IN THE NEWS

EDITED BY TED CUSHMAN

Deck Collapse Injures Scores

Ledger splits from faulty lag screw installation

POLSON FIRE DEPARTMENT

Lag screws and fragments of the split ledger board remain attached to the building, and the mostly intact deck lies on the ground below, in these photos taken the morning after the structure's sudden collapse sent dozens of injured to the hospital.

Summer seldom passes without at least one report of a serious structural failure of an outdoor deck, with large numbers of casualties. Unfortunately, the summer of 2004 is no exception: On July 30, a wood deck collapsed suddenly under the weight of a party crowd at the Diamond Horseshoe Casino in Polson, Mont., injuring dozens of people and sending four with life-threatening injuries to hospitals by helicopter.

Area hospitals were flooded with injured, according to a report by Sherry Devlin of the *Missoulian* newspaper. "In addition to the four life-threatening injuries, three others were classified as critical and 27 as non-life-threatening by EMTs on the scene," writes Devlin. "At least 20 other people arrived at Polson's St. Joseph Hospital in cars and pickup trucks soon after the accident, and another 20 sought medical help during the day on Saturday." Nurses set up a triage center on the St. Joseph's hospital lawn to handle the overflow, according to Devlin's report. Emergency crews responded from five nearby towns, some ambulances driving an hour over rural roads to reach the scene.

Ledger failure. Not surprisingly, the Montana collapse was traced to a failure of the connection point between the deck and the building. Hired by the city of Polson to investigate, architect Paul Bishop of Building Solutions LLC, reported that the deck's untreated Douglas fir ledger "failed downward and outward as a result of vertical loading well

continued on next page

Soil Tests Required in Upstate New York Community

Building officials in Amherst, N.Y., where soil and foundation problems have attracted widespread press attention (see "Foundation Flaws Spark Buffalo Brouhaha," *In the News*, 8/03), are now requiring a soil test for every new house project north of the Onondaga Escarpment, a geologic feature that marks the boundary of the area's deep clay deposits, reports the *Buffalo News*. A town rule requiring rebar in all foundations and footings was shot down last year by a state building code review board, but the town's latest move is consistent with *International Residential Code* provisions allowing local authorities to mandate soil testing where conditions warrant. Where testing reveals problematic soil types, permit applications will have to include an architect's or engineer's letter stating that the foundation design is appropriate for site conditions.

Deck Collapse Injures Scores

continued from previous page

below the maximum allowed by the building code."

"My conclusions were threefold," Bishop told *JLC* in a telephone interview. "The initial problem was that the ledger was attached directly to the siding with no weather protection. That allowed moisture to get between it and the building, and it began to rot. The second issue was that the lag screws were too few and far between, and they were driven through the ledger with a rotary hammer rather than through pre-drilled holes, which induced a splitting force. And then, all of the screws were in exactly the same plane, so that the splitting force was aligned along the entire 57 feet of ledger. The straw that broke the camel's back was that the builder used 2x8 joist hangers on a 2x12, so that all of the weight was distributed to that ledger below that plane of lag bolts."

The deck collapsed after midnight Friday night, and Bishop inspected the wreckage the next morning with a group of town officials. "When I got there, I saw that the ledger had basically unzipped itself," he says. "There were fragments of ledger on the building, and the rest of the ledger remained securely fastened to the deck, which remained intact, on the concrete patio below." Two loud cracking noises, heard by people on the deck just before the collapse, must have been the sound of the ledger splitting, says Bishop: "I didn't see anything else broken."

Evidence removal. Paul Bishop is the only architect in the county surrounding Polson. "And I knew that the only engineer in the county was on vacation," he said. "That's why I offered my services to the town on Saturday morning." Bishop made his inspection barely in time to view the scene undisturbed: By Saturday afternoon, the building owner had allegedly hired a local firm to cut the wreckage up and take it to the landfill. Police have reportedly opened a criminal investigation, centering in part on "exfoliation" (illegal removal) of evidence. At least one victim has already filed a civil lawsuit. "There will probably be condos there instead of a casino, in the end," said one town official.

