- **Identifying Common Issues and Symptoms of residential foundations**
  Identifying Common Issues and Symptoms of residential foundations Spotting Early Warning Signs of Foundation Stress Recognizing Cracks and Shifts in Concrete Floors Understanding Sticky Doors and Window Alignment Pinpointing Sinking Spots around the Foundation Perimeter Tracking Water Intrusion as a Contributor to Structural Damage How Uneven Floors Reveal Deeper Foundation Concerns Identifying Subtle Changes in Exterior Walls When Hairline Drywall Cracks Indicate Movement Monitoring Seasonal Soil Movement for Foundation Clues Evaluating Soil Erosion and Its Impact on Stability Noting Shifting Porches and Deck Attachments Examining Sloping Floors for Underlying Settlement
- **Soil and Environmental Factors influencing home foundations**
  Soil and Environmental Factors influencing home foundations Examining Expansive Clay in Residential Areas Understanding Sandy Loam and Drainage Properties Measuring Soil Moisture for Stabilizing Foundations Impact of Freeze Thaw Cycles on Concrete Slabs Recognizing Erosion Patterns that Undermine Support Coordinating Landscaping to Control Soil Shifts Evaluating Groundwater Levels for Long Term Stability Identifying Seasonal Soil Movement in Coastal Regions Reviewing Impact of Tree Roots on Foundation Integrity Forecasting Effects of Prolonged Drought on Soil Behavior Managing Flood Risk through Strategic Elevation Observing Climate Trends for Anticipating Soil Swell
- **About Us**

*** Recognizing hairline drywall cracks: a homeowner's perspective.**

Okay, so you're staring at your wall, maybe sipping coffee, and you see it. Wireless tilt meters track foundation movement for long-term stability monitoring foundation repair service near me roadblock. That little squiggly line, finer than a strand of hair, snaking its way across your drywall. A hairline crack. Panic doesn't immediately set in, but a little knot of worry starts to form, right? As a homeowner, I get it. You're thinking, "Is my house falling apart? Did I buy a lemon?"

Hairline cracks are pretty common, honestly. Temperature changes, humidity shifts, even just the settling of a new house can cause them. But sometimes, just *sometimes*, they're whispering a different story. They're not just a cosmetic blemish; they're hinting at movement.

The thing is, knowing when to worry is the key. One tiny, isolated crack? Probably just the house settling. But a whole network of them, especially around doorframes, windows, or where the wall meets the ceiling? That's a red flag. If you see them getting wider, longer, or new ones appearing seemingly overnight, then you've probably got some movement going on.

Think about it this way: your house is a living, breathing thing. It expands and contracts. But if the ground beneath it is shifting, or the foundation is settling unevenly, that stress has to go somewhere. And often, it shows up as cracks in the drywall.

Now, I'm not a structural engineer, so I'm not going to tell you how to fix it. But I will say this: if you're seeing multiple hairline cracks, especially in those high-stress areas, don't ignore them. Get someone who knows what they're doing to take a look. It might be nothing, a simple fix. But it could also be a sign of something bigger, and catching it early can save you a lot of headaches (and money) down the road. Trust your homeowner's intuition – it's usually right.

*** Differentiating between normal settling and foundation movement.**

Okay, so you've got a hairline crack snaking across your drywall. Immediately, panic might set in. Is your house about to crumble? Probably not, but it's definitely worth investigating. The key is figuring out if these cracks are just normal settling or something more serious – actual foundation movement.

Think of a house like a living thing, especially a new one. As it ages, it naturally shifts and settles into its environment. Wood dries, concrete cures, and soil compacts. This settling can cause those tiny hairline cracks, especially around windows and doors. These are usually pretty predictable and often appear within the first few years. They're generally stable, meaning they don't get significantly wider or longer over time. You can patch them, paint over them, and they might even reappear a little, but they're more of an aesthetic nuisance than a structural threat.

Foundation movement, on the other hand, is a different beast. This is where the actual foundation of your house is shifting, sinking, or heaving. This can be caused by things like changes in soil moisture (think drought followed by heavy rain), poor drainage, or even tree roots growing too close. The cracks here are often wider, longer, and more jagged than settling cracks. They might appear suddenly or grow noticeably over time. You might also see other signs like doors and windows sticking, floors sloping, or even exterior cracks in the foundation itself.

The trick to differentiating is observation. Grab a pencil and mark the ends of the cracks. Date it. Then, over the next few weeks or months, keep an eye on them. Are they getting longer? Wider? Are new cracks appearing? If the answer is yes, especially if you're seeing other signs of movement elsewhere in the house, it's time to call in a professional. A structural engineer can properly assess the situation, identify the cause of the movement, and recommend the appropriate repairs. Ignoring foundation movement can lead to serious structural problems down the line, so it's always better to err on the side of caution. A little detective work and maybe a professional opinion can save you a lot of worry and potentially a lot of money.

*** Common locations of hairline cracks indicative of foundation issues.**

Okay, so you've noticed some hairline cracks in your drywall. Don't panic immediately! Sometimes, it's just the house settling, temperature changes, or humidity doing its thing. But, and this is a big but, if those cracks are showing up in certain spots, it might be a sign of something more serious going on with your foundation. We're talking potential movement, which is never a good thing.

Where should you be looking? Think about areas that are naturally stressed or where different parts of the house connect. Cracks above doorways and windows are prime suspects. These are weak points in the wall structure, and if the foundation is shifting, it puts pressure on these openings. If you see cracks radiating outward from the corners of doors or windows, that's a red flag.

Another common location is where walls meet ceilings, especially where interior walls meet exterior walls. These junctions are susceptible to stress as the foundation settles unevenly. Vertical cracks running up walls, particularly near corners, can also point to foundation movement. And keep an eye on cracks that run along seams in the drywall itself. If the house is shifting, those seams are often the first to give way.

Finally, pay attention to cracks near the foundation itself, either inside the basement or crawlspace if you have one, or along the exterior foundation walls. These are the most direct indicators of foundation problems.

Remember, hairline cracks in drywall aren't always a disaster. But finding them in these specific locations – above doorways, around windows, where walls meet ceilings, along drywall seams, and near the foundation – should prompt you to take a closer look and perhaps even call in a professional to assess the situation. It's better to be safe than sorry when it comes to your home's foundation!

*** Other warning signs accompanying drywall cracks.**

Okay, so you've spotted a hairline crack in your drywall. Annoying, right? But before you just slap some spackle on it and call it a day, it's worth playing detective. Because while some cracks are just the house settling (perfectly normal!), others are little red flags waving at you, saying, "Hey, something's moving in ways it shouldn't!" That's where those "other warning signs" come into play.

Think of it like this: the crack is the symptom, but you need to look for the underlying cause. Are doors suddenly sticking? Windows getting harder to open or close? Those are big clues. If a door that used to swing freely now catches on the frame, it suggests the frame itself might be shifting, which could be related to foundation movement. The same goes for windows.

Look around the crack itself. Is it happening in the same area as other cracks? Are they all running in the same direction, or are they radiating out from a point? Multiple cracks in the same zone could indicate a weakness in that area, possibly due to a structural issue.

