

Excerpt from *Confessions of a Country Architect* By Don Metz

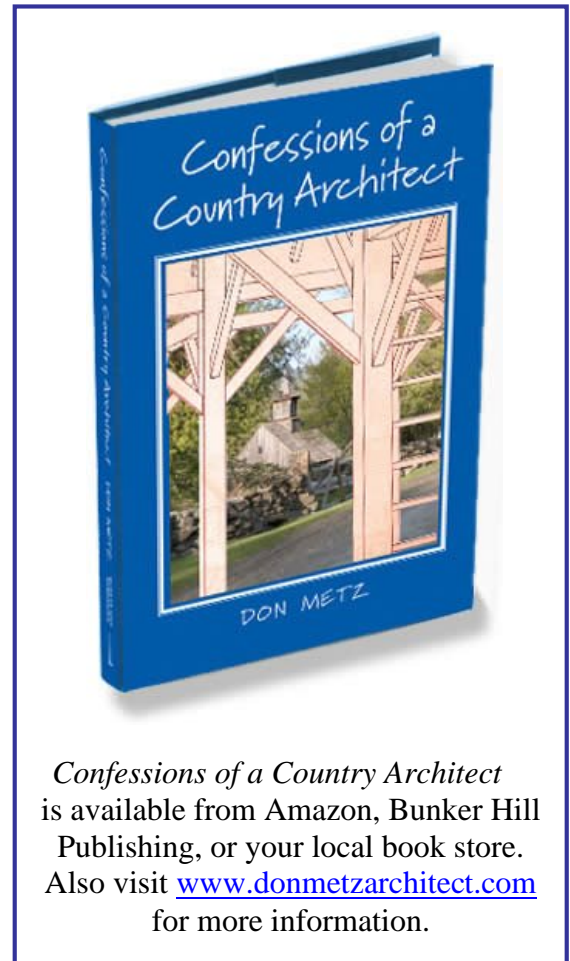
Errors and Omissions

A popular architectural legend goes like this: At the opening ceremonies for a university library, the trustees are sharing a celebratory glass of champagne. Proud of their achievement, they heap praise upon the beaming architect and enumerate the multiple accomplishments that led to this crowning moment. During a pause in the conversation, someone inquires, "How did you calculate the weight of all those books?"

"The books?" The architect's stricken expression tells the rest of the story.

My local phone book weighs a pound and serves fifteen adjacent towns in Vermont and New Hampshire. Almost half of the book consists of yellow pages, which begin with glossy, full-page advertisements shilling the services of injury-claim attorneys. Posed photos of these justice jocks strive for a square-jawed, sensitive-to-the-client but tough-as-heck-on-the-bad-guys effect. If these costly ads are any indication, taking someone to court is our area's most profitable industry.

A few pages before the listings for attorneys, wedged between 'Archery Equipment' and 'Armored Car Service,' the careful reader will find 'Architects'. There is no bold face type here, not a single display ad or hint of self-promotion. Architects don't advertise. Instead, we hope to find work via published examples of our projects, competitions, word-of-mouth, and the benevolent patronage of wealthy relatives. Could it be that modesty warns us away from self-promotion? More likely, it's a matter of ego. We wonder how interested in serious architecture these potential clients could



be if they pick a name at random from the yellow pages, as if they were shopping for the nearest Roto-Rooter service.

Every architect's career is at some point visited by the nightmare of a collapsed building. Just imagining the loss of lives and a building collapsed in ruins can load the drawing of a single line with a ton of anxiety. Most engineers and architects, like physicians, carry professional liability insurance. They pay hefty premiums to protect themselves against the possible outcome of unintentional, but ultimately inevitable lapses in judgment, errors and omissions. These insurance policies, ironically, cover the insured party only during the period in which premiums are being paid. Having dutifully sent off a quarterly check for forty years does nothing to protect against liability after the policy is closed. If, for instance, in year forty-one, the architect cancels the policy -- and a claim is presented relating to a project completed fifteen years before -- the insurance no longer covers the claim. Some architects with small practices, myself included, decide the cost of professional liability insurance is too high for the protection offered, and proceed into the litigious world of looming disasters stark naked.

