

Excavation looks simple from a distance: a machine, a bucket, a hole. Once you get involved in real projects, you learn it is a mix of geology, hydraulics, safety law, logistics, and old-fashioned judgment. Choosing the wrong excavation method can blow a schedule, break a utility, or put people in danger.

A question I hear a lot is, "What are the three main types of excavators, and how does vacuum excavation compare?" Behind that are follow-ups about production rates, costs, OSHA rules, licenses, and whether vacuum excavation is worth the premium.

This article walks through the main machine families, then zeroes in on vacuum excavation: what it is, where it shines, and where it does not.

The three main types of excavators most contractors rely on

If you walk onto a typical civil job or utility project, you will see a range of machines, but most digging is done by three broad categories of excavator. There are countless subtypes, but in practical terms, most fleets are built around these.

1. **Crawler (tracked) excavators**
2. **Wheeled excavators**
3. **Compact / mini excavators**

These are all mechanical excavators, using steel and hydraulics to chip, pry, cut, and lift soil. Vacuum excavation sits in a different family entirely, which we will come back to.

1. Crawler excavators: the workhorses

Crawler excavators are what people usually picture when they hear "excavator": a tracked undercarriage, a rotating upper, and a boom with a bucket. A Caterpillar 320, for example, is roughly a 20 ton excavator and falls right in the heart of that class.

On anything from subdivision basements to highway cuts, the crawler excavator is the primary digging tool. Production is impressive. A mid-size crawler in average soil can move 60 to 100 cubic yards per hour with a skilled operator, sometimes more in ideal conditions.

That does not mean you get that net excavation rate on a real job. Swing radius limits, truck positioning, traffic control, trench boxes, and survey checks all eat into production. Still, when a client asks "What does excavation cost per hour?" they are usually thinking about a crawler with an operator, not a specialty unit.

For rough budgeting in many U.S. Markets:

- A 20 ton excavator with operator and fuel commonly bills in the range of 150 to 250 dollars per hour.
- Add support equipment, trucking, and supervision, and your effective excavation cost per hour may land between 200 and 400 dollars, depending on region and union or non-union labor.

Those are broad bands. Rocky ground, tight access, and heavy traffic control can double the real cost per cubic yard.

2. Wheeled excavators: mobility over brute force

Wheeled excavators fill a niche that most owners do not appreciate until they run one for a while. They sacrifice some stability and breakout force compared with their tracked cousins, but they make up for it with speed and

flexibility on pavement.

On urban road work, utilities, and rail corridors, wheeled excavators can move quickly between sites without a lowboy and without tearing up the asphalt. They can straddle a trench, work in a narrow lane closure, and reposition with very little downtime.

Wheeled excavators are popular in Europe, and they have been gaining ground in dense North American cities. You will see them paired with vacuum excavation more and more, with the wheeled unit handling bulk removal and shaping, while the vac truck exposes sensitive utilities.

3. Compact / mini excavators: precision and access

Mini excavators fill all the small and awkward spaces that big crawlers cannot reach. Typical weights run from 1 to 8 tons. They are the backbone of residential work, landscaping, service line repair, and light commercial jobs.

If a homeowner asks, "Is it illegal to dig a hole in your backyard?" the legal problem is usually not the hole itself. It is what you might hit. A compact excavator plus vacuum excavation is a common combination for backyard utility replacements, especially where lines are shallow and unmarked records are unreliable.

On the production side, people often ask things like, "How long does it take to dig a 100 ft trench?" With a 3 to 5 ton mini excavator in good soil, digging a 100 foot utility trench 2 feet wide and 3 feet deep might take 1 to 3 hours of pure machine time. Add time for layout, spoil management, shoring if required, inspections, and backfill, and the total task easily stretches to most of a day for a small crew.

That brings us to the question lurking behind all of this: where does vacuum excavation fit into the picture, and why is it often slower and more expensive per hour yet still worth using?

What is vacuum excavation?

Vacuum excavation uses high velocity air or water to loosen soil, then a powerful vacuum to suck the material into a debris tank. It is sometimes called "soft dig" because it reduces the risk of damaging buried utilities compared with teeth on a bucket.

There are two primary flavors:

- Hydro excavation, which uses high pressure water to cut soil.
- Air excavation, which uses compressed air instead of water.

People often ask, "What is the difference between hydro excavation and vacuum excavation?" In practice, the term "vacuum excavation" is the umbrella. Hydro excavation is one form: water does the cutting, the vacuum does the removal. Air-vac systems also fall under vacuum excavation, but they avoid the slurry that hydro excavation creates.

On a hydrovac truck, you will see a debris tank, a water tank, high pressure water lines and a wand, a large boom for the suction hose, and often a boiler for winter work. The truck legally resembles a combination of a vacuum truck and a water truck, which is where questions about CDL and tanker endorsements come in.