Bishop says, "My firm has been hired to go to the landfill and retrieve every scrap of the deck and put it into storage. Ultimately it may be reconstructed, the way they put crashed airplanes together." At the bottom of the pile of debris, he

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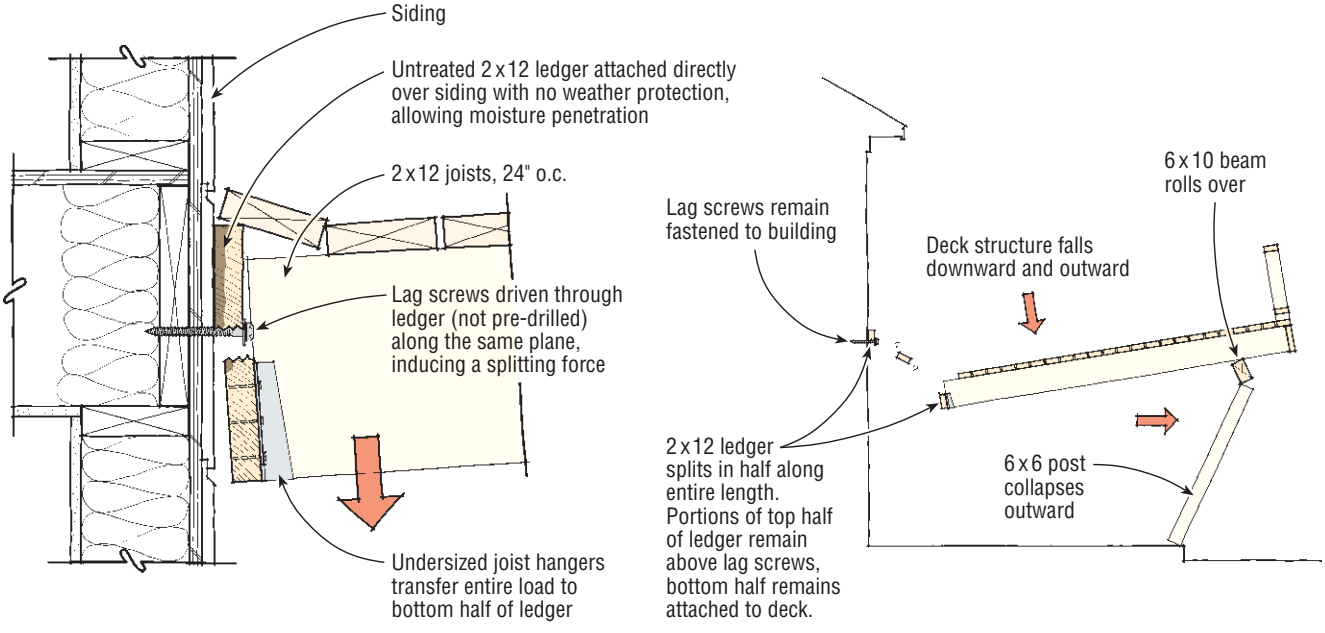
Ledger Failure: Cause and Effect



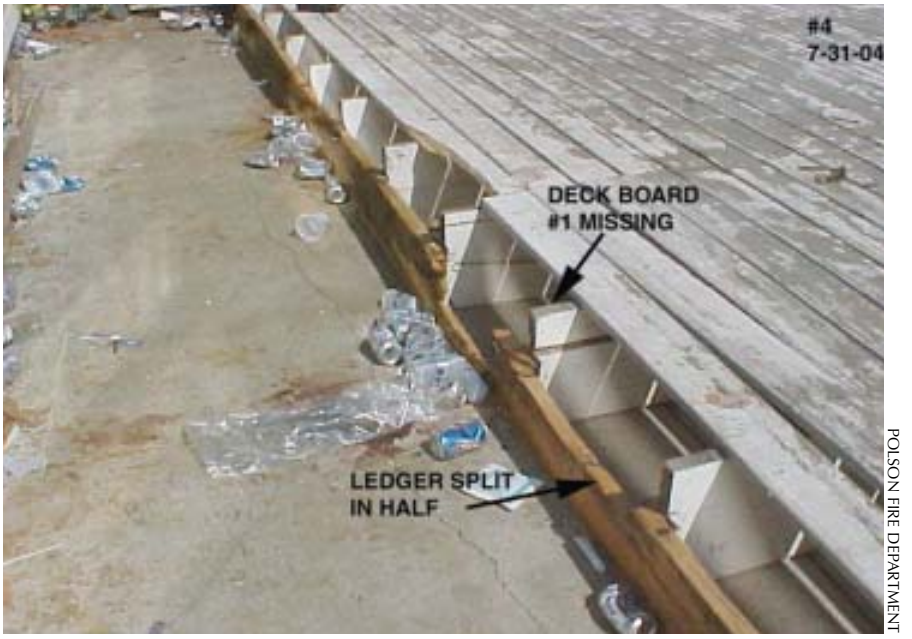
Lag screws driven through the centerline of the deck ledger created a critical split line in the member, which was loaded below that line by undersized joist hangers, according to an architect's report. When the ledger suddenly split, the deck toppled out and down, injuring dozens of people.