I've occasionally wished I were better dressed. Lamar was appalled when he first learned of my decision. "There are people out there who would love to bankrupt you." His employer spends obscene sums every year on insurance to cover the multiple millions of work they produce. Tom Luckey, on the other hand, thinks the insurance industry is purposely designed to ruin a good party.

Over the last three decades of practice, I've committed my share of minor errors and omissions, but all of them have been turned either into auspicious opportunities or equitable alternatives. One such problem almost didn't, and but for the good will of my clients, might have led to first-hand experience with one of those square-jawed phone book attorneys

In the early 1970s, I designed and built a series of earth-sheltered houses. The first of these houses, the Winston house, was sited in a high alpine meadow with infinite views. A stand-up structure would have been a violation of a beautiful pastoral setting. I figured that by tucking the house into the hill and generously planting the roof and foreground, I'd be able to obscure much of the building and minimize its visual impact. Today's energy-saving, sustainable mindset was a few years short of being articulated; in 1971, heating oil cost 19 cents a gallon. When OPEC cut

production in 1973, the cost of oil tripled. Overnight, energy-efficient strategies became architecture's compelling cause celebre, and earth-sheltered houses suddenly became the bulk of my work. In 1974, Architectural Record Magazine recognized the Winston house with an award for excellence in planning and design. Along with architects such as Malcolm Welles and John Barnard, I developed the earth-sheltered concept into a viable building option. Among other popular approaches (super insulation, double envelope and solar heated) the earth-sheltered concept was conceptually the simplest: earth (dirt cheap) can be used to isolate a building from the effects of extreme hot and cold weather. Five feet below grade in New England, earth temperatures hover around 50 degrees Fahrenheit year 'round. A typical building entirely exposed to the weather loses and gains heat at exponential rates as the weather outside gets colder or hotter. Covering that same building with a mantle of earth removes it from the extremes of weather, which for us in New England, is the equivalent of moving the building to Virginia.

For those who have never seen a well-designed earth-sheltered house, the idea evokes images of a dark, moldy cave. A well-designed plan dispels all such fears the moment one walks in the door. For example: imagine a rectangular floor plan placed on a southerly sloping site. The south-facing wall (the long dimension) receives sun all day and is generously glazed, while the north wall is buried into the side of the hill (i.e. Virginia). The northern portions of the east and west ends are also tucked into the hill. A foot or two of earth covers the low-pitched roof, which can be interrupted with skylights where required. Properly designed, there is no sense of being "underground". With more than half of the house enveloped within a snug mantle of earth, the effects of icy storms and hot, humid summers are significantly mitigated, as are reduced costs of heating and cooling.

And so it was that Ray and Pam came to see me on a sunny day in June of 1976 with the intention of building such a house. Ray had recently retired from a medical practice and was anxious to spend his time gardening with Pam and making sculpture and jewelry. Pam couldn't wait to get out of their quaint but drafty farmhouse and into a cozy new home with new flower beds.

The building site we selected was at the northern edge of a pasture above their old farmhouse, a sloping hillside with generous views of the mountains to the south. With three modest bedrooms and a study, our final scheme

resembled the approximate proportions of a shoebox attached to a smaller, similar shape -- the garage -- offset to the northwest corner of the house. Walking up the hill towards the house, you see mostly glass under an overhung roof with tufts of greenery creeping over the rim. Walking down the hill from above, a stubby chimney and two skylights provide the only hint of the dwelling below until you reach the edge and look down at a patio.

Ray and Pam were commendably supportive, relaxed clients. They had seen and admired several other earth-sheltered houses I'd designed, and our collaboration proceeded quickly and smoothly. By October, all the working drawings were completed and a builder selected from among the three who submitted competitive bids. Wayne Pike had already built several earth-sheltered houses with me, and was well qualified for the job. Concrete was poured in early November, the foundation was backfilled, and the heavy-timbered roof system (6 x 12" hemlock timbers spaced 18" apart) was begun by Thanksgiving. By the time the roof decking (2x6 tongue-and-groove fir) was nailed in place, and the insulation and waterproofing applied, winter was upon us and Ray and Pam had left for warmer climes.

It wasn't that they weren't interested in their house-to-be. They'd watched the walls go up and they took lots of progress photos – the kind that get stuffed into fat albums for the dubious entertainment of captive relatives – and they liked everything they saw before they left. As we waved our goodbyes, it never occurred to me that we would soon earn their trust many times over.

