan with 4-inch rigid PVC piping. The PVC duct sloped 1/4 inch per foot toward the soffit vent. In the foreground, a recessed light is air-sealed with a site-built OSB cover foamed in place **(6)**.

Note the existing ineffective thermal control where the garage wing intersects with the main roof, with large areas of exposed fiberglass and loosely placed Propavents **(7)**.

Exposed batts were covered with Majvest membrane where the garage wing and main house intersect **(8)**. The exposed, "cold" end of the LVL is foamed with froth pack to stop condensation from forming and leaking into the house **(9)**.

I assembled a work crew and we started out by making two holes in the gable-end wall of the garage wing to access the spaces behind the bonus-room knee walls. We removed fiberglass insulation from the ceiling and under the bonus-room floor. In the bays of the vertical 2x4 web members of the attic trusses (which acted as the knee wall), the previous builder had stapled 6-inch-thick, kraft-face R-21 batts. We removed 2 inches of fiberglass from the back of the batts to prevent compressing them when we installed a layer of 2-inch XPS insulation; the XPS would serve as the primary air barrier between the bonus room and the cold space behind the knee wall.

At the sloped and flat ceilings of the bonus room, we couldn't readily improve the insulation and air-sealing from below (the ceiling was already quite low at 6 feet 8 inches high). So, we left the existing fiberglass insulation in place and checked the existing insulation baffles for blockages.

We carefully cut and dryfit rigid XPS pieces to make sure they were relatively tight around the attic trusses and the insulation baffles at the top of the knee wall, then screwed them in place through insulation washers and air-sealed all the seams and panel edges.

The usual suspects. Along the eaves, we air-sealed the top plates from above and installed new insulation baffles. We taped the fragile Propavents at their articulated bends to help prevent them from breaking. At recessed lighting and bath-fan locations, we foamed in either site-built OSB or manufactured covers. The two fan units vented out through long lengths of 4-inch flex duct, which we replaced with 4-inch rigid PVC sloped 1/4 inch per foot toward the soffit vents **(6)**. Rounding off the usual air-sealing suspects, all the partition top plates and knee-wall outlets were foamed in.

The not-so-usual suspects. Where the two insulation methods interfaced at the intersection of the garage wing and main house, the original builder seemed to have thrown in the towel with regards to completing the thermal envelope. He left the main roof under the stick-framed section forming the valleys partially sheathed with large areas of exposed fiberglass and Propavents loosely placed **(7)**. To cover the exposed batts, we taped Majvest diffusion-open membrane (siga.com) with Wigluv high-performance tape (siga.com) on the back of the existing baffles, then taped the Majvest to the sheathing to create a continuous air-seal; we needed to make sure the existing baffles would keep venting to the main roof's ridge vent **(8)**.

Another unusual find was an interior leak that was caused by condensation forming on the LVL beam supporting the cantilevered eaves of the main house. When conditions were right, condensation would form on the "cold" LVL where it entered the attic space (the beam was not air-sealed or covered with insulation), causing water to drip through the gaps between the framing and damage the drywall ceiling below. We air-sealed the end of the LVL with foam using a froth pack **(9)**.

Chris West is PHIUS/PHI Certified Passive House consultant/trainer and owner of Eco Houses of Vermont, a building science consultancy specializing in Passive House design for single family, multifamily, and commercial projects.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A Smarter Way of Charging for Overhead and Profit

Accurate bids require more than just applying a formula

BY DAVID GERSTEL

Figuring overhead and profit (O&P) is the most challenging step in creating a bid for a construction project. By contrast, estimating direct costs of construction—namely the costs of labor, material, and trade partners (subs)—is relatively straightforward. You provide your material suppliers and subs with lists, plans, and walk-throughs and get back written quotes. For labor costs, if you have developed a file of labor productivity records, you need only count and multiply to reliably project costs. (If you are not up to speed at figuring direct costs of construction, see my book *Nail Your Numbers: A Path to Skilled Construction Estimating and Bidding* and my earlier *JLC* articles about the creation of labor productivity records and other tools of estimating.)

In this article, I will turn to calculating overhead and profit charges for a project.

For several reasons, those calculations are not as simple as figuring direct costs. To begin with, overhead and profit charges are not as tightly linked to the project at hand. The studs you buy for an addition are for that project and none other. And their cost is a cost of that project and none other. Overhead costs for items such as equipment, office supplies, and owner's pay for running the company, however, are spread across many projects. Questions then arise: How do you best apportion overhead to each of your projects? Likewise, how can you best determine the amount of profit to aspire to on each project?

STARTING OUT WITH FIXED PERCENTAGES

When we are starting out and still naïve about business, we tend to respond to the challenge of charging for overhead and profit by ignoring it. We commit the thinking error of "overhead obliviousness." We are spending steadily for equipment and supplies. We are working late into the night and on weekends at estimating and administrative work. But we don't yet appreciate that we need to get reimbursed for the expenditures and paid for our time.

As for profit, we think that's the payment we collect from our customers for our jobsite work—which we are likely charging for at a rate less than our former bosses charged for our labor at their projects. We find ourselves working 60 or more hours a week between our jobsite and office tasks. Yet we are keeping less money in our pockets than when we worked 40 hours in someone else's company. At that point, many of us, exhausted and poor, give up. We retreat to employee-hood or perhaps, as did certain friends of mine, move into window sales or peddling Tupperware.

Some of us are luckier. We become aware of the necessity of charging for—that is, "recapturing," to use a technical term—overhead costs and realizing a profit. We begin to wonder how much to include for overhead and profit (O&P) in our bids. Maybe we ask Hank, sales manager at the local lumberyard, or some other graybeard whom we revere as a fountainhead of construction wisdom, how much to charge for O&P. "Go with 10 & 10," we are told. "Add 10% of your direct construction costs for overhead and 10% for profit. That's industry standard."

Though he may not use the term, Hank is advising what is called the "fixed percentage method" of charging for overhead and profit. Typically, it does involve use of "10 & 10." That's partly because those percentages are insisted on by certain insurance adjusters and architects though they may have no understanding of overhead and profit in the construction business.

BASIC TERMS

Costs of construction

Also termed direct costs and costs of goods sold (COGS)

Costs of construction include costs for labor (including by an owner), material, subcontractors, and services used at a jobsite.

Overhead

Also termed indirect costs

Overhead is the ongoing cost of running a company. It includes out-of-pocket costs for everything from stamps and staples through heavy equipment. It also includes owner's pay for company management tasks from sales calls and estimating through hiring and firing employees.

Profit

Profit is income, as *JLC* author Michael Anschel explains, that you "aspire" to take in above and beyond all costs for construction and overhead. Realistically, it is also insurance against what I call "profit costs" such as litigation that can arrive even after a project is long over and take a bite out of your hide.

MOVING TO GPM

Often, builders who start with the fixed percentage method move to an alternative method of charging for overhead and profit on their projects. It goes by the abbreviation "GPM," for gross profit margin. It's an odd term. It refers to overhead and profit combined as a percentage of sales price. For example, say a remodeling company bids $150,000 for a project, with $50,000 of the bid for overhead and profit. In that case, it is aiming for a GPM of 33% on the project ($50,000 / $150,000 = .33 = 33%).

GPM for a specific project is figured by applying a formula to the direct costs of construction to produce a bid or so-called "selling price." In the example above, the company would first figure the direct costs ($100,000) for the renovation job. Since it was aiming for a 33% GPM, it would apply the GPM formula, slotting in 33%, to produce a bid of $150,000. The selling price thereby includes $50,000, or 33% of the total price of $150,000, for overhead and profit.

