



photographed by **Daniel Wood**



# ITY

If you want the most intriguing—and inspiring—perspective on our boom town, don't look up. Look down, way down, into enormous pits teeming with big machines and even bigger construction challenges.

by **Kevin Brooker & Erik Froese**

*Once I had a daddy and he worked down in a hole.*

—TRIXIE SMITH "MINING CAMP BLUES"

The great medieval painter, Hieronymus Bosch, had nothing on 21st-century Calgary. Were he to be transported to any of the gaping excavations now peppered across our city, the artist who gained fame portraying hell as a teeming, multi-storey pit filled with muck and fever and unredeemed souls might have to rethink his whole notion of scale.

This is not to say that the giant holes required to build giant buildings are actually hell. Mud and cacophony notwithstanding, they in fact represent a highly organized human endeavour, and the men who work down there—yes, men (though the apparent absence of females seems hellish in its own right)—nevertheless make a pretty good living.

But to those curious few who put their eye up to a knothole and catch a glimpse of a gigantic pit in full digging mode, it can seem a confusing and dangerous-looking enterprise. There are far more strange drills, tanks and earth-moving machines than the Tonka-toy imagination can even conceive. Water spews randomly, forming huge puddles that alternate between being sloppy quick clay and a frozen, chunky nightmare. Ant-like workers clamber through the chaos, their localized efforts seeming tiny and inconsequential against the hyper-industrial scale.

And then there's the ever-present fear of any layman who takes in this Boschian panoply: What's keeping those wooden-looking walls from collapsing utterly?

Here at *Swerve*, however, we are not afraid. We figure that since we're already enduring the insufferable noise and those long, traffic-snarling queues of dump trucks, maybe we should know a little more about the subterranean activities we so love to curse.

So grab your insulated hard hat and put on your steel-toed rubber boots. It's time to peel back the hoarding and stare deeply into the abyss.



*Don't expect anyone to dig up something of extraordinary value, like gold for instance. You would have to dig around 4,000 metres before you hit the sort of igneous bedrock that might contain valuable minerals.*

## **THE LAY OF THE LAND**

Anyone who builds anything, even as small as a garage, has heard of Alberta One Call (1-800-242-3447). It's a hotline designed to prevent excavators from digging into all of the electrical, natural-gas, storm-sewer, sanitary-sewer and communication utilities that criss-cross the city. For a 60-storey building with a footprint larger than 100-metres square, you can bet that one phone call is probably not enough to get the job done. Nevertheless, we'll presume that the permits are in place and the site has been extensively surveyed. We'll even assume the architects have made all of their decisions before earth-movers first scratch the surface, although judging by the length of time that empty pits are seen to languish, it might seem like they haven't.

The first order of business is to understand what's in that patch of earth. While Calgary's underground landscape is well mapped—that is, the location of features like gravel deposits and subterranean waterways are generally understood—it still takes exploratory drilling to determine precisely how the excavators must proceed and, more importantly, where bedrock will be encountered. Whereas you can float a home foundation on a bed of gravel, the sheer mass of giant skyscrapers means that the base layer of concrete must either rest on solid rock or concrete pilings that extend all the way down to solid rock. Around here, that rock is entirely of the soft, sedimentary variety: fine-grained shale or the sandstone which forms what's called the Paskapoo Formation. This latter is the same gold-coloured rock you see on valley outcrops in Silver Springs, but more often in buildings like Old City Hall. It is the widely used material responsible for Calgary being known, a century ago, by the epithet Sandstone City.

Don't expect anyone to dig up something of extraordinary value, like gold for instance. You would have to dig around 4,000 metres before you hit the sort of igneous bedrock that might contain valuable minerals. That said, the movement of various ancient ice sheets means that some gravel and glacial till lying below Calgary originated far away, and therefore contains crystalline rocks not native to this region. For the most part, however, the material present in the first 30 metres below the surface, especially downtown, consists of the less glamorous deposits laid down by the enormous glaciers that spilled out from the Rocky Mountains over the past 1.5 million years. These form an unconsolidated mixture of rounded river rocks, glacial till, sand and clay—a mixture that is not only less than precious, but which is prone to slumping when unsupported and lubricated by flowing groundwater.

That's the dirt. What about human objects of value? Since 1975, the province's commercial developers have been compelled to perform

archeological surveys before they dig. It is even possible, if rare, for a particularly important site to be preserved forever from eradication. Since downtown Calgary has been extensively disturbed over the past 135 years, however, the chance of finding anything of archeological significance in the major excavations now underway is rather slim.

