

If you work around underground utilities in Sacramento for more than a week, you start to think in two languages at once: the language of production and the language of safety. You worry about how long it takes to dig a 100 ft trench through tight clay in East Sacramento, but you also hear OSHA rules in the back of your mind every time someone climbs into a hole.

That is where the shorthand “5-4-3-2-1 rule for excavation” comes in. It is not a line from the federal code, and you will not find it as a formal regulation in OSHA’s books. It is a teaching tool that safety trainers, foremen, and competent persons use to keep a handful of critical excavation rules front and center.

In a city as dense with buried utilities as Sacramento, this rule connects directly to how, when, and where you use vacuum excavation and hydrovac trucks, and what that means for cost, schedule, and crew training.

What the 5-4-3-2-1 Rule Actually Refers To

Different companies teach slightly different versions, but in California utility and civil work, the 5-4-3-2-1 rule usually lines up with key OSHA and Cal/OSHA excavation requirements like this:

- 5 feet: At 5 ft deep, you must use a protective system such as shoring, shielding, or sloping, unless the excavation is entirely in stable rock.
- 4 feet: At 4 ft deep or more, you must provide safe access and egress, typically a ladder, within 25 ft of workers.
- 3 feet: Keep the top of the ladder extending at least 3 ft above the landing, and maintain at least 3 ft of clear space at the top so workers are not climbing into spoils.
- 2 feet: Keep excavated material and surcharge loads at least 2 ft back from the trench edge to reduce the risk of collapse.
- 1: One competent person must inspect the excavation, protective systems, and access at least once per shift and after any hazard-increasing event such as rain, vibration, or a change in soil.

You will sometimes hear variations that swap the “3” for the 19 inch rule, which is the maximum height of a single step in an access route, or that emphasize the 3/4/5 rule for soil sloping instead. The core idea is the same: a simple mental checklist so the crew never forgets the most common failure points.

OSHA’s three most cited violations shift from year to year, but fall protection, hazard communication, and ladders and scaffolding usually dominate. Excavation citations are not the most numerous, but when something goes wrong in a trench, it is rarely minor. That is why seasoned superintendents repeat these numeric rules until they sound like a song you cannot get out of your head.

Why This Rule Matters More in Sacramento Utility Work

Sacramento is a web of aging and new infrastructure stacked in tight corridors. Between SMUD power, PG&E gas in some areas, municipal water and sewer, telecom, and private services, you often have several utilities crossing within a narrow strip of right of way. In the downtown grid, it is common to see old clay or cast-iron lines within a few feet of newer PVC or HDPE.



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Traditional trenching with a 20 ton excavator, like a Cat 320, is still the most used excavator setup on many civil jobs because it moves dirt fast. A 320 with a good operator can move well over 100 cubic yards per hour in an open cut if haul trucks keep up. But once you move from open greenfield sites to utility-rich streets, raw production takes a back seat to precision and damage prevention.

Striking a 4 inch gas main on a busy Sacramento arterial is not just a repair cost. You can shut down blocks, trigger evacuations, and invite serious regulatory scrutiny. The 5-4-3-2-1 rule helps frame what happens once the hole is open, but how you expose those lines is where vacuum excavation and hydrovac trucks have changed local practice.

What Is Vacuum Excavation?

Vacuum excavation uses high-velocity air or water to loosen soil, then a powerful vacuum to lift the material into a debris tank. When water is used as the cutting medium, the method is commonly called hydro excavation or hydrovac. When compressed air is used, many crews simply call it "air-vac" or "vac ex."

In practical field use:

- Hydro excavation uses pressurized water to cut and liquefy the soil, which is then vacuumed out as slurry.
- Air vacuum excavation uses compressed air to break up the soil, keeps it relatively dry, and vacuums it into the tank as loose spoil.

So when someone asks, "What is the difference between hydro excavation and vacuum excavation?" it often comes down to terminology. Hydro excavation is a specific type of vacuum excavation using water. Vacuum excavation, in general, includes both air and water methods.

