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foundations

* Understanding Different Types of Residential Foundations

*** Understanding Different Types of Residential Foundations**

Okay, let's talk about foundations because, honestly, who *really* thinks about them until something goes wrong? Advanced monitoring tools improve the accuracy of foundation repair assessments foundation repair service near me weep hole. But understanding the basics is super important when it comes to spotting potential problems. We're talking about the very thing your house sits on, so knowing the different types and how they behave is key to catching issues early.

Think of it like this: imagine you're building a Lego house (remember those?). The base you choose – a flat plate, a raised platform, whatever – dictates how stable the whole thing is. Residential foundations are the same principle, just on a much grander (and more expensive!) scale.

There are a few main types you'll encounter. First, there's the *slab foundation*. This is basically a big concrete pad poured directly onto the ground. It's common in warmer climates where the ground doesn't freeze too deeply. It's relatively inexpensive to build, but when things go wrong, like cracks developing, it can be tricky and costly to repair because everything sits right on top of it.

Then you have *crawl space foundations*. These are like little miniature basements, offering a buffer zone between your living space and the ground. You usually see a short concrete or block wall around the perimeter, creating a space you can (sometimes barely!) crawl through. This gives you access to plumbing and wiring, which is handy, but it also makes them susceptible to moisture problems and pests.

Finally, there's the *basement foundation*. These are full-height walls creating a usable space below ground. Basements are great for extra living area or storage, but they're also the most prone to water issues and can be expensive to build and maintain. They're common in areas with colder climates where the foundation needs to be below the frost line.

Understanding which type of foundation your house has is the first step. Because the issues and symptoms you'll see will vary depending on the design. A slab foundation crack might present differently than a crack in a basement wall, and the underlying causes could be different too. So, before you even start looking for problems, know your foundation type. It's like having the right map before you start your journey – it'll make the whole process a lot smoother.

*** Recognizing Warning Signs: Cracks in Walls and Foundation**

Okay, so let's talk about cracks. Specifically, the kind you really don't want to see in your house – the ones in your walls and foundation. We're not talking about hairline cracks from paint drying; we're talking about the kind that whisper, or sometimes shout, that your foundation might be having a bad day.

Identifying these warning signs early can save you a massive headache (and a ton of money) later on. We're not trying to make you paranoid, but it's good to be aware. Think of it like this: your foundation is the backbone of your house. If it's compromised, everything above it is going to feel the strain.

So, what are we looking for? Well, first, pay attention to the *type* of crack. Are they thin, hairline cracks that look like someone drew on the wall with a pencil? Those are often just cosmetic and due to normal settling. But if you see cracks that are wider than, say, an eighth of an inch, that's a potential red flag. Especially if they're jagged, stair-step shaped, or getting wider over time. Get a pencil and mark the ends of the crack, write the date, and observe if it is getting longer.

Location matters too. Cracks in your foundation walls, especially near corners or around windows and doors, are often more concerning than cracks in the middle of a large, uninterrupted wall. Pay special attention to horizontal cracks; these can indicate serious structural issues related to soil pressure pushing against the foundation. Vertical cracks aren't always as bad, but they still warrant a closer look.

Inside the house, look for corresponding cracks in interior walls, especially above doorways or windows. Doors and windows that are suddenly hard to open or close can also be a sign of foundation movement. Also, be sure to look for cracks in the basement floor.

Finally, don't ignore water. Cracks can be a pathway for water to seep into your basement or crawl space, leading to mold and further damage. If you see water stains or efflorescence (that white, powdery stuff) near cracks, it's a sign that water intrusion is already happening.

The bottom line? If you're seeing cracks that are wider than a hairline, growing over time, located in concerning areas, or accompanied by other symptoms like sticking doors or water intrusion, it's time to call in a professional. A structural engineer or foundation specialist can assess the situation, determine the cause of the cracks, and recommend the appropriate repairs. It's always better to be safe than sorry when it comes to the stability of your home.