Deck Collapse Injures Scores

continued from previous page

said, was a significant find: "We got some pieces of split ledger that showed weathering around the fasteners. Maybe at some previous event where there were a lot of people on the deck, the ledger split partially, and then water was able to get in there and discolor the split. And then there were some areas of raw wood where it really split when it collapsed. But the thing had been trying to tear itself apart for some time."

In the immediate aftermath of the collapse, a lawyer for the building owner had pointed to the fact that the deck was inspected in recent years by fire officials, and passed. But Bishop says those inspections had no relation to the deck's structural integrity. "The fire department inspects for things like if their fire extinguishers are charged, if their emergency and exit lights function, if their exits weren't blocked by keno machines — it was a very cursory kind of a thing." The fire inspectors aren't trained to evaluate structure, he said.



POLSON FIRE DEPARTMENT

A morning-after photo shows the bottom half of the split ledger board still attached to the otherwise intact deck assembly.

Allowable load vs. occupancy. The misunderstanding points up a common source of confusion in reporting about deck failures: the difference between a deck's allowable occupant load and its required structural bearing capacity. The two unrelated issues are addressed in different chapters of the code: Occupancy is part of the safe egress requirements, while deck bearing capacity is a structural issue.

Bishop and Polson Fire Chief Thomas Maloney had to thrash the issues out as they probed the Polson failure. "It took a little time for him to explain it to me," says Maloney. "He kept telling me that by code, the deck should support more people than could fit onto it. And I kept saying, 'I don't care if you could park ten Abrams M-1 tanks up there — they aren't allowed to have that many people on it."

The issue of whether the deck had more people on it than its permitted occupancy load is debatable, but irrelevant, says Bishop. "A lot more people wanted to be outside on the deck that night than wanted to be inside the building, so it was loaded. I don't think it was over the code max, but the bar owner can say that the number of people made it fail, and that is true in a sense. But by code it should hold more than that weight. And given enough time, it could have collapsed under two people some day, the way it was deteriorating and coming apart."

Bishop draws lessons from the catastrophe. "The way the building code is structured," he points out, "nobody is going to come back and re-inspect that deck for you over the years. You have one chance to do it right — when it is first built and inspected. The contractor and the carpenters and the inspectors — you need to have a conscience about what you are doing. It is so simple to do it right, but the consequences of doing it wrong are so grave."

"A lot of people, especially in rural areas, moan and complain about the building code," Bishop comments. "'Oh, the building code, the building inspector, that miserable son of a bitch.' But that building code is the basic threshold standard for safety, as far as I am concerned. We have absolutely nothing else to protect us, even from ourselves, but that building code. And when guys just flout it — I mean, this particular deck was something you wouldn't want on the back of a trailer house."

The disaster could have been far worse, he observes: "That deck was filled with young people, athletes who were in town for a basketball tournament. Even so, there were some hideous injuries. If it had been a wedding party, with elderly people, a lot of them would not have survived."

Trench Work Poses On-Going Hazard

Working in a trench is one of the most dangerous jobs on a construction site. Federal statistics show 542 worker deaths associated with excavation or trenching between 1992 and 2001 (the Feds say the true number is higher). Construction laborers were the most frequent victims — 236 laborers died in digging accidents during the period — but other trades also suffered: 42 plumbers, 38 excavator operators, and 27 con- struction supervisors were counted among the dead.

By type of employer, the largest class of victims — 141 — worked for excavating firms, while 131 were water, sewer, or other utility workers, and 59 worked for plumbing or hvac contractors. Only 19 of the dead were employed by homebuilders. But anecdotal evidence shows that many of the laborers who lost their lives digging were working on homes at the time, for foundation contractors or other subs on the job.

Things haven't changed in the new century, judging by recent press reports. The summer's rushed construction pace and heavy rains that soften the earth have contributed to a series of fatal accidents that made local papers. In one case, 40-year-old worker Gary Dillon died in a 4-foot-deep sewer trench for a new development in Newark, Ohio, on July 27, according to a *Newark Advocate* report.