Though I go through it in *Nail Your Numbers*, I'll spare you a full explanation of the GPM formula in this article. I will just note that the formula is complex. It's impressive looking. Maybe that's why construction pros think that when they switch from the fixed percentage method to the GPM method for figuring overhead and profit that they are moving up the ladder of business sophistication.

They are not. At its core, GPM represents no advance on the fixed percentage method. Though wrapped up in fancier math, it's just another formulaic percentage calculation.

Think about it. When you use the GPM formula, you are doing the same thing as with the fixed percentage method. Namely, you are including a predetermined percentage for overhead and profit in a bid. You may be using a bigger number—say the 33% long recommended for remodelers—instead of 10% and 10%. But you are still relying on a rigid formula to determine overhead and profit charges for your projects.

THE DEFICIENCIES OF FORMULAIC METHODS

Some construction companies have survived or even prospered, at least for a time, while relying on a fixed percentage or GPM formula. Nevertheless, both methods are deficient. Both incorporate a troubling assumption about overhead. That is, both assume that all companies have the same overhead. Thus, 10 & 10 assumes that overhead is actually 10% of construction costs for all companies. The GPM method does not even separate out overhead and profit charges. Yet, when the formula is put forward with a recommended percentage, which it often is, the assumption is that the percentage will adequately recover overhead for any company that elects to use the formula and automatically provide for profit as well.

Such percentage calculations may be adequate for your company if you manage overhead very tightly. But if you are outfitting an office or shop or showroom, hiring office staff, or making other

substantial investments in marketing and administration, a fixed 10% for overhead likely won't come close to recapturing your actual overhead outlays. If you are using the GPM method with a typical recommended percentage such as 33% (or for that matter, the 40% also often recommended for remodelers), that may or may not be enough to recapture your overhead costs, including pay for your own management work, and provide profit as well.

Also troublesome, when you go with a recommended percentage for overhead—whether 10% or some percentage wrapped up inside of a GPM—it will at best have a coincidental connection to your actual overhead on a specific project. It may have no connection. You are assuming that your overhead, whether figured as a percentage of construction costs as with the fixed percentage method or of selling price as with GPM, is an identical percentage for all jobs. It likely won't be. It can be very different for, say, a kitchen remodel, a new home, a foundation replacement, and construction of a bridge over a creek (a range of projects similar to those done by my company).

Jerrald Hayes, a builder and consultant with deep expertise on overhead and profit issues, insists the formulaic percentage methods of figuring overhead on specific projects are "arbitrary." I agree. Similarly, for profit. A profit charge figured as a standard percentage of construction costs or selling price might happen to be appropriate during some phases of the economic cycle. At others, it could be woefully off. During good times, when work is abundant, you might be leaving money on the table. During hard times, your percentage might force your bids so high you cannot get enough work to keep your company going.

Use of a formulaic percentage for profit assumes, just like the use of a formulaic percentage for overhead, that all jobs are alike. It assumes that all jobs present the same opportunity for profit. It assumes that all projects burden a company with the same level of risk during construction. It presupposes that all projects saddle a company with the same degree of liability after construction is complete. But, as you know, some projects, clients, and designers impose far more hazard than others. Projects with different levels of hazard demand different levels of profit charges to buffer the hazard.

Use of the percentage-based formulas can lead to sheer foolishness. I have seen capable companies pass up good opportunities to build custom homes because of rigid adherence to their formula. They aspired to gross profit margins of around 40% on each and every one of their projects. That was reasonably competitive for remodels given their reputations and the level of service they rendered to clients. It was unnecessarily and unacceptably high for new homes. As a result, they rarely or never got those projects.

BEYOND STANDARD FORMULAS

Is there a smarter method of charging for overhead and profit? I think so. I call the method the "capacity/duration method (CDM)." In the next few paragraphs and the sidebar on the following page, I will describe CDM in general terms. A friendly warning: If you are unfamiliar with the concept, even though it is straightforward, you may find this first pass through CDM heavy sledding. But the specific examples of applying CDM that we will go into shortly will be easier going and should clarify the concept.

Here's what CDM does not do: It does not rely on the use of percentages to figure charges for overhead or profit on a project. Percentages may come into play when a bid is complete with overhead and profit already included, but only to compare your charges to those of competitors. Percentages are not used to calculate your charges.

Here is what CDM does do: It allows for overhead and profit to be figured independently of one another. That is as it should be. They are such different creatures. Though they are figured separately with CDM, both the overhead and the profit calculations are based on the same two factors: first, your capacity for work—the number of projects your company can handle at one time; and second, the duration of a project—the length of time it will take your company to build it.

The goals for CDM are simple. With each project, you aim to recapture the overhead with which the project actually burdens you. With each project, you aim for a profit that is obtainable and that makes doing the project worthwhile for your company. To further explore CDM, let's look at its use in a range of companies from smallest to larger.

CDM FOR A ONE-PERSON COMPANY

Say that you operate without employees. You are the project manager and lead person at your projects. You may work with trade partners, such as plumbers. You may wear your bags. Or you may do both. Off the jobsite, you handle marketing, estimating, bidding, and other office work.

You have enough business savvy that you realize you have overhead (lots of it). You see it as breaking down into two categories: 1) "out-of-pocket overhead"—the money you spend on everything

PROBLEMS WITH STANDARD FORMULAS

- **The percentage-based formulas** for charging for overhead and profit typically incorporate "industry standard" percentages. The charges resulting from use of those recommended percentages may have little relationship to the actual overhead needs or profit opportunities of any particular company using them.
- **Overhead charges** may have little relationship to the overhead burden incurred on a specific job. For some, the percentage may be too high. For others, it may be woefully low.
- **Profit charges** may be divorced from market conditions and opportunities and a company's need for work.
- **With the fixed percentage method**, the percentages, such as the oft recommended "10 and 10," may be too low for a company to recapture its actual overhead and earn a profit adequate for survival.
- **With the GPM method**, overhead and profit are jumbled together. That can encourage overhead obliviousness, which can result in lost jobs or missed opportunities for profit.

THE CAPACITY/DURATION METHOD

For overhead, use the steps below to figure your necessary weekly and total overhead charges for a project:

1. Project your total company overhead for the year.
2. Divide your projected overhead for the year by the number of weeks you expect to have projects under construction. That will give you a figure for overhead per week.
3. Divide overhead per week by the number of projects your company does at a time. That will give you a figure for weekly overhead on each of your projects.
4. Figure overhead charges for an entire project by multiplying your weekly project overhead by the number of weeks you expect the project to be under construction.
5. Modify the figure to fit the particular project, if appropriate.

For profit, use the steps below to figure your necessary weekly and total profit charges for a project:

1. Set a reasonable profit goal for the current year.
2. Divide that profit goal by the number of weeks you expect your company will have projects under construction during the year. That will give you a profit per week figure.
3. Divide profit per week by the number of projects your company can do at a time. That will give you a figure for profit per week for each project.
4. To figure a profit charge for a project, multiply your figure for profit per week for the project by the number of weeks you expect the project to be under construction.
5. Modify as appropriate for the degree of risk the project presents.

from new tools to truck maintenance and office supplies and 2) time spent meeting prospective new clients, creating estimates, doing administrative work, reading *JLC* to keep up with new developments in construction, and otherwise running your company.

You also realize that the pay you take for your work on your jobsites is not profit. You understand that it is a cost of construction—just as wages and labor burden would be if an employee did the work. Profit, you appreciate, is something apart. It is your company's pay. It is necessary to build up working capital. It's essential as insurance against all the liabilities that construction businesses take on.

To ensure top quality on every project, you button up each one before moving on to the next. Therefore, your capacity is one project at a time. How, then, do you use CDM to figure an accurate overhead charge per project?