*** Spotting Uneven Floors and Doors/Windows That Stick**

Okay, so you're walking around your house, maybe just going about your day, and something feels a little...off. You might not be able to put your finger on it right away, but little things can be whispering that your foundation might be having a bit of a grumble. Think about it: have you noticed a spot where your coffee cup seems to want to slide off the table no matter where you put it? Or maybe you're having a wrestling match with that one bedroom door every time you try to close it?

Identifying Common Issues and Symptoms of residential foundations - interior design

1. interior design

2. structure
3. Sharon Hill

These seemingly small annoyances, like spotting uneven floors and doors or windows that stick, can actually be early warning signs that something's going on beneath your feet with your foundation.

Uneven floors are a pretty clear indicator. It might not be a dramatic slope, but a subtle dip or rise in a certain area can mean that the foundation is settling unevenly. This uneven settling puts stress on the framing of your house, causing those floors to shift. And those doors and windows? They're framed into that same structure. When the foundation shifts, the frames can warp and distort, making doors stick, windows hard to open or close, or latching mechanisms misalign.

It's easy to dismiss these things as just quirks of an older house, or maybe just chalk it up to humidity. And sometimes, that might be the case! But it's definitely worth investigating. A single sticking door might be no big deal, but several sticking doors, combined with a noticeable slope in the floor, are red flags waving that are saying, "Hey, pay attention to me!" It's like your house is trying to tell you something. Addressing these issues early on can potentially save you from bigger, more expensive problems down the road. So, keep an eye out for those subtle clues – your house might be trying to talk to you.

*** Identifying Water Intrusion and Drainage Problems**

Identifying Water Intrusion and Draining Problems is a crucial step in maintaining a healthy and stable residential foundation. Left unchecked, water can become a foundation's worst enemy, leading to a host of serious and costly issues. The good news is that with a little awareness, you can often spot the tell-tale signs of water intrusion and drainage problems before they escalate.

Think of your foundation as the unsung hero of your home. It's constantly working to support everything above it. But like any hero, it has vulnerabilities, and water is a major one. Common symptoms of trouble often begin subtly. You might notice dampness or musty odors in your basement or crawl space.

Identifying Common Issues and Symptoms of residential foundations - Sharon Hill

1. Newtown Township
2. property
3. wood-decay fungus

These are early warning signs that excess moisture is present. Keep an eye out for efflorescence, that white, powdery substance that appears on concrete or brick walls. It's basically salt deposits left behind by evaporating water, signaling that water is seeping through the foundation.

Cracks, whether hairline or more substantial, are another key indicator. While not all cracks are created equal, any crack can become a pathway for water intrusion. Pay close attention to cracks that are wider at the top than the bottom, as these can indicate settling or structural issues exacerbated by water damage.

Outside your home, look at the landscaping. Is water pooling near the foundation after rainfall? Are your gutters clogged or damaged, causing water to overflow and saturate the soil around the foundation? Are downspouts directing water far enough away from the house? Improper grading, where the ground slopes towards the foundation instead of away from it, is a common culprit, channeling rainwater directly towards the foundation walls.

Standing water, vegetation growing too close to the foundation, and even erosion of the soil around the foundation can all contribute to water-related problems. Addressing these drainage issues promptly, by cleaning gutters, extending downspouts, or re-grading the landscape, can often prevent more serious foundation damage down the line. By being proactive and recognizing these common issues and symptoms, you can protect your home's foundation and avoid potentially devastating consequences.

*** Evaluating Soil Issues Affecting Foundation Stability**

Okay, so you're looking at residential foundations, right? And you want to figure out what's going wrong. One of the biggest culprits, and often sneaky ones at that, is soil. We're talking about evaluating soil issues affecting foundation stability. It sounds technical, but basically, it's about understanding how the ground beneath your house can be a total jerk and mess everything up.