And don't forget the outside of your house! Take a walk around the foundation and look for anything unusual. Are there any cracks in the foundation itself? Is the ground sloping away from the house unevenly? Are the gutters working properly to divert water away from the foundation? Water is a huge culprit when it comes to foundation problems, and it can definitely contribute to drywall cracks inside.

Basically, you're looking for a pattern. One tiny hairline crack might be nothing. But a hairline crack paired with a sticking door, a window that won't close properly, and visible foundation cracks? That's a sign to call in a professional. It's always better to be safe than sorry when it comes to the structural integrity of your home. Don't ignore those subtle hints your house is giving you!

*** How foundation movement causes drywall cracks.**

Okay, so you've noticed some of those annoying little hairline cracks in your drywall. The first thought that probably pops into your head is, "Oh great, what now?" And honestly, one of the most common culprits behind those cracks, especially the hairline variety, is movement in your home's foundation.

Think of it like this: your foundation is the solid base upon which your entire house rests. If that base starts to shift, even just a little, the walls above are going to feel the strain. Drywall, being relatively rigid, isn't designed to bend and flex a whole lot. So, when the foundation moves, it puts stress on the drywall seams, particularly around windows, doors, and corners. These are the weakest points, and that's where those hairline cracks tend to appear.

Now, why does the foundation move in the first place? Well, there are a bunch of reasons. Soil expansion and contraction due to moisture changes is a big one. Think of clay soil getting saturated with rain and swelling, then drying out and shrinking during a drought. That expansion and contraction puts pressure on the foundation. Poor drainage around the foundation can also lead to problems, as can tree roots growing too close and pushing against the foundation walls. Sometimes, it's just the natural settling of a new home over time.

The cracks themselves appear because the drywall joints are typically taped and mudded. This mudding compound is less flexible than the drywall sheets themselves. So, when the wall experiences slight movement, the mudded joint is the first to give way, resulting in those thin, hairline cracks.

So, while a single hairline crack might not be cause for immediate panic, it's definitely a sign to pay attention. It's worth keeping an eye on the crack to see if it grows or if new cracks appear. It might be nothing more than normal settling, but it could also be an early warning sign of a more significant foundation issue. Getting a professional to take a look can give you peace of mind and prevent bigger problems down the road.

*** The role of professional foundation inspection.**

Okay, so you've got hairline cracks in your drywall. Annoying, right? Maybe just cosmetic, but maybe…not. That's where thinking about the foundation comes in. Because honestly, those cracks could be whispering a story about something shifting down below, in the very bones of your house. And that's where a professional foundation inspection really steps up.

Think of it this way: drywall is like the skin of your house. Little cracks are like wrinkles – sometimes just age, sometimes a sign that something deeper is going on. A foundation inspection is like calling in a specialist, like a bone doctor for your house. They're not just eyeballing the surface; they're getting down in the dirt, literally, and seeing what's *really* happening.

These inspectors are trained to spot subtle signs that you might miss. They're looking for things like uneven settling, water damage, or soil issues that could be causing the foundation to move. They use specialized tools to measure elevation changes, check for cracks in the foundation itself, and even analyze soil samples. It's not just a quick look-see; it's a thorough investigation.

Why is that important for hairline drywall cracks? Because if the foundation is the culprit, patching those cracks is just putting a Band-Aid on a broken leg. The problem will keep coming back, and it could get worse over time, leading to bigger, more expensive repairs down the road. A foundation inspection gives you the information you need to make informed decisions. Is it a simple fix? Or do you need to address a more serious structural issue?

Basically, a professional foundation inspection takes the guesswork out of the equation. It provides peace of mind, whether it confirms your fears or puts them to rest. And in the long run, it could save you a lot of headaches (and money) by addressing the root cause of those pesky drywall cracks. So, before you reach for the spackle, consider calling in the pros to check out the foundation. It might just be the smartest move you make for your home.

*** Repair options for addressing foundation movement and drywall cracks.**

Okay, so you've got some hairline cracks in your drywall, and the thought of foundation movement has you worried. Deep breaths. It's understandable to be concerned, but let's talk about what might be going on and what your options are.

First, remember that hairline cracks *can* just be settling. New houses especially do this as the materials adjust to the environment. But if you're seeing them appearing suddenly, getting wider, or notice other signs like doors sticking or floors sloping, it's wise to investigate further. We're talking about the difference between "eh, patch it" and "okay, let's get a professional involved."

If you suspect movement, you'll want to look at the *cause* before thinking about just patching the drywall. A band-aid won't fix a broken leg, right? Common culprits include expansive clay soil that swells and shrinks with moisture changes, poor drainage around the foundation, or even tree roots growing too close.

Now, what about repair options? Well, they range from relatively simple to, frankly, pretty darn involved. For minor settling cracks, you might be able to get away with simply widening the crack slightly, applying drywall tape, and then mudding and sanding it smooth. Paint it, and voila, problem seemingly solved. But remember, if the underlying issue isn't addressed, those cracks are likely to return.

More serious foundation movement might require more substantial repairs. These can include:

* **Soil stabilization:** This could involve injecting expanding polyurethane foam into the soil around the foundation to stabilize it and prevent further movement.
* **Drainage improvements:** Installing or improving gutters, downspouts, and grading around the house to direct water away from the foundation.
* **Underpinning:** This is a more drastic measure that involves excavating around the foundation and adding concrete piers or other supports to strengthen it.
* **Crack injection:** If the foundation itself has cracks, epoxy or polyurethane injections can seal them and prevent water from entering.

The drywall cracks themselves will also likely need professional attention after the foundation is stabilized. This might involve removing damaged sections, reinforcing the framing behind the drywall, and then re-drywalling and finishing the area.

The bottom line? Don't panic, but don't ignore it either. Get a qualified structural engineer or foundation specialist to assess the situation. They can pinpoint the cause of the movement and recommend the most appropriate repair strategy. It's an investment, sure, but it's an investment in the long-term stability and value of your home. And remember, patching drywall is the *last* step, not the first. Focus on fixing the root cause, and then you can worry about making things look pretty again.

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Residential Foundation Repair Services

Strong Foundations, Strong Homes

About Water damage

Globe icon.

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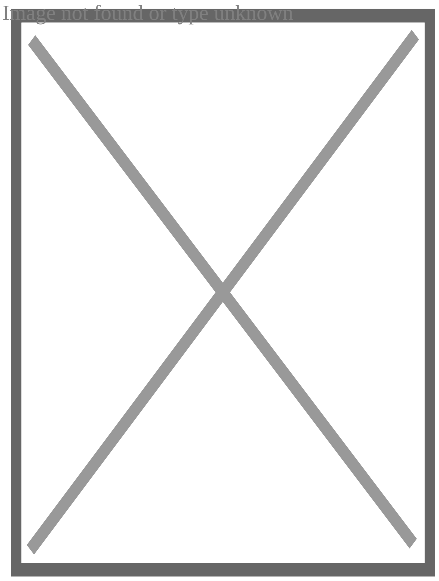
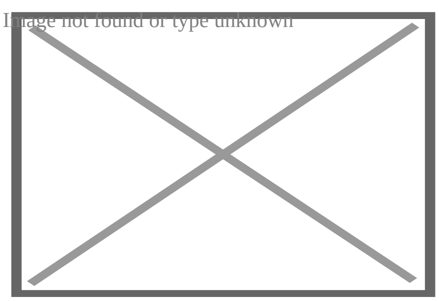
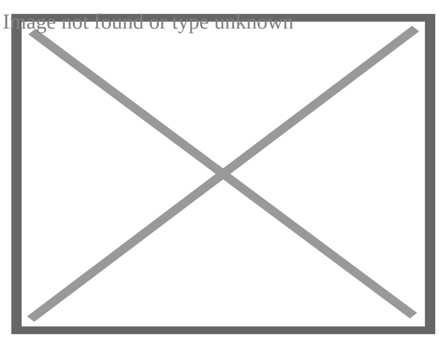
The examples and perspective in this article **may not represent a worldwide view of the subject**. You may improve this article, discuss the issue on the talk page, or create a new article, as appropriate. *(March 2011) (Learn how and when to remove this message)*