As you can see in "Weekly Overhead for a One-Person Company" on the facing page, overhead costs for a hypothetical one-person construction company are $2,400 per week. Therefore, for a one-week repair job, the company needs to recapture $2,400 (1 x $2,400) in overhead. For a four-week deck project, $9,600 (4 x $2,400 = $9,600). And for a 310-square-foot bed and bath addition that takes 13 weeks, the basic overhead charge works out to $31,200 (13 x $2,400 = $31,200). If the company owner thinks a project will burden them with more than usual overhead costs—say extra paperwork, unusual purchases of equipment, or time spent soothing an anxious client—they might want to modify the charge upward.

For your own company, you may, of course, value your off-site management work at a different level than suggested in the sidebar. Likewise, your out-of-pocket costs might run lower or higher. If so, your charges for overhead would vary accordingly. But the key point is that if you establish valid figures, you can calculate a valid weekly average figure for overhead. And using that figure, you can arrive at a valid charge for overhead for small and larger projects.

Figuring profit for projects done by a one-person company can be done with similar steps. For purposes of our example, let's assume that you operate in a prosperous area and that there is strong demand for good builders. Solid profits are within reach. You set a profit goal for your company during the upcoming year of $96K—or $2,000 a week for each of the 48 weeks you expect to be constructing projects (48 x $2,000 = $96,000).

For a one-week job, you would charge $2,000 in profit (1 x $2,000 = $2,000). For a four-week job, $8,000 (4 x $2,000 = $8,000). For that 13-week addition, you would charge $26,000 in profit (13 x $2,000 = $26,000). That is, you would charge those amounts assuming you don't need to bump up or lower your profit charges because of contingencies or circumstances. In some cases, it might be prudent or practicable to make an adjustment. For example, if a project involves much unfamiliar work, consider increasing profit charges in your bid to protect your company against unforeseen costs.

On the other hand, at times, you may have to lower or even forgo profit to fill in a hole in your schedule or to ride out a down period in the economic cycle. If things get really bad, you may have to find ways to slash your overhead—like reducing your pay for running your company. With such moves, you may be able to stay busy enough to at least recapture your remaining overhead during even an extended bad period that makes earning a profit all but impossible.

Finally, when profit is possible, you have to decide what level of profit your conscience and beliefs require. I have known builders who feel guilty about maximizing profit at the expense of clients. At the other end of the spectrum, I have met those who see maximizing profit as a necessity and even as a precious right of an entrepreneur working in our free enterprise economy.

Over time, I came to a middle position. I recognized the need for my company to earn substantial profit—particularly because we had a generous profit-sharing program and because I needed profit for the investments that would give me financial independence. But I also wanted my company to offer good value to our clients. That generally required keeping profit at levels that were highly competitive with other well-established and respected companies.

OVERHEAD ADJUSTMENTS

At times, you may choose to adjust overhead just as you may decide to adjust profit from an initial figure you arrive at with a capacity/duration calculation. But as with profit, any adjustment of overhead will involve judgment calls. For example, I have thought

that, generally speaking, overhead charges for smaller jobs, like bathroom remodels, vs. new homes could be discounted by roughly 10%. Conversely, I have felt that for a larger job, they should be bumped up by 10%. Why? Because I have assumed that small jobs generally would burden me with proportionately less office work and wear and tear on equipment used by my crews. In other words, I have thought that weekly overhead is lower on smaller projects.

Michael Anschel—a seasoned builder who has thoroughly thought through CDM—suggests that I have it backward. A bathroom, he points out, can burden you with more management costs, like client hand-holding. With a small remodel, you are working inside your client's home. They need a lot of attention and reassurance. The reverse, Anschel has found, holds for construction of a new home. He has concluded that his overhead is lower on new construction than on remodels.

There is no hard and fast rule about overhead adjustments. I have done remodels where little hand-holding was necessary. I have built new structures where the client and the designer were both serious PITAs (pains in the hindquarters). I have concluded that adjustment calls can legitimately vary from company to company and project to project. Neither you nor I will get them perfectly right. In fact, we won't get overhead or profit charges for a bid or even direct construction charges in an estimate perfectly right. But as Jerrald

WEEKLY OVERHEAD FOR A ONE-PERSON COMPANY

How to figure overhead charges for a hypothetical one-person construction company

Yearly overhead

- Truck: $10,000
- Other equipment for jobsite and office: $8,000
- Office and shop rental (or value of office and shop space in home): $12,000
- Tools, supplies, professional services, other: $6,200
- Value of owner's work running company: $76,800 ($80/hr. x 14 hrs./week x 48* weeks = $76,800)
- Total annual overhead: $113,000

Overhead per week: $2,400 ($113,000 / 48 = $2,400)
Modify as necessary for particular job conditions.

*48 weeks is used to allow for vacations, dead spots in a schedule, etc. because overhead must be recaptured and profit earned during the time the company is actually in operation.

Hayes puts it, "The idea is to be mostly correct rather than absolutely wrong." And if you are mostly correct, over time, across many bids, the law of averages is on your side. You may run somewhat high on some bids and low on others. But your numbers can average out just where you need them to be.

CDM FOR LARGER COMPANIES

Let's say that over time you build a larger company. You take off your tool belt. You develop your three best carpenters into project leads. You devote yourself entirely to running your company. With each lead running a project, your capacity is three projects at a time. Allowing for vacations and other downtime, you aim to have each lead running jobs 48 weeks a year.

As was the case for a solo operator, you have overhead at two levels, out-of-pocket overhead and owners pay. Running the numbers, you arrive at weekly overhead of $13,500, or $4,500 per project per week (see how those numbers were derived in "Weekly Overhead and Profit for a Larger Company," below). To recapture your overhead, you must charge $4,500 for overhead for each week that a project is under construction.

WEEKLY OVERHEAD AND PROFIT FOR A LARGER COMPANY

How to figure overhead and profit charges for a hypothetical company with three project leads

Yearly overhead

- Out-of-pocket costs for construction equipment, office and shop space, office personnel, etc.: $460,000
- Owner's pay: $188,000
- Total annual overhead: $648,000 ($460,000 + $188,000 = $648,000)

Overhead per week for the 48 weeks that projects are under construction: $13,500 ($648,000 / 48 = $13,500)

Overhead per week per project with each of three leads doing one project at a time: $4,500 ($13,500 / 3 = $4,500)

Overhead charges for individual projects

- For a four-week window replacement project: $18,000 (4 weeks x $4,500/week)
- For a 13-week addition: $58,500 (13 weeks x $4,500/week)

Profit charges

- Goal for year: $250,00
- Average intended profit per week: $5,208 ($250,000 / 48 = $5,208)
- Profit goal per week for each lead and their project: $1,736 ($5,208 / 3 = $1,736)

Let me be clear about the underlying logic here: The purpose of charging for overhead is to recapture the overhead costs of production. That's apparently a challenge for a manufacturing company with a variety of products; allocation of overhead to different product lines is said to be notoriously difficult. We're luckier in construction. Using CDM, we can allocate overhead to each product—that is, each of our projects—readily and accurately.

Even so, use of CDM to charge for profit when a company is building several projects simultaneously does involve judgment calls similar to those that must be made by the solo operator. You need to consider your familiarity with the work required; the other risk factors such as the reliability of the designer and owner; and market conditions and your need for work as well as your profit goals.

Let's say you have built a respected company and are working in a high-cost metro area where there is a lot of demand for your product. You've set your profit goal at $250,000 per year—in part because you have inaugurated profit sharing. (You have realized it's one good way to minimize turnover on your crews. And turnover, you have discovered, is a huge headache and eats up much more profit than profit sharing). To bring in $250K in profit, you will need to charge $1,736 per project per week (again, please see the sidebar for the math).