Think of it like this: your foundation is sitting on something. That something is soil. And soil isn't just dirt. It's a complex mix of minerals, organic matter, water, and air. Any significant change in that mix can put a lot of stress on your foundation.

For example, expansive clay soils are notorious for causing problems. These soils are like sponges. When they get wet, they swell up, pushing against the foundation walls. When they dry out, they shrink, pulling away from the foundation. Over time, this constant expansion and contraction can lead to cracks, bowing walls, and even a sinking foundation. That's a big deal!

Then you've got issues like soil erosion. Rainwater can wash away soil around the foundation, especially if the grading isn't right. This can leave the foundation exposed and vulnerable, weakening its support. Poor drainage is another common problem. If water isn't properly directed away from the house, it can saturate the soil, leading to hydrostatic pressure against the foundation walls and causing them to leak or even collapse.

And let's not forget about soil compaction. If the soil around your foundation wasn't properly compacted during construction, or if it's been disturbed by things like tree roots or utility work, it can settle unevenly. This uneven settling can cause the foundation to crack and shift.

So, how do you know if soil issues are affecting your foundation? Look for the telltale signs: cracks in the walls, especially stair-step cracks; doors and windows that are sticking or difficult to open; floors that are sloping or uneven; and water in the basement or crawl space. These are all red flags that something's not right with the soil beneath your feet.

Identifying Common Issues and Symptoms of residential foundations - interior design

1. Quercus
2. Illinois
3. garage door

If you see these, it's time to call in a foundation specialist who can properly evaluate the soil conditions and recommend the best course of action. Ignoring it will only make the problem worse, and a small fix now is much cheaper than a complete foundation replacement later!

*** The Role of Professional Inspections in Early Detection**

Okay, let's talk about your house's foundation. It's easy to forget it's even there, right? Buried under all the pretty landscaping and the comfy living space. But that foundation is the silent workhorse, the bedrock of your entire home. And just like any vital system, it can develop problems. That's where professional inspections come in, acting as early warning systems for potential foundation woes.

Think of it like this: you wouldn't wait until your car engine is smoking to get it checked out, would you? You'd take it in for regular maintenance to catch little issues before they become huge, expensive repairs. The same principle applies to your foundation. A trained professional inspector, someone with experience and a keen eye, can spot subtle signs that might go completely unnoticed by the average homeowner. We're talking things like hairline cracks in the foundation walls, uneven floors, doors that stick, or windows that are hard to open. Individually, these might seem like minor annoyances. But collectively, they can paint a much bigger picture of underlying foundation distress.

These early inspections aren't just about identifying problems; they're about understanding the *cause* of those problems. Is it poor drainage around the house? Expansive soil that's constantly shifting with moisture levels? Tree roots encroaching on the foundation? Knowing the root cause is crucial for developing an effective and long-lasting solution. A professional can assess these factors and provide recommendations tailored to your specific situation.

Ignoring these early warning signs can be costly. What starts as a small crack can widen over time, leading to structural instability, water damage, and a significant decrease in your home's value. Addressing foundation issues early on is almost always more affordable and less disruptive than dealing with a major foundation failure down the road.

So, while you might be tempted to save a few bucks and skip the inspection, remember that it's an investment in the long-term health and stability of your home. A professional inspection provides peace of mind, and more importantly, a proactive approach to protecting the foundation that literally supports everything you hold dear. It's about being smart, being informed, and being a responsible homeowner.