CDL, endorsements, and training for vacuum excavation

Hydrovac and vac ex trucks are heavy. In most U.S. States, if the combined vehicle weight rating exceeds 26,001 pounds, a commercial driver's license (CDL) is required. Almost every full-size hydrovac falls in that category.

Contractors also ask, “Do you need a tanker endorsement for a hydrovac truck?” and “Is a CDL required for hydrovac jobs?” Here is the practical answer.

The debris tank and water tank together can hold thousands of gallons of slurry and water. Many states and companies treat that as requiring a tanker endorsement, especially if the liquid can move and affect vehicle handling. The safest assumption for a full-size hydrovac is:

- Plan on needing a CDL with at least a tanker endorsement.
- Check state regulations and your insurer. Some jurisdictions take a strict view, others less so, but your risk is on the line if a crash occurs and the driver is under-credentialed.

Operating the vacuum excavation system itself is not a licensed trade in most places, but that does not mean untrained laborers should run it. When people ask, “What kind of training is required for vacuum excavation?” I usually describe three buckets of knowledge.

First, the basics of the truck and controls: pressures, flow limits, lockouts, maintenance checks. Second, safe excavation technique, including standoff distances, daylighting methods, and spoil placement. Third, safety and regulatory awareness: OSHA trenching rules, confined space basics, and traffic control.

For traditional excavators, there is a similar pattern. There is no universal federal license for excavator operators in the U.S., but many owners prefer operators with documented training from manufacturers, unions, or accredited schools. The question, “What certifications do you need to run an excavator?” is really about proving competence and satisfying insurance, not just legal minimums.

How deep can you dig with vacuum excavation?

Depth is one of the most common technical questions: “How deep can vacuum excavation go?” and “How deep can you vacuum excavation safely?”

The short answer: most hydrovac systems can work comfortably in the 10 to 20 foot range, and 30 feet is achievable with planning. Beyond that, production drops and safety concerns rise.

The limiting factors are:

- Vacuum lift: pulling heavy slurry up 20 or 30 feet through a hose eats power and slows production.
- Wand control: the deeper the hole, the harder it is to see and manage the wand precisely.
- Spoil handling and access: the deeper the excavation, the more likely you need shoring or shielding to protect workers entering the hole.

You can find impressive case studies of hydrovacs daylighting utilities at 40 feet or more, often from a bench or shaft, but those are specialized setups.

Compared with mechanical excavation, the depth limit is not the primary constraint. Traditional excavators can dig very deep with benched slopes, [Sacramento Vacuum Excavation](#) long-reach booms, or by working from multiple levels. The real contest between mechanical and vacuum excavation is around precision, risk tolerance, and site conditions, not just depth.

Excavation safety rules that actually matter in the field

Several search terms that come up around excavation are really about safety: the “4 foot rule in excavation”, “19 inch rule”, “35 foot rule”, the “3/4/5 rule for excavation” or “5 4 3 2 1 rule for excavation”, and OSHA’s most cited violations. Most of these terms are shorthand that safety trainers use to help crews remember obligations.

Rather than chasing every mnemonic, it is worth anchoring to the core OSHA requirements that affect both mechanical and vacuum excavation.

OSHA's trenching and excavation standards live mainly in 29 CFR 1926 Subpart P. Five recurring requirements matter on most jobs:

1. Any trench 5 feet deep or more must have a protective system unless the excavation is made entirely in stable rock. In some soils, even shallower cuts deserve shoring, shielding, or benching. When people ask, "How deep can you excavate without shoring?" the safe answer is, "Do not rely solely on the 5 foot threshold. Evaluate soil and exposure, and follow your competent person's judgment."
2. Trenches 4 feet deep or more must have a means of egress, typically a ladder, within a limited travel distance. That 4 foot rule is where the "4 foot rule in excavation" phrase comes from.
3. The "19 inch rule" is often a reference to the idea that a break in elevation of 19 inches or more requires a ladder, ramp, or stair for safe access. Stepping over a 24 inch trench edge might not sound like much, but it is a trip and fall hazard.
4. Access and egress for trench workers typically must be provided so they do not have to travel more than 25 feet laterally to reach a ladder. Some in-house programs talk about a "35 foot rule", but OSHA's 25 foot figure is the one that matters in most U.S. Guidance.
5. Spoil piles and equipment should be kept at least 2 feet back from the edge of the trench to reduce surcharge on the walls and the risk of material falling in.

Where does vacuum excavation fit into this? Some owners treat vacuum excavation as a magic bullet that replaces shoring because no one is "in the hole." That is a dangerous assumption. Vacuum excavation reduces the need for workers to enter unstable soil, but when anyone goes into a cut, the same OSHA rules apply. Even if you are only sending in a worker to adjust a pipe for a few minutes, you need to think about protective systems.