Concrete workers nearby rushed to free Dillon from the earth, but their efforts were in vain. "We found him and pulled his head up, and he still had a pulse, and we kept digging and digging, trying to yank him out of there," one told a reporter. "We couldn't get him out, and his pulse stopped somewhere during that."

Trench collapses account for the majority of excavation deaths in recent government statistics. Although OSHA safety requirements for sloping or shoring trench sides are effective – the agency says deaths declined by 60% after rules were tightened in 1989 — the precautions are still widely omitted. In the case of the Newark accident that killed Gary Dillon, the rules might not have applied in any case: The 4-foot-deep trench that buried Dillon did not reach the safety rule's 5-foot threshold.

But even a shallow trench can kill. One reason trench risks are taken lightly in the field may be that people underestimate soil's deadly nature. As *Small Flows Quarterly* pointed out last year, "A cubic yard of trench soil weighs 2,700 pounds, about the same as a mid-sized automobile. A person buried under only a couple of feet of soil would experience enough pressure on the chest to prevent the lungs from expanding. Suffocation would occur within about three minutes." The force of falling earth can also crush organs and break bones, and the crushing of large and small blood vessels and cells releases toxins into the body. Victims who don't suffocate often die of internal bleeding or shock.

The Pipe Man (short for "pipe manipulator") robotic pipe-laying device could prevent dozens of deaths a year by avoiding the need for sewer and utility workers to work in trenches.

The Fall 2003 *Small Flows* article introduced a new technology that could sharply reduce trench risks, if adopted. The robotic "Pipe Man" de-vice developed by Leonhard Bernold and colleagues at the North Carolina State University's Construction Automation and Robotics Laboratory (www2.ncsu.edu/ncsu/CIL/CARL) eliminates the need for workers to hand-lay pipe in the trench. In tests, Bernold says, the device was faster and cheaper than traditional methods. But he says commercialization is held up by a lack of funding for final refinements.

More information on trench safety is available at www.cdc.gov/niosh/topics/trenching.

Light Heavyweight: New Concrete Lets In the Sun

For a material that dates back to Roman times, concrete is surprisingly able to throw the world a few new twists. In the new "Liquid Stone" exhibition at the National Building Museum in Washington, D.C., architects and inventors are putting concrete through a few paces designed to amaze and amuse. One standout: translucent concrete that uses glass fibers in the mix to allow the passage of light.

Glass fibers in the mix let LiTraCon concrete blocks achieve translucency, opening up a new set of options for daylighting and nighttime illumination in concrete construction.

Hungarian architect Aron Losonczi developed the new material several years ago while studying in Stockholm, Sweden, after being inspired by a glass-and-concrete sculpture he had seen in Budapest, Hungary. But the material has potential uses that are as practical as they are artistic: Andreas Bittis, an executive at LiTraCon, a German company that plans to bring the product to market within the year, suggested that translucent concrete could be used to bring natural light into subway stations, or to provide fire egress structures that would have day-lit visibility even if power failed in an emergency. An early demonstration project uses LiTraCon blocks to make a sidewalk that glows at night with artificial light; Bittis suggests that the same product could create lighted speed bumps or pedestrian crosswalks for streets.

The "Liquid Stone" exhibit is free to the public, and will be open until January 23, 2005. More information is available at www.nbm.org.

OFFCUTS

Builders and county officials in greater Cincinnati, Ohio, are battling over proposals to limit the expansion of housing developments around the city, according to the *Cincinnati Post*. Warren County Commissioner Mike Kilburn is proposing to put all subdivision permits on hold while the county finds out whether it can charge a $10,000-per-house impact fee for street and school construction costs. But Cincinnati HBA president Timothy Hensley says new home construction pays back more than it costs localities within five years, and that with the region "crying for construction," talk of a building moratorium is "scary."

The Colorado Supreme Court says developer W.O. Brisben must pay the court costs of Air Force Captain Eric Krystkowiak after losing a lawsuit for damages based on the captain's outspoken opposition to a Brisben project, according to a story in the *Rocky Mountain News*. Colorado law provides for citizens to recover court costs if they defeat a lawsuit brought in retaliation for democratic participation. Brisben had argued that Krystkowiak broke a contract when he spoke against Brisben's application to build apartments near his condo (Krystkowiak had joined the condo association's effort to stop the apartment project, but left the group when it struck a deal with Brisben). However, the high court ruled that the association's decision could not abridge Krystkowiak's constitutionally guaranteed freedom of speech.