CAPACITY VARIATIONS

Capacity/duration is not a one-size-fits-all method. Some builders who prefer a capacity-based method to the formulaic percentage methods do not equate capacity with the number of projects they can handle simultaneously. They see capacity as the total number of hours their employees can log at their jobsites each week. To charge for overhead, they figure the amount they need to recapture weekly on average. They then divide that amount by the number of hours they expect their employees to log weekly and charge accordingly.

For example, say a builder has overhead of $8,500 per week. On the basis of payroll records, they know that their 10-person crew averages 380 hours per week at their jobsites. After doing the math, you will see that overhead works out to $22.36 per person hour. To recapture that overhead, the builder adds $22.36 per hour to the other costs—wages, benefits, and other labor burden—for each hour of work by a crew member.

Likewise, for profit. These builders establish an annual and per-week goal. They then figure the amount of profit they need to take in for each hour of labor by a crew member to reach their goal. Finally, they add the hourly profit figure to labor and overhead charges to arrive at a total charge for an hour of crew labor.

Figuring overhead and profit charges on an hourly basis was initially favored by a builder whose operation I got to know well as their consultant. I recommended against it. I see capacity as the number of people in a company who are capable of running a project. After all, if you have 100 people on your crew, but none can run a project, your capacity is zero.

Focusing on leads as a basis for figuring overhead and profit can work as effectively for companies that rely on trade partners

ARE CDM BIDS REALISTIC AND COMPETITIVE?

At this point, even if you are finding merit in CDM, you may be wondering whether it will contribute to business-like bids. A good way to run a check is to compare the bids that you create using CDM to the general level of construction pricing in your market. And a path to accomplishing that is to take a look at the square-foot charges you arrived at using CDM versus the prevailing square-foot charges of contractors in your area and at your level.

One-person company. For example, let's say that you are operating a well-established one-person company and have bid on the 310-square-foot bed-and-bath addition mentioned on page 34, and that your numbers are as follows:

1. Direct construction costs at $160,000.
2. Overhead at $31,200.
3. Profit at $26,000.
4. Total bid at $217,200 ($160,000 + $31,200 + $26,000 = $217,200).

That pencils out to just over $700 a square foot for the addition's 310 square feet ($217,200 / 310 = $700.64).

At the time I am writing this article in late 2022, $700 a square foot is a moderate price or, in some markets, even toward the low side, for good-quality residential remodeling in major cities. So, CDM did deliver realistic charges for overhead and profit for the addition. If you wish, you can run the numbers to see how well the method would work for smaller or larger jobs by your one-person company.

Larger company. Will the CDM method produce a business-like bid for a larger operation? Here, I will leave the math to you. But again, the answer is yes. The bid produced by the larger, three-lead company described above comes in at $777 a square foot. Though higher than for the one-person operation, that's in line with what larger established builders have been charging in major metro areas during the recent good years.

Comparing your numbers. To compare your figures to other companies, you need to learn about the typical construction charges in your area. You can find rough but useful approximations in the construction cost catalogs available at online and even brick-and-mortar bookstores. You can simply run a search on Google. Alternatively, and best, you can join or organize a local builder's association such as those described in my article "Your Best Opportunity for Business Education Might Be in Your Hometown" (*JLC*, Mar/19). Construction costs and pricing are frequently a subject of conversation at such groups. And, by the way, so are gross profit margins.

That conversation, too, can be of value to you. Knowing how your charges for overhead and profit as a percentage of your bids (selling price) stack up against other builders can be useful. Yes, to reemphasize, GPM is a crude, one-size-fits-all method of figuring overhead and profit. But it has some value as a way of comparing financial performance of companies in the same industry.

Thus, if you find that you are charging a relatively low percentage of selling price for overhead and profit, you have learned that you have room to bump up your overhead and profit charges.

On the other hand, a comparison of your GPM to that of similar builders might bring unpleasant news: that your overhead and profit charges are a low percentage of your selling price only because your construction costs are bloated. Whenever your costs are an unduly high percentage of your bids, they squeeze out room for overhead and profit.

(subcontractors) for on-site work as it does for companies deploying in-house crews. For example, a company has two project managers (PMs) who run all jobs. Production at the jobsites from foundations through finish, and even cleanup and punch-list work, is handled by trade partners and outside services. In that case, the company's capacity is two. It can't do more projects at a time than the PMs can handle. Using math similar to that used for our earlier examples, overhead can be recaptured across each of the supervisors' projects.

Let's say that you do have two project managers and that your overhead is $5,000 per week, or $2,500 per week per PM. One is responsible for a single project, construction of a small apartment building. You have estimated that the project will take nine months, which is 39 weeks. Therefore, to recapture your overhead, you will have to charge $2,500 x 39 weeks, or $97,500, for overhead on that apartment project.

Meanwhile, the other PM handles three relatively small projects—repairs, renovations, remodels—at a time. To recapture overhead on those projects, you divide $2,500 by three and see that you must charge $833 ($2,500 / 3 = $833) per project each week to recapture the overhead. If the PM's responsibilities shift, and he moves to handling two larger projects or five very small ones rather than three projects at a time, you adjust the overhead charges accordingly.

Jerrald Hayes raises another interesting case: using CDM for a company that has multiple divisions—design, general contracting, cabinetwork, and home repairs. Hayes, whose take on CDM is closely parallel to but not identical to my own, offers a solution at his thought-provoking website, paradigmprojects.com. My own

inclination would be to separately account for overhead for the various divisions—and where overhead costs spread across several divisions, apportion it among them as accurately as practicable. Then the appropriate variation of CDM could be selected for each division. For the general contracting division, overhead could be recaptured and profit assigned on the basis of capacity and of the duration of each project. For design, and for the handyman division as well, it might be best to include overhead and profit in a charge for each hour billed. And so on.

PRESENTING THE BID

After figuring overhead and profit charges for a project using CDM, you must decide how to display the charges in your estimate and bid. Among the possibilities:

- Placing them on a separate line or lines at the end of an estimate.
- Providing for them as part of your charges for project delivery in the general conditions section of your estimates.
- Simply wrapping them up in a single figure to be submitted as a lump-sum bid.

Each choice has its pros and cons and its place. But in all cases, you are accomplishing the same vital tasks: You are recapturing the amount of overhead with which a project actually burdens you. You are aiming to take in profit that aligns with the amount of your company's capacity that a project is actually using and the risk it entails. That is quite different, and in my view better, than taking a stab at overhead and profit with a formulaic percentage divorced from the duration of a project, the portion of your company's capacity it absorbs, and the risks with which it burdens you.

DO YOU WANT IT EASY OR ACCURATE?

You may find yourself shying away from the capacity/duration method, especially if you have long used percentage formulas. After all, it is so easy to automatically apply 10% & 10% or 35% GPM. You can even have a spreadsheet do it for you with just the click of a key. You can readily come up with reasons for continuing on that path. For example, you may have found that using 35% GPM and confining yourself to a narrow niche like kitchen and bath remodeling has consistently recaptured your overhead including good pay for yourself as company manager and provided acceptable profits.

On the other hand, the decision to go that route may be an ill-advised shortcut. Michael Anschel suggests that it is: "I'll argue that builders like a formulaic percentage-based system because it lets them avoid thinking about the real cost of overhead and how to assign it properly to a project."

I have to agree—and ditto for profit. I have encountered so many builders who wish that estimating and bidding would just go away. They want shortcuts. They want someone else, a cost book or a software package, to tell them what their costs for labor, material, and subs should be. They want plug-in formulas for overhead and profit. To be blunt, they want to avoid thinking about their single most important financial responsibility as owners of a business. They want to avoid thinking about and learning to nail down appropriate charges for their product.