Most residential clients understandably want to be on the site as often as possible, trust notwithstanding. Being privy to the everyday progress, the inevitable glitches and triumphs, is part of the excitement of seeing a dream come true. With the client present, eleventh-hour decisions are more easily negotiated, and changes can be made while they are still most cost-effective. (“We had no idea the fireplace mantle was that high off the floor. . .”) With Ray and Pam absent, an ambiguous sense of freedom set in: we were free of the extra effort it takes to deal with even the best of clients -- but we were also free to stumble into errors and omissions all on our own.

Progress continued apace as December turned to January, and even in February it still hadn't snowed more than a few inches. The old-timers called it an "open winter," cold and dry, and without the protective cover of snow that typically insulates the earth from frost penetration. Open winters are

known to be tough on rootstock, insects, burrowing animals and the replenishment of aquifers. As it pertains to buildings in New England, a lack of snow and seasonal cold can drive the frost down more than four feet.. Conversely, a few feet of constant snow cover can result in a frost line only inches deep.

Wayne's finish carpenter, Eddie, who had worked on many projects with me, first noticed the problem in early February as he began installing the large glass doors on the south wall of the living room. The sides of the doors are attached to jambs attached to the bearing walls. As Eddie began to fit the jambs, he noticed the jack stud -- and hence the bearing wall itself -- was more than an inch out of plumb. Disbelieving the evidence, he checked the other four bearing walls and also found them to be tipped -- westward -- by the same margin.

Eddie's phone call to me was brief. "You know who this is?"

"Sounds like Eddie."

"You best get over here."

My usual twenty-minute drive took fifteen.

Eddie's discovery, and the ego-numbing forensic exercise that followed, soon pointed to our problem: the earth used as backfill against the east wall had frozen and expanded. As could be expected, it had moved what was easiest to move -- in this case, the entire roof assembly. The entire heavy roof assembly. Designed to address worst-case scenarios (fully saturated soils followed by a record-breaking snow load topped with a teenager in a wayward Jeep), roof loads for earth-sheltered houses are calculated at over two hundred pounds per square foot. This amounts to four times the design load for conventionally built, northern New England homes. In our case, 150 fifty tons of roof and earth cover had slid westward more than an inch, shearing off the anchor bolts at the top of the concrete bearing wall which, miraculously, was still standing plumb. This frozen freight of timber and earth had migrated westward fraction-by-fraction over a period of weeks, and we never knew it until Eddie held his level plumb to the wall.

The good news was we hadn't completed any finish work that would have to be removed. Additional good news was that Ray and Pam were somewhere

warm and innocent of the evil machinations of frost. Our open winter had allowed frost to penetrate down through the depth of the earth covering the roof (16 inches), past the depth of the insulation (5 inches), plus the depth of the deck and timbers (13 inches). Had the frost gone deeper than those 34 inches -- and it might have with another week's arctic weather -- the concrete wall would have been pushed westward as well. As for why the frost along the north wall didn't push the roof assembly southward, our theory went as follows:

Backfilling around a house means dumping dirt in against the foundation walls. It takes less than an afternoon's work if the material is on site, as it was at Ray and Pam's. As usual, there were several big piles of material heaped up around the building's perimeter. Some of them were heavily laden with clay, some of them were sandy and porous. It was the latter material that was meant to be used as backfill. Sandy soils hold little moisture, allowing minimal frost expansion. The stockpiles of clay were intended to be used as fill on the slopes leading up to the roofline. As Wayne and I reconstructed the most likely scenario, we concluded that some of the sandy material was put in against the north wall, and material from the clay pile was inadvertently dumped against the east wall. The lack of snow cover and subsequent deep frost line completed the story.

Neither Wayne nor I were present when the backfill was put in place. Should we have been? In retrospect, of course, but supervising all the trades at all times requires an expenditure of manpower that few clients can afford. Our excavator, Howard, was one of the best. He had been in business longer than Wayne and I put together, and knew well the dangers of placing clay against a foundation wall -- but he had somehow picked the wrong pile of dirt for part of the job. Would Wayne or I have seen something he didn't? Given the season, all the piles would have been covered with a frozen gray crust. The cold, dry weather would have made it difficult to identify which pile was which. There may have been one of the season's rare dustings of snow that day, making visibility less than ideal. It may have been Howard was late for his supper.