People also ask, "What is OSHA's 3 most cited violation?" All industries considered, the usual top three are fall protection, hazard communication, and respiratory protection, with ladders and scaffolding also near the top. On excavation-heavy sites, you still need fall protection around deep cuts, proper labeling and handling of fuels and chemicals, and safe access systems.

The point of the safety mnemonics, whether "3/4/5 rule" or "5 4 3 2 1 rule for excavation", is to drive home that depth, access, shoring, spoil placement, and inspection are non-negotiable. Vacuum excavation improves one dimension of safety, but it does not let you ignore OSHA.

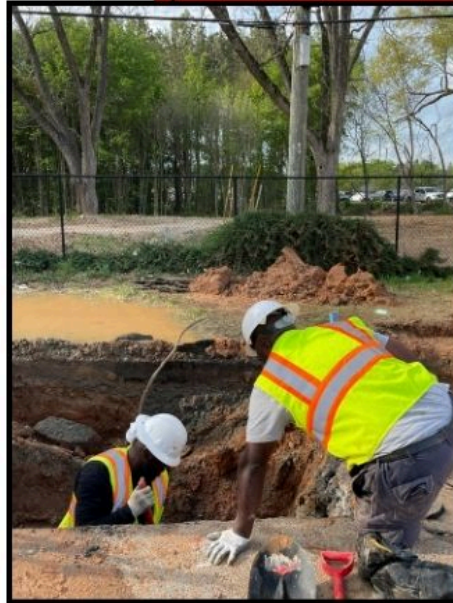
Production and cost: how much can a vac ex excavate in a day?

Compared with an excavator bucket, vacuum excavation looks slow, and in pure cubic yards per hour, it often is. But in risk-sensitive locations, speed is not the only metric.

On a typical utility daylighting job in average soil, a full-size hydrovac might remove 10 to 25 cubic yards per hour. Some hard clays or frost conditions drop that significantly. Sand and loose fill can be much faster.



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For a full day, you might see 80 to 200 cubic yards of material removed, depending on:

- Soil type and moisture.
- Access and hose reach.
- Disposal logistics.
- How detailed the exposure needs to be.

That leads naturally into the question, "How much does it cost for a vac excavation?" or "How much does vacuum excavation cost per day?"

In many U.S. Markets, a hydrovac truck with operator and helper runs in the neighborhood of 250 to 400 dollars per hour, sometimes more in high-cost cities or remote areas. Daily minimums are common. A straightforward, eight-hour shift can easily cost 2,000 to 3,500 dollars or more once you include mobilization, disposal fees, and standby.

If you are trying to price out excavating jobs with vacuum excavation, you need to convert those hourly rates into unit costs. Many owners look for numbers like, "How much to excavate 200 cubic yards?" or "What is the cost of 1000 sq ft of excavation?"

As a rough example, suppose:

- Your hydrovac crew averages 15 cubic yards per hour in mixed soils.
- The combined billing rate for the truck, crew, and disposal averages 350 dollars per hour.

At that rate, removing 200 cubic yards might take around 13 to 14 hours of active excavation. Multiply by 350 dollars per hour and you land in the ballpark of 4,500 to 5,000 dollars, not counting travel time or traffic control.

That is a sample scenario, not a universal price sheet, but it illustrates why vacuum excavation is usually reserved for sensitive work.

For traditional bulk excavation of an open area, like rough grading 10 acres of land, vacuum excavation would almost never be the tool of choice. You would use dozers, scrapers, and large crawlers. The question “How much would it cost to excavate 10 acres of land?” involves volumes in the thousands of cubic yards and is almost always priced in cubic yards or acres, not vacuum excavation hours.

For smaller work, owners often think in square feet. The “cost of 1000 sq ft” of excavation depends so heavily on depth that it is tricky to quote in the abstract. Adjusted to a simple case, like digging a 1000 square foot area to 2 feet deep in accessible soil, a small excavator and skid steer might complete it in a day or two, and the direct excavation portion could fall somewhere in the low thousands of dollars. Vacuum excavation is generally reserved for tighter, more hazardous parts of that footprint, such as around existing utilities.

Where vacuum excavation shines compared with traditional excavators

Vacuum excavation is not a replacement for excavators, bulldozers, and loaders. It is a complement and sometimes a prerequisite. The question, “What are the limitations of vacuum excavation?” is as important as its strengths.

A few scenarios show where it earns its keep.

First, utility locating and daylighting. When a municipality or gas utility needs to expose a line in a crowded corridor, they often specify vacuum excavation only. The risk of striking a gas main or fiber bundle with a bucket is too high. A hydrovac can surgically open a 2 foot by 4 foot window to a depth of several feet with far less chance of damage.