I say "good luck" to those who want to go that route. I am concerned about their likely results over any longer term. The give-up-and-drop-out-rate in construction contracting, not to mention the sheer going-broke rate, is hard to pin down. But it appears to be astronomical. And a major reason, along with leaky buildings and sloppy change-order procedures, is resistance to the work of learning to estimate skillfully and figure overhead and profit thoughtfully.

The resistance is understandable. The learning curve can be steep and the work painstaking for a time. It surely was for me when I began running my own company. But the learning is not nearly as painful as robotically calculating overhead and profit via an "industry standard" formula and, as a result, finding yourself deep in a hole. That was the experience of a friend who became habituated to the GPM method.

"Learning CDM is not nearly as painful as robotically calculating overhead and profit via an 'industry standard' formula and, as a result, finding yourself deep in a hole."

He built a respected company. He did OK financially for a couple of decades. Then a severe recession struck. His overhead, meanwhile, remained about the same—same office, shop, office personnel, etc. But the average size (in dollars) of his projects and total revenue dropped by 75%. Since he was habituated to his 35% GPM, the dollars he was taking in for overhead also fell by 75%.

He was soon not collecting enough on his projects to recapture his ongoing overhead much less make a profit. That is, he was losing money on every job. Because he had overhead and profit jumbled together in his GPM, he did not clearly see what was happening. His company did survive. But only because he slashed his own pay, then burned through all his working capital and mortgaged his home to raise the cash needed to keep his company afloat.

Had he been using CDM, he could have seen that his new, smaller jobs required different charges for overhead than his GPM method was providing. Now, just how he might have dealt with that hard truth is a matter for a whole other article on how you keep a company going when a severe downturn in the economy strikes and work shrinks radically. Whatever the case, you are better off starting with numbers that are clear and true—numbers CDM delivers.

David Gerstel is a veteran builder and the author of bestselling books on construction company management including Nail Your Numbers: A Path to Skilled Construction Estimating. *His most recent book is* Building Freedom: A Construction Pro's Path to Financial Independence. *You can reach him via his website, DavidGerstel.com.*


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Rescuing a Failing Structure

How an underbuilt roof led to destruction of first-floor joists

BY JAKE LEWANDOWSKI

Our company regularly performs structural repairs on 19th- and early 20th-century residential brick buildings in the Chicago area. This one was a three-story, 60-unit apartment building with wood-framed partition walls and floors and a nearly flat and severely underframed roof. The 2x10 joists, running front to back, didn't need to sag much before they were bearing on 2x4 ceiling joists. The partition walls beneath this ceiling were only meant to hold up plaster and lath but had become bearing walls supporting roof loads. The added live and dead loads transferred all the way to the first-floor joists, which had zero support under them and, over the years, had been cut up by previous contractors. You can see the extent of the damage this caused in the photos at the top of the facing page. Most of the joists directly below a full-height partition wall at midspan had failed, with many joists splitting along the centerline. The failure was especially noticeable at knots and other defects, which create a weak link in the lumber.

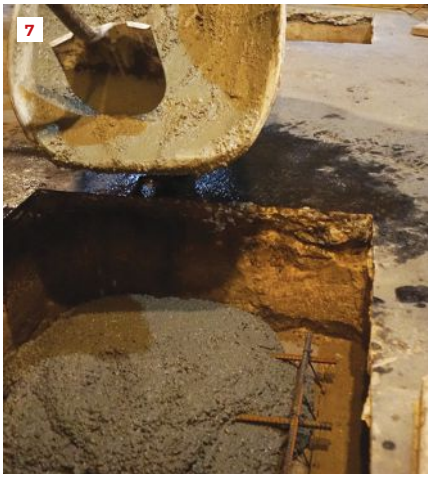
The magnitude of these failures prompted our first step: erecting emergency shoring. The occupants in the three apartments above were moved out and all the plumbing and electrical lines running through the floor were removed.

Working to engineered specs, we began our repair work by digging and pouring footings for steel posts to support an I-beam that would provide the necessary support for the wall above. Before installing this beam, we secured an LVL ledger to the basement walls to provide extra bearing at the joist ends and sistered 1¾-inch-thick LVLs to the joists. These LVLs ran slightly past the midspan where the beam would go, and on each side of the beam, we staggered the LVLs on different faces of the failing joists to increase the bearing. With the LVL sisters in place and raised in line with the bottom of the floor joists, we could install the beam and post down to our footings. The photos and captions on the following pages describe the sequence of steps needed accomplish the critical steps in this repair.

Jake Lewandowski is project manager for Great Lakes Builders, which specializes in structural repairs in Greater Chicago.

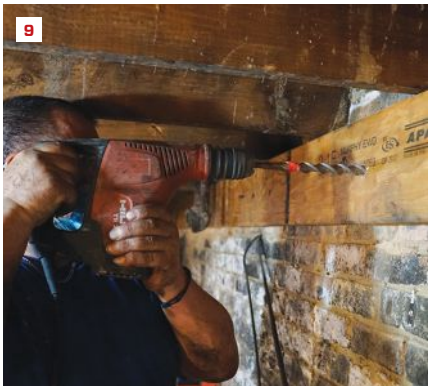
Photos by Jake Lewandowski

A partition wall, which sits directly above these damaged first-floor joists, was not designed to bear the added loads imposed by an underbuilt roof **(1–3)**. To begin repairs, the crew erected emergency shoring **(4)** on each side of where a steel beam will be placed to support the loads.



With the shoring in place, the crew cuts open the basement slab **(5)** to dig 36-by-36-by-18-inch footings for columns to support the new steel I-beam. Note the chairs **(6)**—called “bolsters” in the Midwest—to keep the rebar elevated when the footing is poured **(7)**.


8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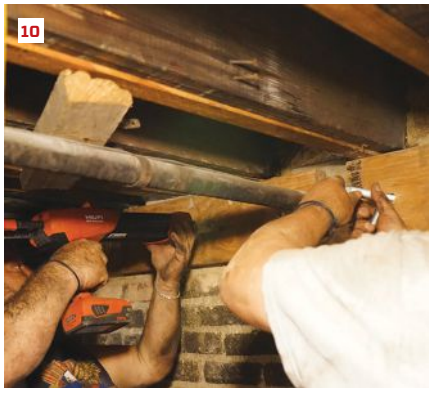
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Toby Bonilla grinds down the high spots on the basement wall in preparation for installing an LVL ledger **(8)**. The ledger is secured with threaded rod epoxied into the wall **(9, 10)**.


11


12


13

Working together, Toby and Ernesto Bonilla sister new LVLS to the existing joists **(11)**. With one end of the LVL sister bearing on a beam or ledger, the opposite end is jacked up to align with the bottom of the existing joist **(12)** and secured with structural screws **(13)**.


14


15

Because space was limited, the new steel beam had to be lifted in two sections, using a Sumner material lift **(14)**. With the lift holding the first section in place, shoring is erected below the beam **(15)**. At this stage, the beam is slightly low to allow the crew to move it laterally into a beam pocket in the far wall of the basement.


16


17


18

Prying against a joist **(16, 17)** pushes the first beam section into the pocket. Grouted into the wall after the columns were set, the beam bears on a steel plate **(18)**. Note the top plate on the beam installed with powder-actuated fasteners prior to lifting.


19


20

The second beam section is lifted into place and shoring erected to safely support it **(19)** until the steel columns, rising from the new footing below, are bolted to the bottom flange of the beam **(20)**. The columns are sized to allow a steel shim to slip below the base; non-shrinking grout is added below each base before it is bolted down with Simpson Titan HDs **(21)**. The author toenails through the nailer on the beam into the joists to keep them from rotating **(22)**. The far end of the second beam cantilevers beyond the far column. Above each column, stiffening plates have been applied by the beam fabricator to ensure loads transfer to the column **(23)**.