FEMA Will Pay to Move Threatened Condos

In a rare decision, the Federal Emergency Management Agency (FEMA) has agreed to help the owners of a North Carolina beachfront condominium project cover the cost of moving the building back from its eroding beach frontage. In July, FEMA announced a $3.6 million grant to the town of Kure Beach to help the building's owners tear it down and rebuild it on the other side of U.S. Highway 421.

Known as "The Riggings," the wood-frame clapboarded multifamily building has been threatened by encroaching waves for years. Federal erosion-control programs are active all around the site, but because of environmental restrictions, The Riggings' own particular beach isn't included. On the northern side, the U.S. Army Corps of Engineers runs a "beach nourishment" project that feeds sand onto the eroding beach to keep it from disappearing. To the south sits a rock breakwater more than half a mile long (technically illegal, but allowed as an exception because it protects parts of historic Fort Fisher from washing away). But near The Riggings, rare "coquina rock" outcroppings form a critical habitat that the Corps isn't allowed to dump sand on; the Riggins has been relying on giant sandbags near the base of the building as a temporary protection since 1985, when an older rock wall failed.

Public interest groups have questioned the expense of a federal relocation program that leaves the building still in an exposed location. But residents say it's justified because their problem is at least partly the result of other federal efforts and regulations.

Painting Brown-Coat Stucco Causing Problems in the Southwest

As if the stucco industry needed another black eye in the wake of the much-publicized latent defect issues surrounding EIFS a few years ago, suppliers and contractors in some Southwest markets are witnessing a public backlash against the material as moisture problems arise from improperly painted exterior stucco on new homes. "It's become a lucrative repair business for me, but the [stucco] industry is suffering," says Steve Scutt, owner of Scutt Plastering in Albuquerque, N. Mex. "I've seen problems on homes that are just completed to those that are four years old."

The problem, says Scutt and others, is that builders at the lower end of the market aren't waiting long enough for a single brown coat of stucco to properly cure before applying a non-porous latex or elastomeric paint. As a result, the coating traps moisture in the wall, hindering the stucco's ability to properly cure and reduce its pH level to mitigate efflorescence and other problems on the surface. "The brown coat needs to cure at least 28 days so the pH can drop [to neutral]," says Richard Owens, sales director for El Rey Stucco in Albuquerque, a supplier to several Southwest markets.

Moisture generated from evaporative cooling systems, an inexpensive air-conditioning alternative in the Southwest, as well as building code and warranty issues resulting from one-coat applications, add to the potential for failure, callbacks, and maintenance issues.

Painting the textured brown coat of stucco (as opposed to applying a pigmented finish layer) has become standard practice in affordable housing projects in markets such as Las Vegas and parts of Southern California, saving builders a few hundred dollars per house on the stucco contract and making it easier to match surface repairs to the original color of the wall.

But as the trend migrates to Arizona and New Mexico, climate issues in those markets — especially seasonal and even daily temperature swings — have caused problems ranging from excessive stucco cracking and spalling to latent moisture issues, including mold growth and structural degradation. "It's a cardinal sin to paint stucco in this part of the country," says Scutt, in light of the freeze-thaw cycles of the Albuquerque climate. "There's been a big influx of builders coming in with no clue about our market."

It's also critical to get a proper mix and thickness; ICC-ES specifies a 1/2-inch thickness for one-coat (or base-only) stucco applications as a comparable alternative to a three-coat application. In addition, a proper base coat mix is essential to lasting performance. "The mixer is the most important guy when it comes to stucco quality and its ability to take paint," says Scutt. "Too much sand, and it'll never cure properly."

While no stucco-specific paint exists, coating manufacturers recommend that both traditional or synthetic stucco surfaces be clean, dry, and dull and have a neutral pH level prior to painting with two coats of a high-quality exterior latex or elastomeric coating, the latter of which helps bridge cracks. Walls with a high pH level need an exterior acrylic masonry primer that is high in alkali and resistant to efflorescence prior to the finish application. "Moisture leaks and high pH are typically the reasons for stucco failures," says Steve Revnew, director of architectural marketing at The Sherwin-Williams Company in Columbus, Ohio.

— Rich Binsacca is a freelance writer in Boise, Idaho.

SHERWIN WILLIAMS

Painted stucco has replaced pigmented applications in some Southwest markets, but suppliers worry that builders aren't allowing the cladding to cure properly and possibly causing latent moisture problems.