Second, inside cities and industrial plants where access is tight. Traditional excavators and backhoes need room to swing and track. A vac truck can park in a lane or outside a fence and run hose 100 feet or more to the dig location. That flexibility is hard to price on a spreadsheet but invaluable when you face real-world obstructions.

Third, environmental and contamination concerns. Some sites require all spoils to be contained and hauled off as potentially contaminated material. Vacuum excavation puts spoil directly into the tank, which simplifies handling. That does not eliminate disposal costs, but it keeps the site cleaner.

There are real tradeoffs. Limitations include slower bulk removal, significant water use in hydro excavation, slurry disposal costs, and dependence on a relatively complex, maintenance-intensive vehicle. Air excavation avoids the slurry but can struggle in cohesive clays.

Where vacuum excavation is least sensible is in large, open cuts, mass grading, and simple trenching in greenfield sites with good utility maps and minimal conflict risk. In those cases, a conventional excavator is dramatically more productive and more economical.

How vacuum excavation fits alongside the “big iron”

A question that comes up from people on the equipment side is, “What is the most used excavator?” and “What is stronger than a bulldozer?” The answer varies by region and sector, but crawlers in the 20 to 30 ton class and mid-size dozers dominate a lot of heavy civil work. For pure pushing power, a large dozer or scraper outmuscles an excavator in bulk earthmoving.

Vacuum excavation does not compete head-on with that iron. It fits into workflows such as:

- Potholing in advance of a trench line so that a crawler can dig confidently without hitting unknown utilities.

- Exposing tie-in points, valves, or services so that a mini excavator can connect or replace lines without surprises.
- Pre-clearing areas where shoring or shielding will be installed, reducing the risk of a cut wall collapsing onto workers placing trench boxes.

If you already run excavators, you are not replacing them with a hydrovac. You are adding a specialized tool that often works in front of and around them.

Career and training questions around excavation work

People considering a career shift sometimes ask very human questions: “Is 50 too old to become a heavy equipment operator?” or “What is the highest salary for an excavator operator?” On the medical side, similar phrases like “Is vacuum delivery painful?”, “How risky is vacuum delivery?” and “What is the 5 3 1 rule for labor?” are about childbirth, not earthwork. Search engines sometimes mix them with vacuum excavation content because of shared words, but they belong to an entirely different domain.

In construction, late starters can absolutely succeed. A 50 year old with good physical conditioning and a solid work ethic can learn to operate excavators or hydrovacs. The biggest challenges are usually stamina on long shifts, comfort with technology, and willingness to start at an entry-level rate during training.

On pay, experienced excavator and hydrovac operators in high-demand markets can reach total compensation in the 80,000 to 100,000 dollar range or more, especially with overtime. “What is the highest salary for an excavator operator?” sometimes stretches higher in remote or resource-heavy regions with harsh climates. Those jobs pay for both skill and hardship.

Hydrovac operators in particular are often cross-trained as CDL drivers, which improves flexibility and earning potential. The combination of a clean CDL with endorsements, documented excavation training, and a good safety record is highly valued.

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Buying or renting vacuum excavation equipment

For owners, the final question is usually about capital: "How much is a vac ex to buy?" or "How much is a vacuum excavation truck?" These are not small purchases.

As of recent years, a new full-size hydrovac truck can easily range from roughly 400,000 to over 700,000 dollars, depending on:

- Tank size.
- Blower and pump capacity.
- Chassis.
- Cold-weather package.
- Automation and controls.

Smaller trailer units and compact vac systems cost less, but production is lower. Many contractors rent or subcontract vacuum excavation rather than buying, especially when their usage is intermittent.

If you own traditional excavators already, the decision to buy a vac truck should be based on realistic utilization. Run the numbers. How many days per year will you genuinely keep that truck busy? If you only need vacuum excavation for occasional potholing or specialized urban work, partnering with a dedicated vac contractor often makes more sense.

A practical way to choose between traditional and vacuum excavation

The choice is rarely binary. On most projects, you blend mechanical and vacuum methods. When I help owners think through it, I suggest a quick mental checklist.

1. What is under the ground, and how confident are you in the records?
2. How close will you be to high-consequence utilities like gas, high-voltage, or major fiber?
3. How restricted is access for traditional equipment?
4. What are the soil conditions, water table, and environmental restrictions?
5. What are the safety margins you are willing to accept?

If you are digging in clean ground, with well-mapped utilities, lots of room, and forgiving schedules, a crawler or mini excavator will do 90 percent of the work efficiently. If you are in a congested corridor, next to a hospital, under a highway, or over a gas main whose exact location is uncertain, vacuum excavation often goes from “nice to have” to “required.”

Excavators, dozers, and hydrovacs are tools. None is king in every context. The best operators and contractors are the ones who understand the strengths, the limits, and the real costs of each, then choose the right mix for the job in front of them.