Still, some interesting human artifacts have been dug up in Calgary over the years, almost exclusively in the top two metres of soil. The Mona Lisa Art Supply store near 7th Street and 17th Avenue S.W., for example, was built over a major bison-kill site. In addition to buffalo and dog remains, sometimes exotic imported materials are found, such as tools made with North Dakota flint or obsidian from the Yellowstone region. The oldest human settlement yet discovered was near the present-day district of Hawkwood, where carbon dating of artifacts indicates an age of over 8,000 years old. Archeologists aren't sure who those people were, or what relation they bore to the Blackfoot tribes who migrated here some time before the 1700s and the arrival of the first Europeans. As for those first white settlers, they didn't leave much to posterity. Some flintlocks and copper pots dating back to the 1820s are as old as you could hope to find.

Otherwise, the backhoes can expect to paw through a certain amount of bricks, foundations, old furniture and appliances and other detritus from Calgary's first downtown construction boom just prior to the First World War. In some cases, giant tanks filled with strange concoctions of petroleum products and ground goops have been unearthed. But mostly it's just a lot of mud and gravel.

## **DIGGIN' A HOLE**

So it's mid-February and you're standing on the corner of 9th Avenue and 5th Street staring at a blank lot that used to contain the most fun you could have with your boots on, when you begin to wonder: what's next for this beer-baptized and mammary-sanctified piece of property?

While the site of Cowboys' next incarnation remains uncertain, the future of its former whereabouts does not: the site is being excavated to make way for the billion-dollar, 49-floor Penny Lane towers. As you might imagine, digging a cavity in which to sprout a building weighing many hundreds of thousands of tons is a considerable task.

For starters, you need to figure out what to do with something like 98,000 cubic metres of earth. That was the amount removed from the pit below what are currently Calgary's tallest buildings, the Petro Canada Centre. It is equivalent to the quantity of dirt that would need relocation if 360 average-sized new homes were built, which, interestingly enough, happens about every month in Boom Town these days.

By far the largest portion of this excavated material is high-quality riverbed gravel. That, and any sandstone found, is simply sold by the excavating companies to cover roads, decorate yards or whatever else people use this stuff for. As for the rest of the exhumed muck—mostly shale, boulders and other debris—the City of Calgary takes that to help meet the municipality’s ravenous demand for backfill.

Another issue with digging a crater anywhere from two to seven storeys deep (most skyscraper excavations are in the three-to-five-storey range) is getting things out of it. Imagine in some distant hypothetical past a couple thousand men burrowing away on the site of some temple to the gods. Ten metres down, they’re passing soil up to ground level through an ingenious pulley system, when all of a sudden the head architect says to his buddy, “Wait a minute. How are we going to get all of those dudes outta there when we’re finished?”

In the case of expansive projects like EnCana’s The Bow, which covers a full city block between Centre Street and 1st Ave. S.E., you can simply build a giant dirt ramp. Dump trucks wait in a line at the bottom of



the pit, where they are filled by backhoes. Foremen roll around in Ford F-150s checking up on dust-covered workers. Massive vehicles filled with cement pour steaming slop onto the ground. At the end of the day all of these contraptions motor back up out of their subterranean drudgery and merge into the rush-hour traffic.

Of course at some point the ramps (they usually build two) have to go as well. When that time comes almost everything except a single backhoe is moved to the surface. Alone and dwarfed by the dimensions it’s labouring within, the machine starts to dig away at a \$15,000 ramp it probably helped to create, feeding dirt into the bucket of a specially designed excavator, which is reaching down from street level into the pit with an enormous hydraulic arm. When all is said and dug, the 50,000-plus-pound Cat is then plucked from the void by a gigantic crane like a stuffed animal in a coin-operated amusement game.

In locations too small to fit a driveable ramp, excavators just dig around, passing earth from one level up to another in a sort of tiered system until it can be scooped up from above. All equipment is lowered or raised by crane.