21


22


23

2022 Index

JLCONLINE.COM

The 2022 *JLC* Editorial Index contains listings for feature articles, selected departments, product reviews, and tool reviews. References are listed by topic rather than by article title. The following codes are used to help you find information:

*** — In-depth coverage**
L — Letters
Q — Question and Answer
P — Product information

Note: Articles from the Professional Deck Builder *sections in the March, May, July/August, and September/October 2022 issues of* JLC *are indexed separately on page 47 with page numbers corresponding to those within the* PDB *sections. The codes used are the same as listed above.*

JLC Index

Professional Deck Builder Index

Drive projects to a faster finish.

NEW Wafer-Head Construction Screw

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Deck-Drive DWP WOOD SS Screw

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Strong-Drive SDWS FRAMING Screw

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Pan-Head Marine Screw

Save time on your next job with the new Finish Trim and Wafer-Head Construction screws from Simpson Strong-Tie. These high-performance fasteners are designed for a wide range of applications — framing, cabinetry, trim, outdoor furniture and more. The Finish Trim screw's low-profile head makes it ideal for finish work, while the Wafer-Head Construction screw offers high pull-through capacity for strength. Both feature our unique SawTooth® point, which eliminates the need for predrilling and makes driving easy. And with our Quik Guard® coating, they're suitable for interior and exterior jobs.

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SIMPSON Strong-Tie®

BY VINCENT SALANDRO

1. Time-Saving Column Wraps
Snap-Tite PVC Column Wraps from Superior Aluminum Products snap together for quick installation with no PVC glue or adhesive required. Wraps are available in 6- or 8-inch widths in lengths up to 10 feet with smooth or wood-grained white finishes. Surfaces can be painted with 100% acrylic exterior paint or acrylic with urethane additive paint, with a light reflective value greater than 55. superioraluminum.com

2. Recycled Bamboo-Hue Cladding
Fiberon has added a light brown hue called bamboo to its Wildwood composite cladding collection. Available in a variety of board lengths and widths, Wildwood cladding has an open-joint profile and is made from 94% mixed recycled wood fiber and plastic content. Fiberon says that a durable composite core will resist rotting, cracking, insects, and decay, and that the boards will cut and install similar to wood, without staining or painting maintenance requirements. fiberoncladding.com

3. Cold-Applied Waterproofing
Hydralastic 836 is a cold-applied, solvent-free, single-component waterproofing compound that does not shrink and has a low volatile-organic-compound content, according to the manufacturer. The product is suitable for use on interior or exterior concrete surfaces on above-grade or below-grade applications, such as positive-side waterproofing for foundations and split-slab applications. A 5-gallon pail costs $280. wrmeadows.com

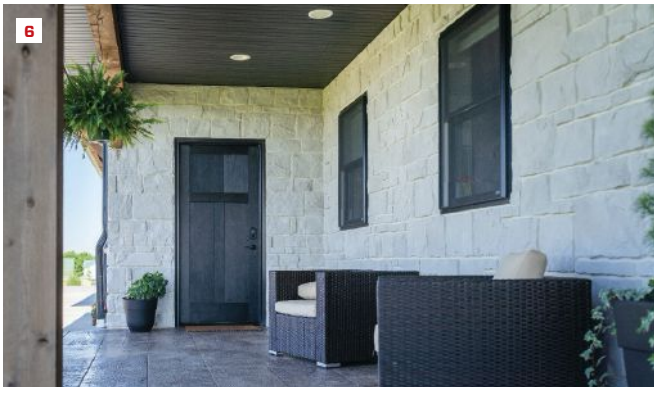
4. R-12 Duct Wrap
CertainTeed InsulPure Fiberglass Duct Wrap and WideWrap now have an R-12 option. Available in 48-inch (Duct Wrap) and 60-inch (WideWrap) widths to accommodate larger duct sizes and reduce material waste, the wraps are noncombustible and include recycled content formed with a formaldehyde-free binding agent. According to CertainTeed, the product can reduce unwanted heat loss or gain from equipment and ductwork and, when properly installed, helps to eliminate condensation problems on cold duct surfaces. certainteed.com

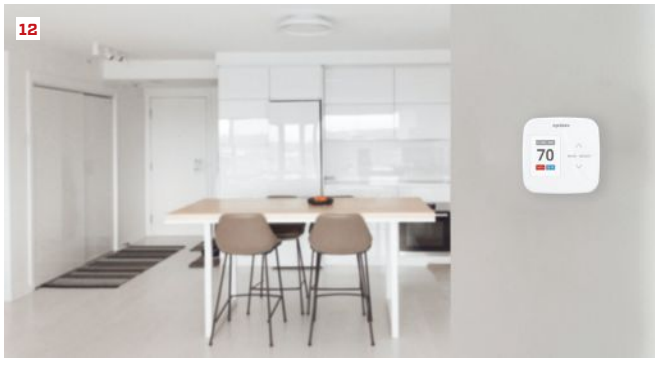
5. 14-Day Painter's Tape
CP 27 14-Day ShurRelease Blue Painter's Tape now features a solventless, rubber-based adhesive and a premium backing paper to improve sustainability, adhesion, and removability, Shurtape says. ShurRelease is primarily used for interior and exterior masking and can be safely applied to painted walls, glass, vinyl, metal, and wood. According to the manufacturer, the new formula prevents lifting and minimizes paint bleed, while allowing the tape to remove cleanly without damage for up to 14 days. A roll of 36mm-by-55m tape costs $11.75. shurtape.com

6. Black Vinyl Soffit
ProVia's Universal vinyl soffit product line now includes coal-black soffit in a solid or vented profile. Universal soffit is 0.040 inch thick with drilled aeration, controlled airflow, and deep V-grooves. ProVia says the material will not warp, bend, chalk, or fade and resists dents and scratches better than aluminum. The soffit is backed by a lifetime limited guarantee. provia.com

7. Self-Adhered Roof Underlayment
Polystick IR-Xe self-adhered ice and water protection underlayment for shingle roof coverings from Polyglass comprises a polymer modified bitumen upper compound and a proprietary self-adhesive SBS compound on the bottom to help prevent wind uplift. A split-release film allows for easy application. The underlayment is reinforced with a fiberglass mat and surfaced with aggregate to enhance skid resistance and allow exposure up to 90 days polyglass.us

8. Portable, Corded Power Hub
To help keep jobsites more organized, the PowerHub 1 from Klein Tools includes six surge-protected, overcurrent-protected, and covered 120-volt outlets, an elevated 5,000-lumen LED work light, two USB-A ports, two USB-C ports, and an integral GFCI to protect against ground faults. The vertical design saves space on site, and support arms keep small electronics off the ground while they're charging. An integrated power-cord wrap holds up to 50 feet of 12 AWG cord (cord not included) to facilitate storage and transport. The PowerHub 1 retails for $250. kleintools.com





9. Zippable Work Barrier
Made from durable lightweight fabric, ZipWall's ZipSheet barrier is machine washable and reusable. Sheets require no cutting or measuring and can be zipped together to form a barrier as wide as needed. Sheets are available in two heights for use in rooms with ceilings up to 9 feet and up to 12 feet. A 10-foot-by-9-foot ZipSheet with a door costs $97. zipwall.com

10. Drainage Composite Mat
ABP Advanced Drain drainage composite mat is composed of an extruded polymer matrix of tangled, randomly oriented monofilaments shaped into a series of parallel, porous channels to promote water flow in all directions and is backed with a nonwoven filter fabric designed to eliminate hydrostatic pressure from behind below-grade foundation walls, retaining walls, plaza decks, and balconies. The drainage mat can be installed vertically or horizontally and is sold in 39 1/2-inch-by-135-foot rolls of 1/4-inch thickness, with fabric on one or two sides. On the Advanced Building Products website, a roll with fabric on two sides lists for $648. advancedbuildingproductsshop.com