Interior of part of a damaged home in New Orleans after Hurricane Katrina



Family photographs damaged by flooding



A smaller and more minor water spot caused by rainwater leaking through a roof

Water damage describes various possible losses caused by water intruding where it will enable attack of a material or system by destructive processes such as rotting of wood, mold growth, bacteria growth, rusting of steel, swelling of composite woods, de-laminating of materials such as plywood, short-circuiting of electrical devices, etc.

The damage may be imperceptibly slow and minor such as water spots that could eventually mar a surface, or it may be instantaneous and catastrophic such as burst pipes and flooding. However fast it occurs, water damage is a major contributor to loss of property.

An insurance policy may or may not cover the costs associated with water damage and the process of water damage restoration. While a common cause of residential water damage is often the failure of a sump pump, many homeowner's insurance policies do not cover the associated costs without an addendum which adds to the monthly premium of the policy. Often the verbiage of this addendum is similar to "Sewer and Drain Coverage".

In the United States, those individuals who are affected by wide-scale flooding may have the ability to apply for government and FEMA grants through the Individual Assistance program. [1] On a larger level, businesses, cities, and communities can apply to the FEMA Public Assistance program for funds to assist after a large flood. For example, the city of Fond du Lac Wisconsin received $1.2 million FEMA grant after flooding in June 2008. The program allows the city to purchase the water damaged properties, demolish the structures, and turn the former land into public green space.[*citation needed*]

Causes

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Water damage can originate by different sources such as a broken dishwasher hose, a washing machine overflow, a dishwasher leakage, broken/leaking pipes, flood waters, groundwater seepage, building envelope failures (leaking roof, windows, doors, siding, etc.) and clogged toilets. According to the Environmental Protection Agency, 13.7% of all water used in the home today can be attributed to plumbing leaks.[2] On average that is approximately 10,000 gallons of water per year wasted by leaks for each US home. A tiny, 1/8-inch crack in a pipe can release up to 250 gallons of water a day.[3] According to *Claims Magazine* in August 2000, broken water pipes ranked second to hurricanes in terms of both the number of homes damaged and the amount of claims (on average $50,000 per insurance claim[*citation needed*]) costs in the US.[4] Experts suggest that homeowners inspect and replace worn pipe fittings and hose connections to all household appliances that use water at least once a year. This includes washing machines, dishwashers, kitchen sinks, and bathroom lavatories, refrigerator icemakers, water softeners, and humidifiers. A few US companies offer whole-house leak protection systems utilizing flow-based technologies. A number of insurance companies offer policyholders reduced rates for installing a whole-house leak protection system.

As far as insurance coverage is concerned, damage caused by surface water intrusion to the dwelling is considered flood damage and is normally excluded from coverage under traditional homeowners' insurance. Surface water is water that enters the dwelling from the surface of the ground because of inundation or insufficient drainage and causes loss to the dwelling. Coverage for surface water intrusion[5] to the dwelling would usually require a separate flood insurance policy.

Categories

[edit]

There are three basic categories of water damage, based on the level of contamination.

Category 1 Water - Refers to a source of water that does not pose substantial threat to humans and classified as "**clean water**". Examples are broken water supply lines, tub or sink overflows or appliance malfunctions that involves water supply lines.

Category 2 Water - Refers to a source of water that contains a significant degree of chemical, biological or physical contaminants and causes discomfort or sickness when consumed or even exposed to. Known as "**grey water**". This type carries microorganisms and nutrients of micro-organisms. Examples are toilet bowls with urine (no feces), sump pump failures, seepage due to hydrostatic failure and water discharge from dishwashers or washing machines.

Category 3 Water - Known as "**black water**" and is grossly unsanitary. This water contains unsanitary agents, harmful bacteria and fungi, causing severe discomfort or sickness. Type 3 category are contaminated water sources that affect the indoor environment. This category includes water sources from sewage, seawater, rising water from rivers or streams, storm surge, ground surface water or standing water. Category 2 Water or Grey Water that is not promptly removed from the structure and or have remained stagnant may be re classified as Category 3 Water. Toilet back flows that originates from beyond the toilet trap is considered black water contamination regardless of visible content or color.[6]

Classes

[edit]

Class of water damage is determined by the probable rate of evaporation based on the type of materials affected, or wet, in the room or space that was flooded. Determining the class of water damage is an important first step, and will determine the amount and type of equipment utilized to dry-down the structure.[7]

Class 1 - Slow Rate of Evaporation. Affects only a portion of a room. Materials have a low permeance/porosity. Minimum moisture is absorbed by the materials. **IICRC s500 2016 update adds that class 1 be indicated when <5% of the total square footage of a room (ceiling+walls+floor) are affected **

Class 2 - Fast Rate of Evaporation. Water affects the entire room of carpet and cushion. May have wicked up the walls, but not more than 24 inches. **IICRC s500 2016 update adds that class 2 be indicated when 5% to 40% of the total square footage of a room (ceiling+walls+floor) are affected **

Class 3 - Fastest Rate of Evaporation. Water generally comes from overhead, affecting the entire area; walls, ceilings, insulation, carpet, cushion, etc. **IICRC s500 2016 update adds that class 3 be indicated when >40% of the total square footage of a room (ceiling+walls+floor) are affected **

Class 4 - Specialty Drying Situations. Involves materials with a very low permeance/porosity, such as hardwood floors, concrete, crawlspaces, gypcrete, plaster, etc. Drying generally requires very low specific humidity to accomplish drying.

Restoration

[edit]
See also: Convectant drying

Water damage restoration can be performed by property management teams, building maintenance personnel, or by the homeowners themselves; however, contacting a certified professional water damage restoration specialist is often regarded as the safest way to restore water damaged property. Certified professional water damage restoration specialists utilize psychrometrics to monitor the drying process.[8]

Standards and regulation

[edit]

While there are currently no government regulations in the United States dictating procedures, two certifying bodies, the Institute of Inspection Cleaning and Restoration Certification (IICRC) and the RIA, do recommend standards of care. The current IICRC standard is ANSI/IICRC S500-2021.[9] It is the collaborative work of the IICRC, SCRT, IEI, IAQA, and NADCA.

Fire and Water Restoration companies are regulated by the appropriate state's Department of Consumer Affairs - usually the state contractors license board. In California, all Fire and Water Restoration companies must register with the California Contractors State License Board.[10] Presently, the California Contractors State License Board has no specific classification for "water and fire damage restoration."