### **AGAINST THE WALL**

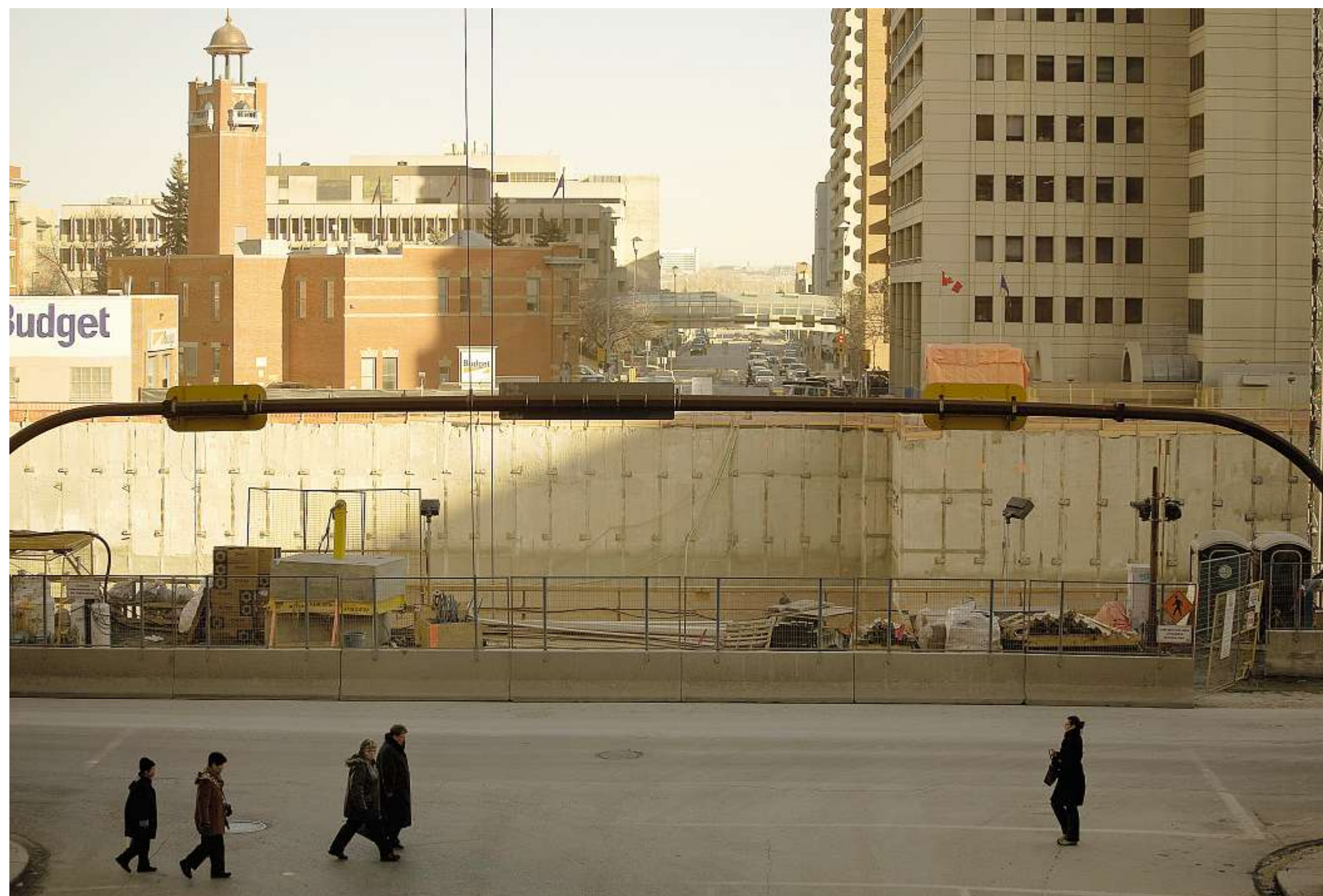
By far the biggest safety concern is the sides of the hole collapsing. With all manner of roads, utilities and buildings immediately adjacent to construction sites—not to mention all the workers and machines inside the pit—the consequences of any form of cave in are extremely grave. On Feb. 14th, in a fatal accident at the Highbury construction site in the southwest, trucking-company owner Randy Williams was parked below a 30-by-60-metre wall of dirt that gave way in an excavation trench collapse. According to the 2003 Occupational Health and Safety Code, the employer must stabilize the walls in an excavation more than 1.5 metres deep according to the stability of the soil. If the soil is classified as hard and compact, walls must be sloped to within 1.5 metres of the bottom of the trench at an angle of not less than 30 degrees. If, among other characteristics, the soil has been excavated before or exhibits signs of surface cracking, walls must be sloped to not less than 45 degrees.

The safest protective strategy is to shore up the walls of construction holes with some kind of, well, shoring. That tooth-rattling, picture-toppling, headache-inducing metronomic pounding you hear throughout the city core? It is the sound of colossal steel pilings being slammed deep into the ground around the perimeter of building sites—the first step in reinforcing excavation walls before any digging starts. Piles can also be drilled into place and then encased in lean-mix concrete, but since that method is slightly more expensive—and not nearly as annoying as hammering on them for days—construction companies often choose the former technique. (Deep pits, however, require drilled piles because they are stronger and more exact). Once the pilings are in place, unearthing begins.