11. Low-Vapor-Permeance Under-Slab Barrier
Viper II Under-Slab Barriers help defend against water vapor and soil gas below a concrete slab. According to the maker, the multilayer vapor barrier/retarders resist punctures and tears, have low vapor permeance, and include a virgin resin in the manufacturing process that contributes to the long-term stability and durability of the material. Available in six weights from 20 to 6 mils, all Viper II products are tested to meet and exceed Class A, B, and C requirements in ASTM E 1745. The barrier is available in 14-foot-wide rolls of varying lengths. isibp.com

12. Programmable, Wi-Fi-Enabled Thermostats
All models in AprilAire's new S86 series of thermostats offer color display, capacitive touch interface, real language setup, basic and advanced installer settings, and menu-style navigation. Users can create daily or weekly settings. Models include the Multi-Stage Universal, the Multi-Stage Universal with IAQ—with ventilation, dehumidifier or humidifier controls—and the Wi-Fi Multi-Stage Universal with IAQ controlled via the AprilAire Healthy Air app. aprilairepartners.com

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These programs are funded by the energy-efficiency charge on all customers' gas and electric bills, in New York and Massachusetts per state regulatory guidance.

Metabo HPT 8-Gallon Trolley-Style Compressor

BY TONY BLUE

Cordless jobsites? Not quite … at least, not today. It's hot, probably 90°F. Locusts buzz in the nearby remaining pine tree. We're just outside Lake George, N.Y., in an early 2000s suburban neighborhood, the kind with no sidewalks on a road that purposefully meanders back and forth. Our company was hired to fix significant damage to a house, mainly the front porch and garage, caused by a large pine tree crashing down onto the roof earlier in the summer.

My guys will perform all the work themselves: framing, siding, roofing, decking, and so on. Rick's white work van is parked on the side of the road, a little rust in the usual spots. He opens the squeaking rear doors and grabs the rolled-up polypropylene hose off the hook. Rick is older; he's been around the block more than once and has built hundreds of houses. Jon is younger, more life left in his body. "I already got my battery nailer out, old man," Jon jokes. Rick replies, "You can use it—that damn thing is too heavy."

A couple of months earlier, I had been asked if I had some projects in the works on which I could try out Metabo's new electric 8-gallon wheelbarrow compressor. While I didn't have a specific project in mind, I knew we would use it. What I didn't realize was how perfect a compressor it was going to be for us, already replacing our workhorse gas compressor on a couple of jobsites.

We perform most of our work in-house, and for small jobs, our cordless framing nailers are spot on: not much setup, with extra batteries already on the site. Sure, they are heavier than our pneumatic nailers, but for occasional use, their weight is not enough of an issue to bother us. After a couple of hours or more of continuous nail-gun use, though, weight and speed of the tool become a concern.

Specs. In the past, we have had to pick between the lesser of two evils: a small pancake compressor that runs all day just to keep up and even then may not have enough power, or a powerful gas compressor that we have to listen to just the same, as well as purchase fuel for every couple of days. Queue "The Tank," the name that Metabo has given its model EC1315S mobile, electric wheelbarrow compressor. A single-tank, 8-gallon, 225-psi high-capacity compressor that we can plug into a standard outlet? Well, that porridge is just right, my friend.

We still use a compressor to power positive placement and framing nailers, as well as roofing, flooring, and coiled siding nailers for clapboards. Having one that is somewhat mobile and not too large is important to us. Although the Metabo is a little heavy—at 93 pounds—for one person to load into a work van or trailer, when stood upright, it fits in well with our other equipment.

Performance. In use, it held all the air we needed to run two nailers of any kind without continuously kicking on and off. In our experience, 5 cfm at 90 psi is pretty good for a portable electric. In our testing, the compressor went from zero to shut off (225 psi) in a little over three minutes. During operation, recharging from 175 psi to 225 psi took about 39 seconds. At a reported 76 dB, it is noticeably quieter than our gas compressor.

One day, I swung by the site to empty the dump trailer. A couple of the old tires were squatting and the Metabo made quick work of standing them up again, even with the weight in the loaded trailer. Eight gallons is comparable to most gas compressors. Starting at 225 psi, I should not have been surprised at the volume of air it sent into the tire before kicking on.

The rubber tires and metal handle feel sturdy and well built. We would, however, like to see the drain valve more accessible toward the outside without the user having to flip the compressor upright. And I would also love to have some type of holder for an air hose and connections; what stays attached to the compressor won't get forgotten and left on a nearby shelf.

Whether or not you are a Metabo loyalist, I think this compressor is a good value. For a powerful, portable, reliable jobsite compressor, $460 is a reasonable amount to pay. metabo-hpt.com

Tony Blue owns @SquaredAwayContracting in Greenwich, N.Y. He is a general contractor who enjoys nerdy energy efficiency and moisture management details.

With multiple nail guns in action, the author would typically need to use a gas compressor on this site, but the Metabo HPT 8-gallon portable compressor suits his needs perfectly.

Photo by Tony Blue

Mullet M5 High-Speed Cyclone Dust Collector

BY TOM O'BRIEN

Thanks largely to tool-triggered vacuums and HEPA filters, today's jobsites are much cleaner and safer than back when I got started. The only thing I don't care for is the expense of replacing filled dust bags and clogged filters.

To minimize this problem, cyclonic devices that pull dust particles out of the air ahead of the filtration have been standard equipment in woodworking shops for decades. Thankfully, this technology is finally making it to the jobsite. Earlier this year, I reviewed a portable cyclonic air scrubber (see "Filter-free Air Scrubber," Apr/22). Soon afterward, I had the opportunity to test the Mullet, a cyclonic dust separator that's designed to easily attach to most wet/dry vacuums **(1)**.

Putting it together. Upon opening the box, what struck me was that the Mullet's entire body is molded from a single piece of sturdy plastic. Company co-founder DJ Bell told me that it's manufactured using a process called "rotational molding," in which the raw plastic is placed inside a metal mold, heated up, and slowly rotated, causing the softened material to adhere to the inside walls of the mold and gradually form the desired shape. Besides affording the opportunity to make the unit lightweight and practically unbreakable, rotational molding enables the cyclone separator portion on top to have curved parabolic walls as opposed to the straight cone shape typically seen on dust separators. This tornado shape is more effective at spinning dust particles out of the air before they reach the vacuum, Bell said.

Assembling the unit simply required screwing casters to the base and connecting the exhaust to the vacuum's inlet port using 1 1/2-inch PVC pipe. All the fittings necessary to make a rigid connection with almost any shop vacuum were included in the box, as was a self-adhesive template that ensured I cut the vertical pipe in exactly the right places. The pipe fittings are pressure-fit, not glued, so if anyone wanted to use the Mullet with more than one vac, they could order an extra pipe from the manufacturer or use standard 1 1/2-inch Schedule 40.

Wheeling the conjoined twins around the work site was no problem—the integrated outlet pipe on top made a perfect handle—and separating them for transport required only the turn of a thumbscrew **(2)**.

Does it suck? I put this device through rigorous testing in my home shop and on various jobsites. Freed from concerns about running up the costs mentioned previously, I soon found myself breaking out the vac when the day before I might have reached for a broom, or settled for a tool-mounted dust bag, or cut the MDF in the driveway.

Inserting a middleman into the dust collection process never resulted in any noticeable loss of suction, even when the 5-gallon dump bin was filled to the brim **(3)**. After I had twice emptied the bin, the dust bag in my vac felt as empty as when I started testing.