Hydrovac trucks usually resemble a cross between a pressure washer, a tanker truck, and a giant shop vacuum. They carry a debris tank, a high pressure water system, a vacuum blower, and a boom to position the suction hose. They are heavier than most straight dump trucks, which is why you often hear questions like whether a tanker endorsement is required for a hydrovac truck, and whether a CDL is required for hydrovac jobs. In California, most hydrovac rigs are CDL vehicles. Whether you need a tanker endorsement depends on how the state classifies the water and debris tanks and how the vehicle is registered, so contractors verify that with DMV and their insurer instead of guessing.

How Deep Can Vacuum Excavation Go?

In field conditions around Sacramento, you typically see vacuum excavation used for these depth ranges:

- Potholing and utility locates from surface down to 5 or 6 ft to daylight existing facilities.
- Slot trenching for new shallow lines, often 2 to 4 ft deep.
- Deeper daylighting around critical crossings that may run 8 to 15 ft deep with extensions.

From a purely mechanical standpoint, the limiting factor usually is not suction power. You can run additional vacuum tube sections and dig 20 to 30 ft deep if needed. The practical limits tend to be:

So when someone asks, "How deep can vacuum excavation go?" the honest answer is that on most urban utility jobs, reliable production is 10 to 15 ft. Deeper work is possible, but you quickly hit diminishing returns and more complex safety measures, especially with shoring.

This ties back to the question, "How deep can you dig without shoring?" Under OSHA and Cal/OSHA, once you cross 5 ft in depth, your default assumption is that you need a protective system unless you can prove the excavation is in stable rock. In many Sacramento soils, especially when wet, that proof does not exist. A hydrovac truck can reduce the risk of a collapse during initial exposure compared to a toothed bucket, but it does not remove the requirement for shoring, shielding, or proper sloping once workers enter the excavation.

How Much Can a Vac Ex Excavate in a Day?

Production with vacuum excavation is far more variable than with a conventional excavator. It is affected by soil type, water table, debris tank capacity, dump site distance, and whether you are using air or water.

On typical Sacramento utility work, I have seen these ranges:

- In soft topsoil or loose fill, a hydrovac can remove 8 to 12 cubic yards in a long day of potholing and slot trenching.
- In heavy clay or compacted road base, it might only manage 3 to 6 cubic yards per day.
- When you are just daylighting short sections of existing utilities, production is often measured in number of test holes per day instead of volume.

For basic volume math, remember why contractors divide by 27 for cubic yards. A cube of soil that is 3 ft by 3 ft by 3 ft contains 27 cubic feet. One cubic yard is 27 cubic feet, so you take your total cubic feet and divide by 27 to get cubic yards.

If an owner asks for a rough number on "How much to excavate 200 cubic yards?" with a vacuum rig, the honest response is a range and a conversation. At 8 cubic yards per day, you are looking at around 25 working days. At 12 cubic yards per day, closer to 17 days. On a congested city block with limited staging, traffic control, and nighttime work windows, those days do not always land back to back.

A conventional excavator could move that same 200 cubic yards in a few hours on an open site. That is what drives many cost questions around vacuum excavation.

What Does Vacuum Excavation Cost?

Vacuum excavation is not cheap on a straight dollars-per-yard basis. In the Sacramento region, rough numbers I have seen for a fully crewed hydrovac unit, including truck, operator, and at least one laborer, often land in a range of about \$350 to \$500 per hour, depending on:

- Travel distance from the yard.
- Day vs night work.
- Traffic control requirements.
- Waste disposal rules for slurry.
- Union vs non-union wage scales.

That is why questions such as “How much does vacuum excavation cost?” or “What does excavation cost per hour?” rarely have a single definitive number. For a small private job, the minimum charge might be a half-day, regardless of the volume you actually remove. On a larger public works project, a bid item for vacuum excavation may be structured per hour, per day, or per pothole, with a typical production assumption behind the scenes.