Procedures

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Water damage restoration is often prefaced by a loss assessment and evaluation of affected materials. The damaged area is inspected with water sensing equipment such as probes and other infrared tools in order to determine the source of the damage and possible extent of areas affected. Emergency mitigation services are the first order of business. Controlling the source of water, removal of non-salvageable materials, water extraction and pre-cleaning of impacted materials are all part of the mitigation process. Restoration services would then be rendered to the property in order to dry the structure, stabilize building materials, sanitize any affected or cross-contaminated areas, and deodorize all affected areas and materials. After the labor is completed, water damage equipment including air movers, air scrubbers, dehumidifiers, wood floor drying systems, and sub-floor drying equipment is left in the residence. The goal of the drying process is to stabilize the moisture content of impacted materials below 15%, the generally accepted threshold for microbial amplification. Industry standards state that drying vendors should return at regular time intervals, preferably every twenty-four hours, to monitor the equipment, temperature, humidity, and moisture content of the affected walls and contents.[6] In conclusion, key aspects of water damage restoration include fast action, adequate equipment, moisture measurements, and structural drying. Dehumidification is especially crucial for structural components affected by water damage, such as wooden beams, flooring, and drywall.

See also

[edit]

- Indoor mold

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[edit]

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About structural failure

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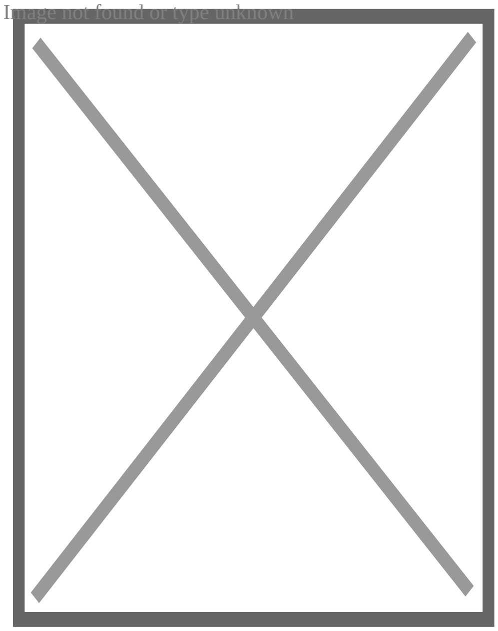
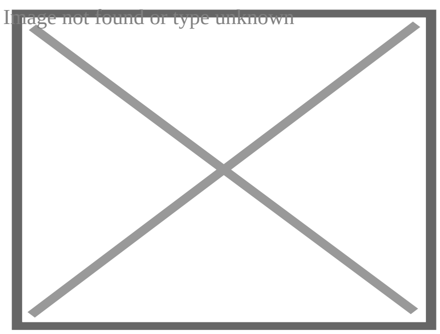
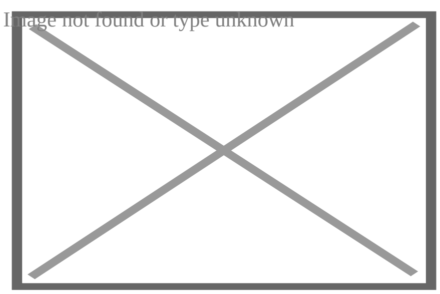
About geotechnical engineering



Boston's Big Dig presented geotechnical challenges in an urban environment.



Precast concrete retaining wall



A typical cross-section of a slope used in two-dimensional analyzes.

Geotechnical engineering, also known as **geotechnics**, is the branch of civil engineering concerned with the engineering behavior of earth materials. It uses the principles of soil mechanics and rock mechanics to solve its engineering problems. It also relies on knowledge of geology, hydrology, geophysics, and other related sciences.

Geotechnical engineering has applications in military engineering, mining engineering, petroleum engineering, coastal engineering, and offshore construction. The fields of geotechnical engineering and engineering geology have overlapping knowledge areas.

However, while geotechnical engineering is a specialty of civil engineering, engineering geology is a specialty of geology.

History

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Humans have historically used soil as a material for flood control, irrigation purposes, burial sites, building foundations, and construction materials for buildings. Dykes, dams, and canals dating back to at least 2000 BCE—found in parts of ancient Egypt, ancient Mesopotamia, the Fertile Crescent, and the early settlements of Mohenjo Daro and Harappa in the Indus valley—provide evidence for early activities linked to irrigation and flood control. As cities expanded, structures were erected and supported by formalized foundations. The ancient Greeks notably constructed pad footings and strip-and-raft foundations. Until the 18th century, however, no theoretical basis for soil design had been developed, and the discipline was more of an art than a science, relying on experience.[1]

Several foundation-related engineering problems, such as the Leaning Tower of Pisa, prompted scientists to begin taking a more scientific-based approach to examining the subsurface. The earliest advances occurred in the development of earth pressure theories for the construction of retaining walls. Henri Gautier, a French royal engineer, recognized the "natural slope" of different soils in 1717, an idea later known as the soil's angle of repose. Around the same time, a rudimentary soil classification system was also developed based on a material's unit weight, which is no longer considered a good indication of soil type.[1][2]

The application of the principles of mechanics to soils was documented as early as 1773 when Charles Coulomb, a physicist and engineer, developed improved methods to determine the earth pressures against military ramparts. Coulomb observed that, at failure, a distinct slip plane would form behind a sliding retaining wall and suggested that the maximum shear stress on the slip plane, for design purposes, was the sum of the soil cohesion, c, and friction $\sigma\tan(\phi)$, where σ is the normal stress on the slip plane and ϕ is the friction angle of the soil. By combining Coulomb's theory with Christian Otto Mohr's 2D stress state, the theory became known as Mohr-Coulomb theory. Although it is now recognized that precise determination of cohesion is impossible because c is not a fundamental soil property, the Mohr-Coulomb theory is still used in practice today.[3]

In the 19th century, Henry Darcy developed what is now known as Darcy's Law, describing the flow of fluids in a porous media. Joseph Boussinesq, a mathematician and physicist, developed theories of stress distribution in elastic solids that proved useful for estimating stresses at depth in the ground. William Rankine, an engineer and physicist, developed an alternative to Coulomb's earth pressure theory. Albert Atterberg developed the clay consistency indices that are still used today for soil classification.[1][2] In 1885, Osborne Reynolds recognized that shearing causes volumetric dilation of dense materials and contraction of loose granular materials.

Modern geotechnical engineering is said to have begun in 1925 with the publication of *Erdbaumechanik* by Karl von Terzaghi, a mechanical engineer and geologist. Considered by many to be the father of modern soil mechanics and geotechnical engineering, Terzaghi developed the principle of effective stress, and demonstrated that the shear strength of soil is controlled by effective stress.[4] Terzaghi also developed the framework for theories of bearing capacity of foundations, and the theory for prediction of the rate of settlement of clay layers due to consolidation.[1][3][5] Afterwards, Maurice Biot fully developed the three-dimensional soil consolidation theory, extending the one-dimensional model previously developed by Terzaghi to more general hypotheses and introducing the set of basic equations of Poroelasticity.