The late Niles Lacoss, a self-taught jack-of-all-trades, was fond of referring to structural engineers as "Blacksmiths with glasses." Niles was known for his ability to back up his innate common sense with whatever arcane engineering formula pertained to the problem at hand. One of his last projects was fabricating parts for the Mt. Washington Cog Railway steam

engine. All the design work and machining was accomplished in his sooty little blacksmith shop nestled down in the hollow below his house. Had Niles still been living, he would have been the first person I'd have consulted about our little problem with Jack Frost. Next in line was Hank Woodard, a structural engineer with (glasses and) a knack for crunching numbers.

Before I telephoned Hank, I spent a sleepless night pursuing answers. There are situations in architecture where an inch or two of discrepancy means little, but an eight-foot-high wall out-of-plumb by more than an inch is intolerable. Equally intolerable would have been leaving the roof where it was. By midnight, I had exhausted the notion of shimming out the walls, or moving the tops of the walls back to plumb. (Unfortunately, we had already completed a clever detail, whereby the blocking between the beams above the walls had already been routed into the sides of the beams before the roof was decked over.) Shimming or moving the tops of the walls would have meant that the blocking would have been inboard of the wall plane on one side and outboard on the other, instead of flush on both sides, as it was meant to be. Moving the bottoms of the walls would have meant moving all sorts of plumbing -- the roof drain drops, baseboard heat, sewer and water lines penetrating the floor slab within the walls – a huge undertaking.

By two a.m. I was through with the use of hydraulic jacks. If we had wanted to push the roof farther westward, we could have pushed against the frozen earth to the east easily. But pushing the roof back to the east required something to push against, and there was nothing but air on the exposed, west end of the house. Furthermore, the hill sloped away from the building towards the west. I finally concluded that no practical combination of triangulated trusses, posts and fulcrum points could ever provide 150 tons of resistance to the jacks.

By four in the morning, I was warming to the might of giant winches.

The winch on a bulldozer is located at the back of the machine, behind the drive train, between the tracks. It feeds out a reel of braided cable, which is turned hydraulically on a drum. The force of the hydraulics is unimaginable. For instance, if the cable were to be attached to an immovable object, the winch is strong enough to reel in the bulldozer as if it were a Tonka Toy, even when it's mired up to its floorboards in mud. So why not hire the most colossal bulldozer we could find, anchor it at the east end of the house (I pictured the rear end of the machine chocked firmly against beefy steel

columns planted deep into the frozen ground) and winch the roof back into place?

A ragged dawn found me conceptualizing a second pair of steel columns, which would be planted below the west-end roofline. It was to these two columns that the cable would be attached. When the winch pulled against the columns, they would in turn push against a horizontal beam positioned so as to transfer the pull to the ends of the 6 x 12 roof joists. Eureka!

Fundamental to any of these procedures was an open a ditch along the east side of the roof. No matter how we moved the assembly back into place, I knew we had to make room for its relocation as well as replace the clay with sandy fill to prevent future movement. In order to salvage some small portion of my bruised self-esteem, I also knew I would insist on doing the work myself, partly because I didn't entirely mind the drudgery of the ditch, but also because I felt Ray and Pam deserved some kind of redemptive gesture. A long afternoon with an eighty-pound jackhammer would bring back some memorable days at the quarry, and, I hoped, deliver my penance.

Hank returned my call and listened politely to my winching scheme. "How big a cable on the winch?" he asked. For calculating purposes, we guesstimated the cable's size and tensile strength. "And the machine would be anchored how?" The steel columns/posts would provide adequate stability if they were of sufficiently thick section and buried deeply.. Hank was kind enough not to ask why the roof ended up where it was.

Then came the bad news: When a cable is stretched, he explained, it behaves like a taut rubber band. The heavier the load, the more it elongates -- until it ultimately fails. The first bit of stretching comes easily, but as the load increases, the degree of elongation decreases in inverse proportion to the load. According to Hank, our hypothetical 1-inch cable was strong enough to slide the 150 tons of roof. So far, so good. But then Hank delivered a brief discourse on axial fatigue and static strength tests -- and dropped the bomb: in essence, the cable's elasticity made its behavior unpredictable. If we'd wanted to move the roof an indefinite distance with no precise stopping point, we could do it. But we needed to move the roof an inch and a fraction, no more, no less. It was impossible to accurately predict the point at which the cable would stop stretching and begin to pull -- and when it did overcome the inertia and begin to pull, it was impossible to

regulate the winch so that it would pull only the distance desired. We discussed providing structural stops, blocks, beams or posts that would somehow stop the movement of the roof at the precise spot we intended, but the idea quickly became too impractical to pursue. As usual, Hank ended our conversation with “Let me do some numbers and call you back.”