When full, the bin is emptied by unscrewing the lid and pouring the contents into a trash bag. To prevent dust from escaping, Bell suggested using a rubber band or duct tape to fasten the trash bag over the opening or adding water to make a slurry. When a torrential rainstorm flooded my normally dry shop space, I was glad to find out that the Mullet also excels at wet vacuuming.

The Mullet is made in the U.S. and is available directly from the manufacturer for $250, shipping included. As of this writing, it has not been certified for work covered by RRP or silica rules, but testing is ongoing. mullettools.com

Tom O'Brien is a carpenter and freelance writer in New Milford, Conn.

The parabolic cyclone that forms the top section of the Mullet M5 Cyclone Dust Collector scrubs dust particles out of the air before they fill up the vacuum cleaner bag or clog up the filters **(1)**. A simple thumbscrew connects and disconnects the Mullet from the vac with ease **(2)**. Every time the 5-gallon-capacity dump bin fills up, a dust bag lives to fight another day **(3)**.

Photos by Tom O'Brien

A Value-Priced Track Saw

BY MARK CLEMENT

The Ryobi PTS01 One+ HP brushless 6 1/2-inch track saw is not the most powerful or rugged one on the market. But at $300—which includes the saw, a blade, two 27 1/2-inch tracks, an 18-volt 4.0-Ah lithium battery, a charger, and accessories—it's a great value.

If you're a power user, you could (and probably should) spend hundreds more for a "pro-grade" track saw. But not everyone needs pro-grade quality for what I consider to be a specialty tool for occasional use. What's important is having a tool that works for the job at hand. Before track saws began to make their appearance on jobsites, I used a wormdrive saw and a shooting board to make straight cuts; with a small investment in the Ryobi saw, I can make those cuts much more quickly, accurately, and safely.

Performance. Having used the Ryobi track saw on several projects, including a couple of decks and an interior trim job, I've found that power is not this saw's forte. However, if the only thing standing in its way is 32 feet of composite decking or a door that needs resizing—both of which I tested the saw on—it's smooth sailing. I also used the Ryobi to trim the edges of a 16-foot-deep pressure treated deck, with great results (Ryobi claims that the saw can rip up to 260 lineal feet per charge). Sure, other saws have longer tracks, or longer battery life, or are corded, but for 16 feet? The Ryobi handled the job easily.

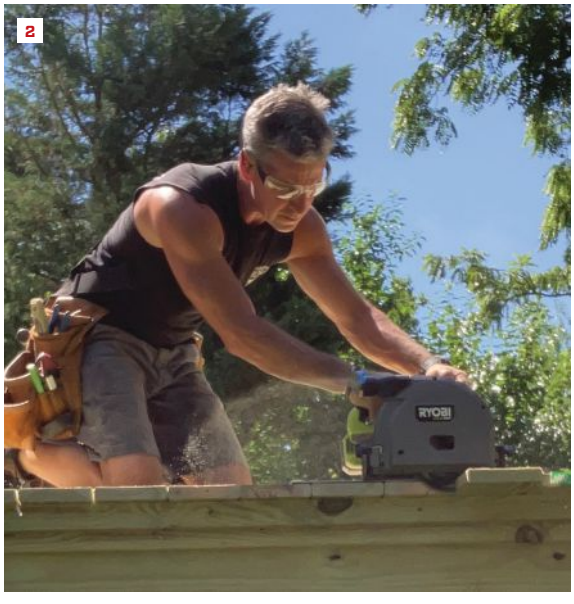
The plunge mechanism is the same as on every other track saw I've seen and works smoothly. The shoe is plastic but seems plenty durable for occasional use, while the blade height adjustment is just as finicky as on saws that cost 30% more. One quibble is the saw's rear-facing, nonadjustable dust chute: Without a hose attached to it, the port shoots dust onto both the track and the user; when attached, the hose sticks out right next to your hand. This is a minor chafe, however, as I work mainly outdoors.

Cutting capacity. When the saw is used with the track, its cutting capacity at 90 degrees is 1 15/16 inches; without the track, cutting capacity is 2 1/8 inches. You can cut bevels up to 48 degrees; at 45 degrees, the cutting capacity is 1 7/16 inches with the track and 1 9/16 inches without it. While the thumb release takes some getting used to, the bevel adjustment works fine.

The saw comes with a decent 40-tooth carbide-tipped blade, and the kit includes two 27 1/2-inch tracks that bolt together to form a single 55-inch track (additional sections can be bolted together to form a longer track). The tracks are on par with most others in the category in terms of functionality and are gummy enough to stay in place when you're breaking down sheet goods, cutting door bottoms, or trimming composite or PT decking. As far as I know, though, the tracks can't be used with any of the other tools in Ryobi's 18-volt One+ system. ryobitools.com

Mark Clement is a small-town carpenter in Ambler, Pa., author of The Carpenter's Notebook A Novel, *and member of the JLC Live Demonstration Team. Follow him on Instagram at @myfixituplife.*

Photos by Mark Clement



The Ryobi 18V One+ HP track saw has a brushless motor powered by a 4.0-Ah battery that spins the blade at 4,300 rpm **(1)**. The 6 1/2-inch saw has a rear-facing dust port that ejects sawdust directly behind it when not connected to a vacuum system **(2)**.

BY CHRIS YERKES

Traditional Siding for an Untraditional Hemp Home

Many homes on Cape Cod are clad with cedar shingles, but I'm confident none were built like the one that my company, Cedarworks, recently sided. As part of the homeowner's goal to reduce the project's embodied carbon—the upfront CO_2 released into the atmosphere as a result of the construction process (see "A Builder's Guide to Carbon-Neutral Building Practices," Nov/22)—general contractor C.H. Newton Builders of West Falmouth, Mass., had sprayed the walls and roof with hemplime insulation.

Hemplime (or hempcrete) is made from the hemp plant's woody core, a lime-based binder, and water. On this house, it took the place of sheathing, housewrap, and spray-foam insulation. The mixture is sprayed into the framing cavities from the exterior after battens have been nailed to the interior surfaces of the studs **(1)**. The result is a low-carbon, airtight wall assembly with an R-value of about 2.5 per inch that can be finished with lime plaster or, in this case, vapor-permeable cedar shingles over a rainscreen assembly (learn more about this project at capecodhemphouse.com, and about hemp as a building material at US Hemp Building Association, ushba.org).

Before we could install the rainscreen, all of the exterior walls needed to be finished with a lime render, a porous plaster that won't trap moisture. Then plywood blocks were screwed through the thick hempcrete into the wall framing with 12-inch-long screws **(2)**. We fastened vertical 1x4 battens to these blocks, shimming as needed to straighten the walls because of the irregular surface created by this construction method **(3)**. To complete the rainscreen, we installed horizontal 1x4 battens 5 inches on-center for the white cedar shingles, again using shims as needed to create flat wall planes **(4)**.

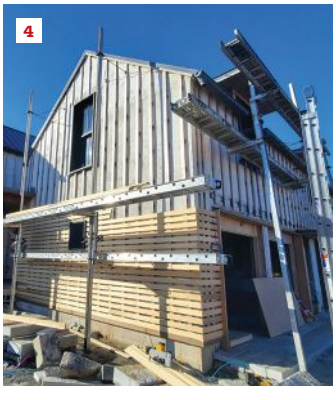
Once the rainscreen was installed, shingling was relatively straightforward. We started with woven corners to establish a 5-inch exposure for each course, nailing the corners together with stainless steel ring-shank 4d siding nails **(5)**. In the field, we used stainless steel narrow crown staples, keeping them short at $1\frac{1}{4}$ inches long to avoid damaging the plaster surface of the hempcrete underneath the rainscreen **(6, 7)**.

Chris Yerkes owns Cedarworks (cedarworksonline.com), in Brewster, Mass.


1


2


3


4


5


6


7

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