If someone wants a quick rule of thumb for “How much does it cost for a vac excavation?” on simple potholing in Sacramento streets, a safe planning figure might be a daily cost in the \$3,000 to \$4,500 range per truck and crew. You adjust from there based on scope.

On the capital side, “How much is a vacuum excavation truck?” or “How much is a vac ex to buy?” depends heavily on size and configuration. A new full-size hydrovac truck from a major manufacturer can easily run \$400,000 to \$600,000 or more before tax, equipment, and branding. Smaller trailer-mounted units cost less, but also move less material and have shorter hose reach. That high capital cost is one of the reasons many local contractors hire specialty vacuum excavation subs rather than owning their own units.

Where Vacuum Excavation Fits Under the 5-4-3-2-1 Rule

The 5-4-3-2-1 rule is mostly about what happens after the soil is removed, but the method you choose to remove the soil affects how risky [Sacramento Vacuum Excavation](#) those key points become.

When you use a backhoe or mid-size excavator to dig near a gas main or 12 kV duct bank, you are always balancing production and risk. A tooth that hooks a conduit can pull it sideways and destabilize the trench wall. A hydrovac or air-vac reduces the direct mechanical force on those facilities, which lowers the chance of line strikes and associated emergency conditions.

Once you dig down 4 ft or more, you still need safe access. On vacuum jobs, you often see narrow, straight-sided holes that do not leave much room for a trench ladder. Crews sometimes rely on climbing the hose or the wall, which is exactly the kind of behavior the ladder and 19 inch rules are meant to prevent. A competent person needs the authority to stop that and require a properly rated ladder or an alternate safe access system.

At 5 ft and deeper, sloping is not realistic in the middle of a Sacramento street with existing utilities, traffic, and adjacent structures. That is where shoring and trench shields enter the picture. Vacuum excavation can create a nearly vertical cut that stays apparently stable for a long time, especially in dry, stiff clay. The deceptive appearance of stability is dangerous. It tempts people to work in an unprotected excavation because “it has been open all day with no problem.” The 5 in 5-4-3-2-1 exists to cut off that rationalization.

Keeping spoils and equipment at least 2 ft from the edge is actually harder with hydrovac rigs than with an excavator. A compact excavator can sit a bit back and swing spoil to a stockpile beyond the 2 ft setback. A hydrovac crew is often parked as close as legally possible in a lane closure, with hose and boom reaching over the trench. If they are not mindful, the spoils hose will drop material too close to the edge, loading the soil above the cut. A competent person should walk that edge often, check for cracks, and enforce the 2 ft rule.

Limitations of Vacuum Excavation

Vacuum excavation is not a magic tool that solves every problem underground. It has real limitations that matter when planning Sacramento utility work.

Production is slower than mechanical excavation, especially in tight clays, gravels, or cobbles. It is also noisy, and hydrovac work uses large volumes of water. On dry, friable soils, air vacuum excavation can avoid creating slurry, which reduces disposal costs and is often preferred by engineers who worry about introducing extra water near existing structures.

The limitations of vacuum excavation show up strongly when you move from potholing to long linear work. A slot trench 1 ft wide and 4 ft deep for a new fiber line might sound like a good hydrovac task, but if you are trenching 1,000 ft, the daily production could make the schedule unrealistic. In those cases, a hybrid approach is common: **Sacramento Vacuum Excavation** vacuum excavation around existing crossings and critical points, with traditional machines handling the bulk open trench.

There is also the practical question of “Can I dig a trench with a pressure washer?” The short answer is that while a pressure washer uses water at high pressure, it is not a hydrovac. You do not have the debris tank, the vacuum, or the right safety controls. Trying to use a consumer pressure washer as an excavation tool, especially around utilities, is a recipe for uncontrolled jets cutting into cables or pipes.

Training, Certifications, and Who Should Operate What

On the training side, crews often ask what kind of training is required for vacuum excavation, and whether specific certifications are needed to run an excavator or hydrovac truck.