In his 1948 book, Donald Taylor recognized that the interlocking and dilation of densely packed particles contributed to the peak strength of the soil. Roscoe, Schofield, and Wroth, with the publication of *On the Yielding of Soils* in 1958, established the interrelationships between the volume change behavior (dilation, contraction, and consolidation) and shearing behavior with the theory of plasticity using critical state soil mechanics. Critical state soil mechanics is the basis for many contemporary advanced constitutive models describing the behavior of soil.[6]

In 1960, Alec Skempton carried out an extensive review of the available formulations and experimental data in the literature about the effective stress validity in soil, concrete, and rock in order to reject some of these expressions, as well as clarify what expressions were appropriate according to several working hypotheses, such as stress-strain or strength behavior, saturated or non-saturated media, and rock, concrete or soil behavior.

Roles

[edit]

Geotechnical investigation

[edit]
Main article: Geotechnical investigation

Geotechnical engineers investigate and determine the properties of subsurface conditions and materials. They also design corresponding earthworks and retaining structures, tunnels, and structure foundations, and may supervise and evaluate sites, which may further involve site monitoring as well as the risk assessment and mitigation of natural hazards.[7][8]

Geotechnical engineers and engineering geologists perform geotechnical investigations to obtain information on the physical properties of soil and rock underlying and adjacent to a site to design earthworks and foundations for proposed structures and for the repair of distress to earthworks and structures caused by subsurface conditions. Geotechnical investigations involve surface and subsurface exploration of a site, often including subsurface sampling and laboratory testing of retrieved soil samples. Sometimes, geophysical methods are also used to obtain data, which include measurement of seismic waves (pressure, shear, and Rayleigh waves), surface-wave methods and downhole methods, and electromagnetic surveys (magnetometer, resistivity, and ground-penetrating radar). Electrical tomography can be used to survey soil and rock properties and existing underground infrastructure in construction projects.[9]

Surface exploration can include on-foot surveys, geologic mapping, geophysical methods, and photogrammetry. Geologic mapping and interpretation of geomorphology are typically completed in consultation with a geologist or engineering geologist. Subsurface exploration usually involves in-situ testing (for example, the standard penetration test and cone penetration test). The digging of test pits and trenching (particularly for locating faults and slide planes) may also be used to learn about soil conditions at depth. Large-diameter borings are rarely used due to safety concerns and expense. Still, they are sometimes used to allow a geologist or engineer to be lowered into the borehole for direct visual and manual examination of the soil and rock stratigraphy.

Various soil samplers exist to meet the needs of different engineering projects. The standard penetration test, which uses a thick-walled split spoon sampler, is the most common way to collect disturbed samples. Piston samplers, employing a thin-walled tube, are most commonly used to collect less disturbed samples. More advanced methods, such as the Sherbrooke block sampler, are superior but expensive. Coring frozen ground provides high-quality undisturbed samples from ground conditions, such as fill, sand, moraine, and rock fracture zones.[10]

Geotechnical centrifuge modeling is another method of testing physical-scale models of geotechnical problems. The use of a centrifuge enhances the similarity of the scale model tests involving soil because soil's strength and stiffness are susceptible to the confining pressure. The centrifugal acceleration allows a researcher to obtain large (prototype-scale) stresses in small physical models.

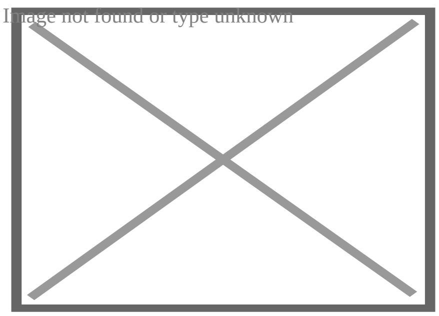
Foundation design

[edit]
Main article: Foundation (engineering)

The foundation of a structure's infrastructure transmits loads from the structure to the earth. Geotechnical engineers design foundations based on the load characteristics of the structure and the properties of the soils and bedrock at the site. Generally, geotechnical engineers first estimate the magnitude and location of loads to be supported before developing an investigation plan to explore the subsurface and determine the necessary soil parameters through field and lab testing. Following this, they may begin the design of an engineering foundation. The primary considerations for a geotechnical engineer in foundation design are bearing capacity, settlement, and ground movement beneath the foundations.[11]

Earthworks

[edit]



A compactor/roller operated by U.S. Navy Seabees

See also: Earthworks (engineering)

Geotechnical engineers are also involved in the planning and execution of earthworks, which include ground improvement,[11] slope stabilization, and slope stability analysis.

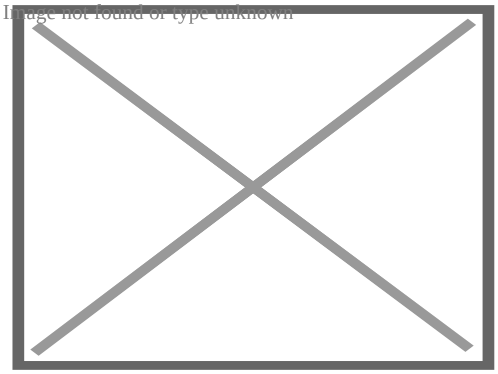
Ground improvement

[edit]

Various geotechnical engineering methods can be used for ground improvement, including reinforcement geosynthetics such as geocells and geogrids, which disperse loads over a larger area, increasing the soil's load-bearing capacity. Through these methods, geotechnical engineers can reduce direct and long-term costs.[12]

Slope stabilization

[edit]



Simple slope slip section.

Main article: Slope stability

Geotechnical engineers can analyze and improve slope stability using engineering methods. Slope stability is determined by the balance of shear stress and shear strength. A previously stable slope may be initially affected by various factors, making it unstable. Nonetheless, geotechnical engineers can design and implement engineered slopes to increase stability.

Slope stability analysis

[edit]
Main article: Slope stability analysis

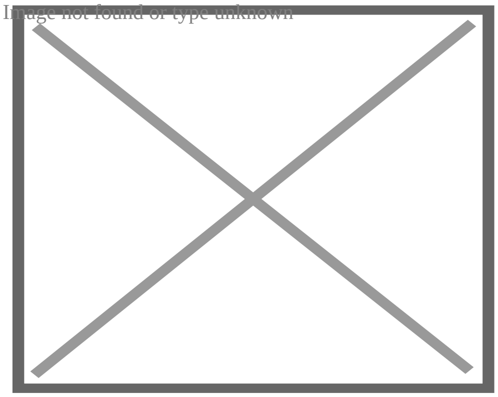
Stability analysis is needed to design engineered slopes and estimate the risk of slope failure in natural or designed slopes by determining the conditions under which the topmost mass of soil will slip relative to the base of soil and lead to slope failure.[13] If the interface between the mass and the base of a slope has a complex geometry, slope stability analysis is difficult and numerical solution methods are required. Typically, the interface's exact geometry is unknown, and a simplified interface geometry is assumed. Finite slopes require three-dimensional models to be analyzed, so most slopes are analyzed assuming that they are infinitely wide and can be represented by two-dimensional models.

Sub-disciplines

[edit]

Geosynthetics

[edit]
Main article: Geosynthetics



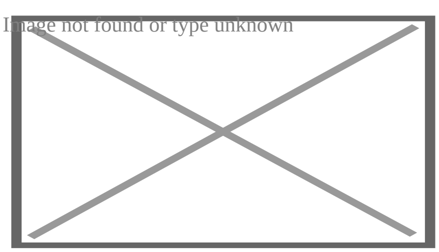
A collage of geosynthetic products.