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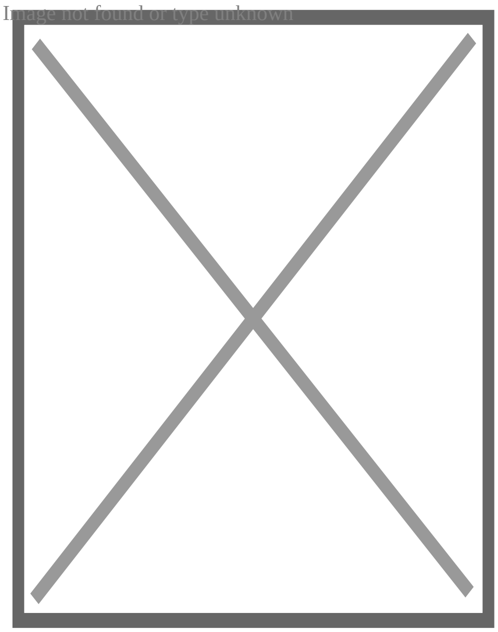
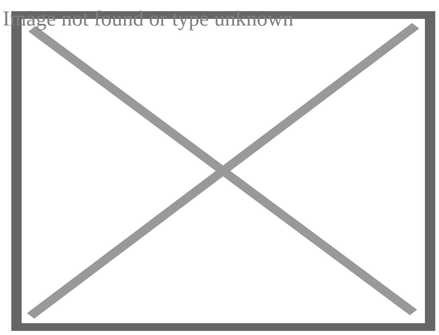
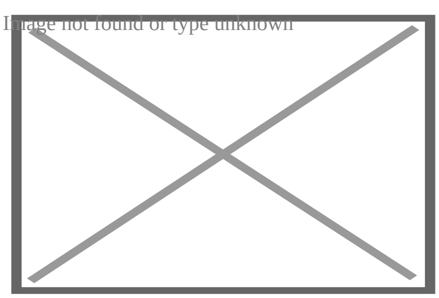
About geotechnical engineering



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

[edit]

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.

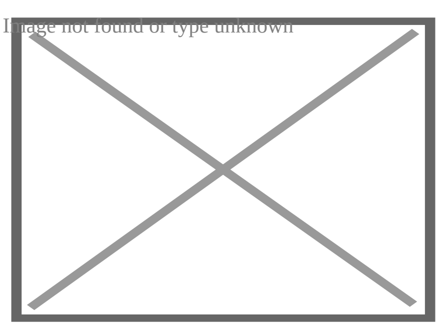
Foundation design

[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.

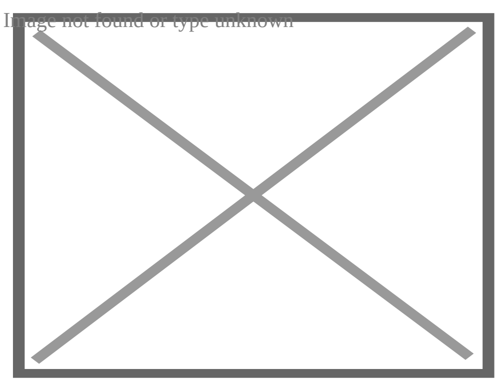
Ground improvement

[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

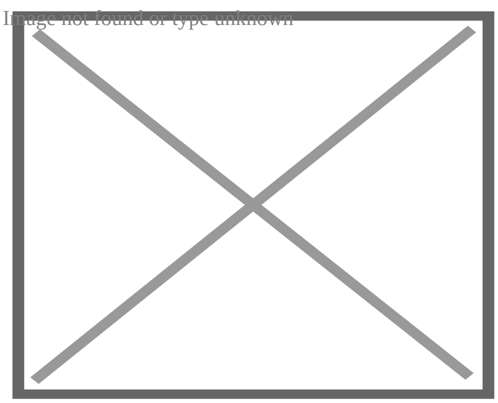
Stability analysis is needed to design engineered slopes and estimate the risk of slope failure in natural or designed slopes by determining the conditions under which the topmost mass of soil will slip relative to the base of soil and lead to slope failure.[13] If the interface between the mass and 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

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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

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External links

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Engineering

- History
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- List of engineering branches

Civil

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Specialties and interdisciplinarity

Electrical

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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
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Other