For excavators, California does not require a single universal license that every operator must hold, but employers have a legal obligation to ensure operators are trained and competent. Many reputable firms require a mix of:

- Formal equipment training through union apprenticeship or manufacturer/operator schools.
- Documented on the job training under a qualified mentor.
- Task specific safety training tied to excavation, including the 5-4-3-2-1 rule, soil classification, and shoring systems.

Vacuum excavation requires its own training. Operators must understand pressure settings, standoff distances near utilities, hose handling, lockout and tagout for the truck systems, and traffic control if they are working in the street. The question “Is a CDL required for hydrovac jobs?” often comes up at hiring time. For full size hydrovac trucks on Sacramento streets, the answer is almost always yes, because these units exceed weight thresholds that trigger CDL requirements.

The job market for heavy equipment and vacuum operators in Northern California still pays solid wages. The highest salary for an excavator operator on union jobs can exceed \$40 per hour in base wages, with benefits on top. That is why some people in midlife ask, “Is 50 too old to become a heavy equipment operator?” Age alone is

not a barrier. What matters is physical ability, willingness to learn, and tolerance for outdoor conditions and irregular hours. Utility work is often driven by outages, shutdown windows, and emergency calls.

Planning, Pricing, and When Vacuum Excavation Makes Sense

Owners often start with simple cost-per-square-foot or per-hour questions: “What is the cost of 1000 sq ft of excavation?” or “How much would it cost to excavate 10 acres of land?” Those questions make sense for grading and large scale earthwork, where bulldozers and scrapers dominate and production is measured in acres and thousands of cubic yards.

For urban utility work in Sacramento, the pricing logic is different. Here, you are more likely to price out excavating jobs based on a blend of:

- Mobilization and demobilization of the vac truck.
- Hourly or daily rates for vacuum excavation.
- Lump sum pricing per pothole or per utility crossing.
- Separate bid items for shoring, shielding, or trench boxes.
- Traffic control, flagging, and lane closure costs.

Vacuum excavation is often justified not because it is cheaper on the face of it, but because it reduces risk. The cost of a single significant utility strike, including delays, claims, and reputational damage, can dwarf the premium you paid for a hydrovac crew for a few days.

For homeowners wondering “Is it illegal to dig a hole in your backyard?” the concern is smaller but related. You are generally allowed to dig on your own property, but you still need to respect local ordinances, call 811 to have utilities located, and stay within depth and setback rules that protect retaining walls, property lines, and adjacent foundations. A typical backyard project rarely needs a hydrovac truck, but the same logic applies: know where the utilities are and stay safe.

Putting It All Together on a Sacramento Street

On a real Sacramento utility project, the 5-4-3-2-1 rule, vacuum excavation, and traditional machines all interact.

Imagine a crew replacing a section of water main along a busy arterial, with existing gas and electric crossing the alignment. They might:

- Use vacuum excavation to pothole and expose all known utilities along the route before bringing in the big excavator.
- Install shoring or trench shields once the trench passes 5 ft in depth, with ladders placed so no worker is more than 25 ft from safe access.
- Keep spoils and the hydrovac hose discharge at least 2 ft from the trench edge, even when space is tight.
- Have a competent person walk the trench multiple times per shift, check for cracks, water intrusion, or bulging walls, and verify that the 5-4-3-2-1 points are still being met.

A 20 ton excavator or even larger dozer class equipment remains stronger than a bulldozer in pure breakout or ripping power, but that strength is not useful if you are digging blind into a forest of utilities. The most used excavator on these jobs is often a mid size tracked unit that can handle trench work but still sit comfortably behind cones and barriers. The heavy production machines take over only when the path is clear.

The 5-4-3-2-1 rule gives the crew a shared mental model. Vacuum excavation gives them a way to see what they are getting into before they commit the iron. Together, they turn chaotic underground work into something more predictable, which is the real currency on a busy Sacramento schedule.