Geosynthetics are a type of plastic polymer products used in geotechnical engineering that improve engineering performance while reducing costs. This includes geotextiles, geogrids, geomembranes, geocells, and geocomposites. The synthetic nature of the products make them suitable for use in the ground where high levels of durability are required. Their main functions include drainage, filtration, reinforcement, separation, and containment.

Geosynthetics are available in a wide range of forms and materials, each to suit a slightly different end-use, although they are frequently used together. Some reinforcement geosynthetics, such as geogrids and more recently, cellular confinement systems, have shown to improve bearing capacity, modulus factors and soil stiffness and strength.[14] These products have a wide range of applications and are currently used in many civil and geotechnical engineering applications including roads, airfields, railroads, embankments, piled embankments, retaining structures, reservoirs, canals, dams, landfills, bank protection and coastal engineering.[15]

Offshore

[edit]
Main article: Offshore geotechnical engineering



Platforms offshore Mexico.

Offshore (or *marine*) *geotechnical engineering* is concerned with foundation design for human-made structures in the sea, away from the coastline (in opposition to *onshore* or *nearshore* engineering). Oil platforms, artificial islands and submarine pipelines are examples of such structures.[16]

There are a number of significant differences between onshore and offshore geotechnical engineering.[16][17] Notably, site investigation and ground improvement on the seabed are more expensive; the offshore structures are exposed to a wider range of geohazards; and the environmental and financial consequences are higher in case of failure. Offshore structures are exposed to various environmental loads, notably wind, waves and currents. These phenomena may affect the integrity or the serviceability of the structure and its foundation during its operational lifespan and need to be taken into account in offshore design.

In subsea geotechnical engineering, seabed materials are considered a two-phase material composed of rock or mineral particles and water.[18][19] Structures may be fixed in place in the seabed—as is the case for piers, jetties and fixed-bottom wind turbines—or may comprise a floating structure that remains roughly fixed relative to its geotechnical anchor point. Undersea mooring of human-engineered floating structures include a large number of offshore oil and gas platforms and, since 2008, a few floating wind turbines. Two common types of engineered design for anchoring floating structures include tension-leg and catenary loose mooring systems.[20]

Observational method

[edit]

First proposed by Karl Terzaghi and later discussed in a paper by Ralph B. Peck, the observational method is a managed process of construction control, monitoring, and review, which enables modifications to be incorporated during and after construction. The method aims to achieve a greater overall economy without compromising safety by creating designs based on the most probable conditions rather than the most unfavorable.[21] Using the observational method, gaps in available information are filled by measurements and investigation, which aid in assessing the behavior of the structure during construction, which in turn can be modified per the findings. The method was described by Peck as "learn-as-you-go".[22]

The observational method may be described as follows:[22]

1. General exploration sufficient to establish the rough nature, pattern, and properties of deposits.
2. Assessment of the most probable conditions and the most unfavorable conceivable deviations.
3. Creating the design based on a working hypothesis of behavior anticipated under the most probable conditions.
4. Selection of quantities to be observed as construction proceeds and calculating their anticipated values based on the working hypothesis under the most unfavorable conditions.

5. Selection, in advance, of a course of action or design modification for every foreseeable significant deviation of the observational findings from those predicted.
6. Measurement of quantities and evaluation of actual conditions.
7. Design modification per actual conditions

The observational method is suitable for construction that has already begun when an unexpected development occurs or when a failure or accident looms or has already happened. It is unsuitable for projects whose design cannot be altered during construction.[22]

See also

[edit]

- icon Image not found or type unknown Engineering portal

- Civil engineering
- Deep Foundations Institute
- Earthquake engineering
- Earth structure
- Effective stress
- Engineering geology
- Geological Engineering
- Geoprofessions
- Hydrogeology
- International Society for Soil Mechanics and Geotechnical Engineering
- Karl von Terzaghi
- Land reclamation
- Landfill
- Mechanically stabilized earth
- Offshore geotechnical engineering
- Rock mass classifications
- Sediment control
- Seismology
- Soil mechanics
- Soil physics
- Soil science

Notes

[edit]

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External links

[edit]

- Worldwide Geotechnical Literature Database

- v
- t

- e

Engineering

- History
- Outline
- List of engineering branches

Civil

- Architectural
- Coastal
- Construction
- Earthquake
- Ecological
- Environmental
    - Sanitary
- Geological
- Geotechnical
- Hydraulic
- Mining
- Municipal/urban
- Offshore
- River
- Structural
- Transportation
    - Traffic
    - Railway

Mechanical

- Acoustic
- Aerospace
- Automotive
- Biomechanical
- Energy
- Manufacturing
- Marine
- Naval architecture
- Railway
- Sports
- Thermal
- Tribology

Specialties and interdisciplinarity

Electrical

- Broadcast
    - outline
- Control
- Electromechanics
- Electronics
- Microwaves
- Optical
- Power
- Radio-frequency
- Signal processing
- Telecommunications

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Engineering education	◦ Bachelor of Engineering ◦ Bachelor of Science ◦ Master's degree ◦ Doctorate ◦ Graduate certificate ◦ Engineer's degree ◦ Licensed engineer
Related topics	◦ Engineer

Glossaries	◦ Engineering
	    ◦ A–L
	    ◦ M–Z
	◦ Aerospace engineering
	◦ Civil engineering
	◦ Electrical and electronics engineering
	◦ Mechanical engineering
	◦ Structural engineering

Other

- Agricultural
- Audio
- Automation
- Biomedical
  - Bioinformatics
  - Clinical
  - Health technology
  - Pharmaceutical
  - Rehabilitation
- Building services
  - MEP
- Design
- Explosives
- Facilities
- Fire
- Forensic
- Climate
- Geomatics
- Graphics
- Industrial
- Information
- Instrumentation
  - Instrumentation and control
- Logistics
- Management
- Mathematics
- Mechatronics
- Military
- Nuclear
- Ontology
- Packaging
- Physics
- Privacy
- Safety
- Security
- Survey
- Sustainability
- Systems
- Textile

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Soil science

- History
- Index

Main fields

- Pedology
- Edaphology
- Soil biology
- Soil microbiology
- Soil zoology
- Soil ecology
- Soil physics
- Soil mechanics
- Soil chemistry
- Environmental soil science
- Agricultural soil science

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Soil topics

- Soil
- Pedosphere
  - Soil morphology
  - Pedodiversity
  - Soil formation
- Soil erosion
- Soil contamination
- Soil retrogression and degradation
- Soil compaction
  - Soil compaction (agriculture)
- Soil sealing
- Soil salinity
  - Alkali soil
- Soil pH
  - Soil acidification
- Soil health
- Soil life
- Soil biodiversity
- Soil quality
- Soil value
- Soil fertility
- Soil resilience
- Soil color
- Soil texture
- Soil structure
  - Pore space in soil
  - Pore water pressure
- Soil crust
- Soil horizon
- Soil biomantle
- Soil carbon
- Soil gas
  - Soil respiration
- Soil organic matter
- Soil moisture
  - Soil water (retention)