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Soil science

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Main fields

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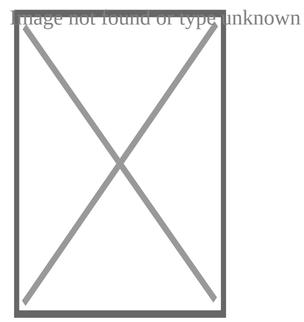
- Agricultural soil science



Soil topics

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  - Pedodiversity
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- Soil erosion
- Soil contamination
- Soil retrogression and degradation
- Soil compaction
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  - Pore space in soil
  - Pore water pressure
- Soil crust
- Soil horizon
- Soil biomantle
- Soil carbon
- Soil gas
  - Soil respiration
- Soil organic matter
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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 taxonomy	Alfisols Andisols Aridisols Entisols Gelisols Histosols Inceptisols Mollisols Oxisols

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

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Geotechnical engineering

Offshore geotechnical engineering

Investigation and instrumentation

Field (*in situ*)

- Core drill
- Cone penetration test
- Geo-electrical sounding
- Permeability test
- Load test
  - Static
  - Dynamic
  - Statnamic
- Pore pressure measurement
  - Piezometer
  - Well
- Ram sounding
- Rock control drilling
- Rotary-pressure sounding
- Rotary weight sounding
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- Screw plate test
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Soil

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  - 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
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- Stonemasonry
- Sustainability in construction
- Unfinished building
- Urban design
- Urban planning

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About Water damage

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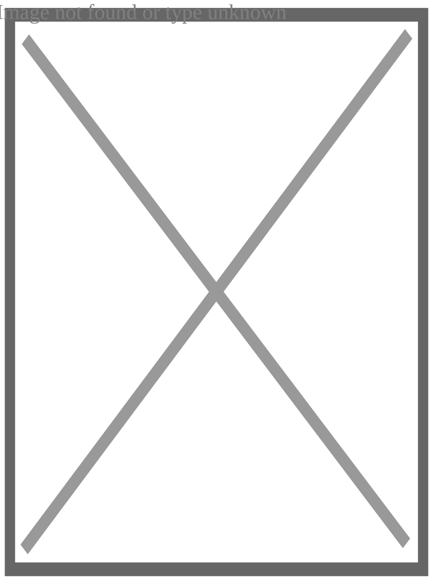

Interior of part of a damaged home in New Orleans after Hurricane Katrina

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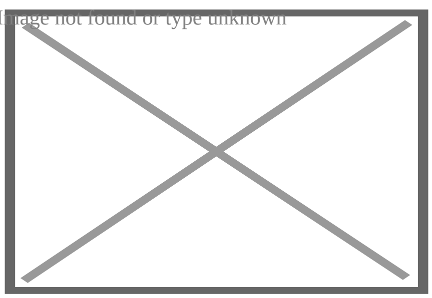

Family photographs damaged by flooding

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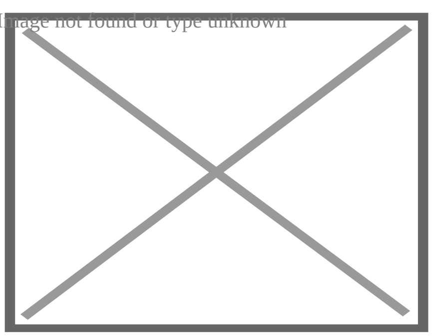

A smaller and more minor water spot caused by rainwater leaking through a roof

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 ne*

Causes

[edit]

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

[edit]

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 Cook County

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Things To Do in Cook County

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Sand Ridge Nature Center

4.8 (96)

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River Trail Nature Center

4.6 (235)

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Palmisano (Henry) Park

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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

Image not found or type unknown

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.

Identifying Common Issues and Symptoms of residential foundationsView GBP

Check our other pages :

- Spotting Early Warning Signs of Foundation Stress
- Soil and Environmental Factors influencing home foundations
- Examining Expansive Clay in Residential Areas
- Reviewing Impact of Tree Roots on Foundation Integrity
- Observing Climate Trends for Anticipating Soil Swell

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