Still without a solution in mind, Wayne and I nonetheless rented a compressor and jackhammer later that morning. At least we would prevent the roof from moving further while we searched for a solution. At least we were doing something. The temperatures that day were just above freezing, but the work was so grueling, we were quickly down to our shirtsleeves, trading off five-minute spells with the beast.

As I’d learned from Bo at the quarry, the jackhammer is not a subtle instrument. But I’d forgotten how it sets up a peculiar resonance with the tissue at the tip of the nose. The itchy, jiggly sensation is impossible to appease while clinging with both hands to the chattering hammer. Was advancing age making it worse, or had I simply chosen to forget? Every time I took over the hammer, my nose itched like hell. Shrugging it into my shoulder was the best I could do to reduce the sensation.

We finished the ditch just in time to fill it with sand before darkness fell. I collapsed into bed that night at the mercy of tender regions of my body I’d never heard from before. Ten hours later, I awoke still exhausted, but with a vision so providential and compelling that I was on the phone to Wayne before I’d brushed my aching teeth.

The dump truck driver must have been puzzled. The house was obviously still being built – even if it might have looked to him like a walkout basement with dirt on the roof and big windows. He certainly saw the big yellow crane with the forty-foot boom parked alongside the driveway. And there he was with a two-ton wrecking ball in the bed of his truck – the type used to demolish old buildings. Had he driven to the wrong address?

My brainstorm was so unsophisticated I hadn’t dared call Hank for fear that he would talk me out of it with a line of reasoning too levelheaded to ignore. Thirty-six hours had passed since Eddie’s discovery, and I had to fix the thing – now. I knew my impatience was dangerous, but my instinct felt right. Yes, I was acting unprofessionally, no calculations, no lawyers or insurance agents, no structural consultants, but I was prepared to risk ridicule, not to

mention a big chunk of money, if only to satisfy a stubborn curiosity. Blow by blow, I was sure we could pound the roof back into place with a two-ton wrecking ball.

Prior to the crane's arrival, we rigged up a double thickness of 6 x 12s along the west end of the roof. They were bolted to the butt ends of the 6 x 12 roof joists, and would serve to absorb the blows from the wrecking ball. The impact load would be then transferred to the ends of the joists, which were lined up serially, the length of the house. The roof's structural decking, tongue-and-groove 2 x 6s spiked to the joists, would act to tie the joists together in a relatively dimensionally stable rectangle. Such was my theory. And to chart my theory's progress, if any, I dusted off my old surveyor's transit.

A transit is generally used to establish elevations, compute angles between compass points and measure distances. Looking through the lens is akin to looking through a high-powered rifle telescope, with fine-lined cross hairs superimposed on the targeted image. My target was a 3 x 5 file card. With a razor-sharp pencil, I'd drawn a row of vertical hash lines one-sixteenth of an inch apart. A thicker line, my base line, zero, was at the right (east) end of the pattern. I stapled the card to the south side of the house. With the transit steadied on a tripod thirty feet away, I hoped to track the movement, fraction-by-fraction, blow-by-blow, as the roof moved eastward back to where it belonged.

When I explained what we were about to do, the crane operator was dumbfounded. "You want to do what?"

Excited by the prospect of seeing an architect do something delectably stupid, the dump truck driver couldn't wait for the folly to begin. "You heard him, Ellis," he said. "Pound it."

Once he had been reassured that he was not responsible for damages, the crane operator lifted the wrecking ball from the bed of the truck and moved his rig to the west end of the house. When the crane's stabilizers were secure on the frozen ground and the cab leveled, he lifted the boom to a 45-degree angle so that the ball hung next to our battering beams. After another brief explanation of what we intended, he swung the boom away from the house, and then brought it back.

Thump. The house shook. The crane operator looked guiltily pleased at the shocking effect.