As the hole progresses downwards—it takes about a month to dig each storey of depth—workers attach, by hand, what’s called lagging to the inside of the piles. This is the untreated spruce timber you can see, which holds the tremendous pressure from the soil and water behind it at bay. In fact, that pressure is so intense that even the huge H-shaped pilings aren’t enough to keep the walls from pushing inwards, so specifically engineered German-made rods capable of holding 110,000 pounds of force are drilled into the walls at predetermined angles so as to miss



*Dump trucks wait in a line at the bottom of the pit, where they are filled by backhoes. Foremen roll around in Ford F-150s checking up on dust-covered workers. Massive vehicles filled with cement pour steaming slop onto the ground.*



any outside utilities. Grout is pumped along the rod forming a ball-like anchor at its end. Then more lagging is attached and the wall becomes truly stabilized. While it's not the only shoring system ever invented (some companies drill concrete pilings the whole way around the perimeter, forming a continuous concrete slurry wall; others have tried freezing the ground solid, which wasn't nearly as effective), this lagging arrangement is the most common and extremely safe. There hasn't been a full-scale skyscraper-excavation collapse in Calgary since it was invented. Which isn't to say there can't be other problems.

### **WATER TORMENT**

Finding a legal place to leave your car in downtown Calgary is a total pain in the arse. Parking also costs about the same per month as a week at your favourite ski chalet during spring. Highrise developers know this. It is a big reason why they spend so much money to dig down five or six storeys when structurally they could stop at three: they want to build

elaborate parkades that can be rented out for \$375 a stall.

The people behind Bankers Hall, however, might wish they'd been a little less ambitious in the mid-'80s. Being situated in the Bow River flood plain, Calgary's downtown rests just above the surrounding water-table level. Dig a hole below that level and H<sub>2</sub>O will continually flow into your pit at a constant rate. Despite containing a fair amount of silt, this water is clean and can be safely drunk and workers sometimes do, although most wait until the murky fluid is pumped up and out of their subterranean workplace through a thorough filtering system and into either a cup or the storm sewer.

The problem all this liquid poses is that it silently washes earth out from behind the lagging, which creates voids. If these gaps aren't identified and filled, the outcome is very bad. Over time, the ground will eventually settle, as it did south of Bankers Hall below 9th Avenue, causing cracks in roads and ruining buried utilities such as water mains and sewers. In the case of Bankers Hall, it also caused shoring to tilt, which forced them to

stop digging and redesign their building. The end product was a substantially smaller parkade and an unresolved \$23-million-dollar lawsuit.

Here's the interesting part according to longtime Calgary builders. Because highrises have developed such sophisticated de-watering arrangements under and around their basements (most of it goes into the sanitary drainage system), the downtown water table has dropped significantly over the past 40 years. Apparently this makes managing the excavating process much easier than it used to be.

### WHAT LIES BENEATH

Like futuristic space vehicles terraforming Mars in a science-fiction movie, adamantite-toothed diggers, Godzilla-sized cranes and tank-treaded drilling machines scrape, lift and bore in the sludge and mire for three or four months until it finally happens: they reach footing depth.

Because blue shale starts to disintegrate when exposed to air and water, a covering layer of concrete is immediately dispensed at this point. Over the next three or four weeks workers will bend and tie an intricate network of rebar together in preparation for the pouring of the skyscraper's unwavering root, the raft slab. This is a two-to-three-metre-thick piece of cement equal in length and width to the highrise's core structure, which it will eventually support. The raft slab is the thing that will prevent the building from falling over; and its creation is the purpose of all this excavation in the first place. Lagging will be removed and piles will be pulled. There's nothing left after this but for the hole to be filled back in with concrete, steel and dirt.

### IN THE COMPANY OF GIANTS

The Great Pyramid of Giza was the tallest man-made structure on earth for nearly 4,000 years. Here in bumpkin southern Alberta, we have built, since 1968, 11 buildings that dwarf the last remaining Wonder of the Ancient World, whose original height was 146.6 metres. If an ancient Egyptian were to walk through our downtown she would probably sink to her knees at the sight of the Calgary Tower. She might lay offerings to the sun god Ra at the base of Bankers Hall. She would prostrate herself on the steps of the Petro-Canada Centre.

But we modern Homo sapiens have become so accustomed to living and working in some of the greatest feats of engineering in the history of humankind that we have lost our sense of perspective. Only when we stare down into the gargantuan pits that characterize our growing city does the absence of the buildings they will eventually house give insight into what their creation means.

These holes aren't the Hell of a Hieronymus Bosch painting. They are modern monuments to scope. ☺

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