- **v**
- **t**
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Soil classification

World Reference Base for Soil Resources (1998–)	○ Acrisols ○ Alisols ○ Andosols ○ Anthrosols ○ Arenosols ○ Calcisols ○ Cambisols ○ Chernozem ○ Cryosols ○ Durisols ○ Ferralsols ○ Fluvisols ○ Gleysols ○ Gypsisols ○ Histosol ○ Kastanozems ○ Leptosols ○ Lixisols ○ Luvisols ○ Nitisols ○ Phaeozems ○ Planosols ○ Plinthosols ○ Podzols ○ Regosols ○ Retisols ○ Solonchaks ○ Solonetz ○ Stagnosol ○ Technosols ○ Umbrisols ○ Vertisols
USDA soil	○ Alfisols ○ Andisols ○ Aridisols ○ Entisols ○ Gelisols ○ Histosols

Applications	◦ Soil conservation ◦ Soil management ◦ Soil guideline value ◦ Soil survey ◦ Soil test ◦ Soil governance ◦ Soil value ◦ Soil salinity control ◦ Erosion control ◦ Agroecology ◦ Liming (soil)
Related fields	◦ Geology ◦ Geochemistry ◦ Petrology ◦ Geomorphology ◦ Geotechnical engineering ◦ Hydrology ◦ Hydrogeology ◦ Biogeography ◦ Earth materials ◦ Archaeology ◦ Agricultural science ◦ Agrology
Societies, Initiatives	◦ Australian Society of Soil Science Incorporated ◦ Canadian Society of Soil Science ◦ Central Soil Salinity Research Institute (India) ◦ German Soil Science Society ◦ Indian Institute of Soil Science ◦ International Union of Soil Sciences ◦ International Year of Soil ◦ National Society of Consulting Soil Scientists (US) ◦ OPAL Soil Centre (UK) ◦ Soil Science Society of Poland ◦ Soil and Water Conservation Society (US) ◦ Soil Science Society of America ◦ World Congress of Soil Science

Scientific journals

- *Acta Agriculturae Scandinavica B*
- *Journal of Soil and Water Conservation*
- *Plant and Soil*
- *Pochvovedenie*
- *Soil Research*
- *Soil Science Society of America Journal*

See also

- Land use
- Land conversion
- Land management
- Vegetation
- Infiltration (hydrology)
- Groundwater
- Crust (geology)
- Impervious surface/Surface runoff
- Petrichor

- Image not found or type unknown Wikipedia:WikiProject Soil
- Image not found or type unknown Category soil
- Category soil science
- Image not found or type unknown List of soil scientists

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Geotechnical engineering

Offshore geotechnical engineering

Investigation and instrumentation

Field (*in situ*)

- Image not found or type unknown Core drill
- Image not found or type unknown Cone penetration test
- Image not found or type unknown Geo-electrical sounding
- Image not found or type unknown Permeability test
- Image not found or type unknown Load test
  - Static
  - Dynamic
  - Statnamic
- Image not found or type unknown Pore pressure measurement
  - Piezometer
  - Well
- Image not found or type unknown Ram sounding
- Image not found or type unknown Rock control drilling
- Image not found or type unknown Rotary-pressure sounding
- Image not found or type unknown Rotary weight sounding
- Image not found or type unknown Sample series
- Image not found or type unknown Screw plate test
- Deformation monitoring
  - Image not found or type unknown Inclinometer
  - Image not found or type unknown Settlement recordings
- Image not found or type unknown Shear vane test
- Image not found or type unknown Simple sounding
- Image not found or type unknown Standard penetration test
- Image not found or type unknown Total sounding
- Image not found or type unknown Trial pit
- Image not found or type unknown Visible bedrock
- Nuclear densometer test
- Exploration geophysics
- Crosshole sonic logging

Soil

- Types
  - Clay
  - Silt
  - Sand
  - Gravel
  - Peat
  - Loam
  - Loess
- Properties
  - Hydraulic conductivity
  - Water content
  - Void ratio
  - Bulk density
  - Thixotropy
  - Reynolds' dilatancy
  - Angle of repose
  - Friction angle
  - Cohesion
  - Porosity
  - Permeability
  - Specific storage
  - Shear strength
  - Sensitivity

Structures (Interaction)

Natural features

- Topography
- Vegetation
- Terrain
- Topsoil
- Water table
- Bedrock
- Subgrade
- Subsoil

Earthworks

- Shoring structures
  - Retaining walls
  - Gabion
  - Ground freezing
  - Mechanically stabilized earth
  - Pressure grouting
  - Slurry wall
  - Soil nailing
  - Tieback
- Land development
- Landfill
- Excavation
- Trench
- Embankment
- Cut
- Causeway
- Terracing
- Cut-and-cover
- Cut and fill
- Fill dirt
- Grading
- Land reclamation
- Track bed
- Erosion control
- Earth structure
- Expanded clay aggregate
- Crushed stone
- Geosynthetics
  - Geotextile
  - Geomembrane
  - Geosynthetic clay liner
  - Cellular confinement
- Infiltration

Foundations

- Shallow
- Deep

- **Mechanics**
  - Forces
    - Effective stress
    - Pore water pressure
    - Lateral earth pressure
    - Overburden pressure
    - Preconsolidation pressure
  - Phenomena/ problems
    - Permafrost
    - Frost heaving
    - Consolidation
    - Compaction
    - Earthquake
      - Response spectrum
      - Seismic hazard
      - Shear wave
    - Landslide analysis
      - Stability analysis
      - Mitigation
      - Classification
      - Sliding criterion
      - Slab stabilisation
    - Bearing capacity * Stress distribution in soil
- **Numerical analysis software**
  - SEEP2D
  - STABL
  - SVFlux
  - SVSlope
  - UTEXAS
  - Plaxis

Related fields	◦ Geology ◦ Geochemistry ◦ Petrology ◦ Earthquake engineering ◦ Geomorphology ◦ Soil science ◦ Hydrology ◦ Hydrogeology ◦ Biogeography ◦ Earth materials ◦ Archaeology ◦ Agricultural science ◦ Agrology

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Construction

Types	◦ Home construction ◦ Offshore construction ◦ Underground construction ◦ Tunnel construction
History	◦ Architecture ◦ Construction ◦ Structural engineering ◦ Timeline of architecture ◦ Water supply and sanitation

Professions	○ Architect ○ Building engineer ○ Building estimator ○ Building officials ○ Chartered Building Surveyor ○ Civil engineer ○ Civil estimator ○ Clerk of works ○ Project manager ○ Quantity surveyor ○ Site manager ○ Structural engineer ○ Superintendent
Trades workers (List)	○ Banksman ○ Boilermaker ○ Bricklayer ○ Carpenter ○ Concrete finisher ○ Construction foreman ○ Construction worker ○ Electrician ○ Glazier ○ Ironworker ○ Millwright ○ Plasterer ○ Plumber ○ Roofer ○ Steel fixer ○ Welder