I ran over to the transit and peered through the lens at the hash lines. Nothing. The transit crosshairs were still on zero. After a few more futile swings, we speculated that the ball was not moving with enough speed to deliver the punch we needed. Wayne suggested we raise the boom to almost vertical, which would give us more radius, more leverage, more thump. The new geometry worked to our advantage, but the old crane's clutch was sticky, and swinging the boom at such a vertical angle was awkward and jerky. On the third swing, the two-ton ball rebounded in an unexpected trajectory and grazed the crane cab with deadly indifference.

The operator was now convinced we were nuts. "Jeesum!"

I saw where a patch of paint had been scraped off the corner of the cab, and began to wonder if I'd made a fool of myself.

The dump truck driver covered his told-you-so grin with his glove. Wayne called time out and fetched a rope from his truck.

We tied the rope to the cable just above the wrecking ball and asked the crane operator to lower the boom to about seventy-five degrees and leave it stationary. A few test pulls suggested we might have better control and accuracy if we swung the ball ourselves. Wayne, Eddie and I began pulling the rope. The truck driver, overjoyed by the lunacy of our enterprise, jumped in to lend assistance. I imagined him telling the story that night at the Elks' Club bar.

With enough rope played out, the four of us were able to draw the ball almost fifteen feet away from the building. Swung through its forty-foot radius, it made a deep, booming, hollow sound as it whomped against the timbers. After three or four tries, I checked the transit, and it seemed we had advanced -- maybe a sixteenth -- or was it a thirty-second of an inch? Three hits more and the evidence was unmistakable: the hammer was working.

For the next hour, we pounded the cross timbers with a grim kind of glee. Trial and error soon taught us that four or five hits in one location gave us a sixteenth of an inch, but additional pounding in that same spot yielded no further progress. The roof system was apparently flexible enough so that it

became temporarily concaved at the point of assault, like a stiff trampoline might behave when struck with a bowling ball. A series of poundings at consecutive, four-foot intervals along the length of the roof's edge, however, gained us roughly a sixteenth-of-an-inch at each location. Countless trips to the transit charted our inexorable progress. The announcement of each successive sixteenth was greeted with cheers. The big ball was working. When we'd reached the full distance, we whomped it one last time for good measure and traded high fives all around. Now the truck driver would have an even better story to tell. Ten minutes later, it began to snow hard for the first time all winter, a perfect, soft, white coda to our brutal performance.

Hank was appalled when I called to report on our success. How could we have proceeded without his calculations? "What'd you say the ball weighed? (As much as a compact car loaded with three Vikings' linemen.) How far did you swing it?" I could hear him furiously clicking at the buttons on his calculator -- and then a long pause. "My numbers say it doesn't work."

Niles Lacoss once told me that according to aeronautical formulae, bumblebees can't fly. I had seen such examples in sports, the four-minute mile, the sixty-yard field goal, and I knew he was right: It can't be done, but then, it is. Flushed with the success of our improbable flight, I said, "But Hank, if we had done the numbers first, the roof would still be back where it was, right?"

Hank's tolerance was more than I deserved. "What did your insurance people have to say?"

I respected Hank, and relied on his engineering expertise without hesitation. We had worked together often, and I wanted him to respect me, too. I just couldn't tell him I had no insurance, so I fudged my answer: "Not much . . ."

I'm not sure how much Ray and Pam wanted to hear about what had happened, but I was so pleased with the course we'd chosen that I felt compelled to tell the whole story from beginning to end. To be sure, I'd been lucky, but if we'd pursued the conservative route, gone through the standard procedures of errors and omissions insurance claims, and all the attendant expert witnesses, engineers and lawyers who come along for the ride, the remedial process would have been enormously time-consuming, tedious, expensive and, worst of all, entirely out of my hands. As it was, I chalked up my expenses in dollars, anxiety and time as an affordable withdrawal from

my personal insurance fund. I had applied the flinty values of thrift, self-reliance, independence and accountability that I admired so much among my adopted Yankee mentors, and the outcome was as good as it could be. In other words -- to the extent that it was possible for an over-educated flatlander to presume local status – when the chips were down, I'd gone native.

Confessions of a Country Architect is available from Amazon, Bunker Hill Publishing, or your local bookstore. Also visit www.donmetzarchitect.com for more information.