Organizations	◦ American Institute of Constructors (AIC) ◦ American Society of Civil Engineers (ASCE) ◦ Asbestos Testing and Consultancy Association (ATAC) ◦ Associated General Contractors of America (AGC) ◦ Association of Plumbing and Heating Contractors (APHC) ◦ Build UK ◦ Construction History Society ◦ Chartered Institution of Civil Engineering Surveyors (CICES) ◦ Chartered Institute of Plumbing and Heating Engineering (CIPHE) ◦ Civil Engineering Contractors Association (CECA) ◦ The Concrete Society ◦ Construction Management Association of America (CMAA) ◦ Construction Specifications Institute (CSI) ◦ FIDIC ◦ Home Builders Federation (HBF) ◦ Lighting Association ◦ National Association of Home Builders (NAHB) ◦ National Association of Women in Construction (NAWIC) ◦ National Fire Protection Association (NFPA) ◦ National Kitchen & Bath Association (NKBA) ◦ National Railroad Construction and Maintenance Association (NRC) ◦ National Tile Contractors Association (NTCA) ◦ Railway Tie Association (RTA) ◦ Royal Institution of Chartered Surveyors (RICS) ◦ Scottish Building Federation (SBF) ◦ Society of Construction Arbitrators
By country	◦ India ◦ Iran ◦ Japan ◦ Romania ◦ Turkey ◦ United Kingdom ◦ United States
Regulation	◦ Building code ◦ Construction law ◦ Site safety ◦ Zoning

Architecture	◦ Style
	  ◦ List
	◦ Industrial architecture
	  ◦ British
	◦ Indigenous architecture
	◦ Interior architecture
	◦ Landscape architecture
	◦ Vernacular architecture

Engineering	◦ Architectural engineering
	◦ Building services engineering
	◦ Civil engineering
	  ◦ Coastal engineering
	  ◦ Construction engineering
	  ◦ Structural engineering
	◦ Earthquake engineering
	◦ Environmental engineering
	◦ Geotechnical engineering

Methods	◦ List ◦ Earthbag construction ◦ Modern methods of construction ◦ Monocrete construction ◦ Slip forming

Other topics

- Building material
  - List of building materials
  - Millwork
- Construction bidding
- Construction delay
- Construction equipment theft
- Construction loan
- Construction management
- Construction waste
- Demolition
- Design–build
- Design–bid–build
- DfMA
- Heavy equipment
- Interior design
- Lists of buildings and structures
  - List of tallest buildings and structures
- Megaproject
- Megastructure
- Plasterwork
  - Damp
    - Proofing
  - Parge coat
  - Roughcast
    - Harling
- Real estate development
- Stonemasonry
- Sustainability in construction
- Unfinished building
- Urban design
- Urban planning

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- Germany
- United States
- Czech Republic
- Israel

About Cook County

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Things To Do in Cook County

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Sand Ridge Nature Center

4.8 (96)

Photo

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River Trail Nature Center

4.6 (235)

Photo

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Palmisano (Henry) Park

4.7 (1262)

Driving Directions in Cook County

Driving Directions From Palmisano (Henry) Park to

Driving Directions From Lake Katherine Nature Center and Botanic Gardens to

Driving Directions From Navy Pier to

https://www.google.com/maps/dir/Navy+Pier/United+Structural+Systems+of+Illinois%2C+Inc/@41.8918633,-87.6050944,14z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1sunknown!2m2!1d-87.6050944!2d41.8918633!1m5!1m1!1sChIJ-wSxDtinD4gRiv4kY3RRh9U!2m2!1d-88.1396465!2d42.0637725!3e0

https://www.google.com/maps/dir/Lake+Katherine+Nature+Center+and+Botanic+Gardens/United+Structural+87.8010774,14z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1sunknown!2m2!1d-87.8010774!2d41.6776048!1m5!1m1!1sChIJ-wSxDtinD4gRiv4kY3RRh9U!2m2!1d-88.1396465!2d42.0637725!3e2

https://www.google.com/maps/dir/Palmisano+%28Henry%29+Park/United+Structural+Systems+of+Illinois%2
87.6490151,14z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1sunknown!2m2!1d-
87.6490151!2d41.8429903!1m5!1m1!1sChIJ-wSxDtinD4gRiv4kY3RRh9U!2m2!1d-
88.1396465!2d42.0637725!3e1

Reviews for

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Jeffery James

(5)

Very happy with my experience. They were prompt and followed through, and very helpful in fixing the crack in my foundation.

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Sarah McNeily

(5)

USS was excellent. They are honest, straightforward, trustworthy, and conscientious. They thoughtfully removed the flowers and flower bulbs to dig where they needed in the yard, replanted said flowers and spread the extra dirt to fill in an area of the yard. We've had other services from different companies and our yard was really a mess after. They kept the job site meticulously clean. The crew was on time and friendly. I'd recommend them any day! Thanks to Jessie and crew.

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Jim de Leon

(5)

It was a pleasure to work with Rick and his crew. From the beginning, Rick listened to my concerns and what I wished to accomplish. Out of the 6 contractors that quoted the project, Rick seemed the MOST willing to accommodate my wishes. His pricing was definitely more than fair as well. I had 10 push piers installed to stabilize and lift an addition of my house. The project commenced at the date that Rick had disclosed initially and it was completed within the same time period expected (based on Rick's original assessment). The crew was well informed, courteous, and hard working. They were not loud (even while equipment was being utilized) and were well spoken. My neighbors were very impressed on how polite they were when they entered / exited my property (saying hello or good morning each day when they crossed paths). You can tell they care about the customer concerns. They ensured that the property would be put back as clean as possible by placing MANY sheets of plywood down prior to excavating. They compacted the dirt back in the holes extremely well to avoid large stock piles of soils. All the while, the main office was calling me to discuss updates and expectations of completion. They provided waivers of lien, certificates of insurance, properly acquired permits, and JULIE locates. From a construction background, I can tell you that I did not see any flaws in the way they operated and this an extremely professional company. The pictures attached show the push piers added to the foundation (pictures 1, 2 & 3), the amount of excavation (picture 4), and the restoration after dirt was placed back in the pits and compacted (pictures 5, 6 & 7). Please notice that they also sealed two large cracks and steel plated these cracks from expanding further (which you can see under my sliding glass door). I, as well as my wife, are extremely happy that we chose United Structural Systems for our contractor. I would happily tell any of my friends and family to use this contractor should the opportunity arise!

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Chris Abplanalp

(5)

USS did an amazing job on my underpinning on my house, they were also very courteous to the proximity of my property line next to my neighbor. They kept things in order with all the dirt/mud they had to excavate. They were done exactly in the timeframe they indicated, and the contract was very details oriented with drawings of what would be done. Only thing that would have been nice, is they left my concrete a little muddy with boot prints but again, all-in-all a great job

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Dave Kari

(5)

What a fantastic experience! Owner Rick Thomas is a trustworthy professional. Nick and the crew are hard working, knowledgeable and experienced. I interviewed every company in the area, big and small. A homeowner never wants to hear that they have foundation issues. Out of every company, I trusted USS the most, and it paid off in the end. Highly recommend.

When Hairline Drywall Cracks Indicate MovementView GBP

Check our other pages :

- Forecasting Effects of Prolonged Drought on Soil Behavior
- Recognizing Erosion Patterns that Undermine Support
- Coordinating Landscaping to Control Soil Shifts
- Reviewing Impact of Tree Roots on Foundation Integrity
- Understanding Sticky Doors and Window Alignment

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