



- **Understanding Expansive Clay and Its Impact on Foundations**  
Understanding Expansive Clay and Its Impact on Foundations Examining Sandy Loam for Residential Support Identifying Areas Vulnerable to Soil Erosion Evaluating Soil Moisture Fluctuations Beneath Homes Approaches for Chemical Soil Stabilization Techniques for Addressing Soil Heave Issues Managing Settlement with Targeted Soil Compaction Recognizing Soil Drainage Limitations Investigating Soil Stress Testing in Residential Sites Incorporating Root Barriers to Prevent Shifts Examining Seasonal Swelling and Shrinking of Soil Employing Sustainable Methods for Long Term Soil Health
- **Planning French Drains for Effective Water Control**  
Planning French Drains for Effective Water Control Setting Up Sump Pumps to Prevent Basement Flooding Extending Gutter Downspouts for Extra Protection Excavation Basics for Residential Construction Projects Coordinating Soil Compaction Methods on Site Limiting Erosion Through Proper Grading Techniques Evaluating Perimeter Drain Systems for Dry Foundations Installing Exterior Waterproof Barriers for Walls Adapting Site Plans to Local Rainfall Patterns Understanding Swale Placement for Controlled Water Flow Enhancing Overall Site Drainage with Gravel Trenches Minimizing Subsurface Water Accumulation Around Foundations
- **About Us**



## **foundation repair service home repair.**

Certainly! When it comes to home maintenance and ensuring the stability of your foundation, understanding common signs of poor soil drainage is crucial. Poor soil drainage can have significant implications for the structural integrity of your home, leading to various problems that can be both costly and dangerous to ignore.

One of the most noticeable signs of poor soil drainage is the presence of standing water around your home, especially after rainfall. This water doesn't just sit there; it seeps into the ground, saturating the soil and potentially leading to soil erosion. Over time, this can cause the ground beneath your foundation to become unstable, leading to cracks in the foundation walls or even settlement issues where parts of your home begin to sink.

Another telltale sign is the growth of moss or mushrooms around your home's foundation. These organisms thrive in damp, poorly drained soil, indicating that the area may be retaining too much moisture. This excess moisture can lead to the deterioration of wooden structures and the corrosion of metal components, further compromising the stability of your foundation.

Additionally, if you notice that your basement or crawl space is consistently damp or musty, this is a strong indicator of poor drainage. Moisture in these areas can lead to mold growth, which not only poses health risks but can also weaken the structural materials of your home.

Lastly, uneven or sinking patches in your yard can signal drainage problems. These depressions can collect water, exacerbating the issue and potentially leading to more significant foundation problems down the line.

Addressing these signs promptly is essential to prevent further damage. Solutions may include improving the grading around your home, installing proper drainage systems, or even modifying the soil composition to enhance drainage. By recognizing and addressing these signs early, you can help ensure the long-term stability and safety of your home's foundation.

### **Importance of recognizing soil drainage issues early to prevent extensive foundation damage.**

Recognizing the importance of identifying soil drainage issues early is critical when it comes to preventing extensive foundation damage. This is particularly true for homeowners and builders who are keen on maintaining the structural integrity of their properties. Soil drainage issues, if left unchecked, can lead to a host of problems that not only compromise the foundation but also result in costly repairs down the line.

When soil becomes saturated with water, it expands and exerts pressure on the foundation. Over time, this pressure can cause the foundation to crack, shift, or even settle unevenly.

The consequences are not just structural; they can also lead to water infiltration, mold growth, and a decrease in the overall value of the property. By recognizing soil drainage limitations early, homeowners can take proactive steps to mitigate these risks.

One of the first signs of poor soil drainage is the appearance of cracks in the foundation, walls, or floors. These cracks may be subtle at first but can worsen over time. Additionally, pooling water around the foundation, especially after heavy rains, is a red flag. Yellowing or wilting plants near the foundation can also indicate that the soil is retaining too much moisture.

Early recognition allows for timely intervention. Simple solutions like installing proper drainage systems, such as French drains or sump pumps, can redirect water away from the foundation. Grading the landscape to ensure water flows away from the house can also make a significant difference. In some cases, more extensive solutions like soil replacement or the installation of drainage mats may be necessary.

Moreover, early recognition can save homeowners a considerable amount of money. Minor drainage issues are far easier and less expensive to fix than extensive foundation damage. Insurance companies may also be more willing to cover costs if the issue is addressed promptly, rather than allowing it to escalate.

In conclusion, the importance of recognizing soil drainage issues early cannot be overstated. It is a proactive approach that not only preserves the structural integrity of the foundation but also safeguards the overall value and safety of the property. By staying vigilant and addressing drainage limitations as soon as they are noticed, homeowners can avoid the extensive and costly damage that often accompanies neglected soil drainage problems.

### **Methods for assessing soil drainage conditions around a residential property.**

Understanding the drainage conditions of soil around a residential property is crucial for various reasons, including maintaining a healthy garden, preventing erosion, and ensuring the structural integrity of the home. In this essay, we will explore several methods for assessing soil drainage conditions, which are essential for recognizing soil drainage limitations.

Firstly, one of the most straightforward methods to assess soil drainage is the percolation test, commonly known as the perc test. This test involves digging a small hole in the area of interest, filling it with water, and timing how long it takes for the water to drain. This method provides a clear indication of how well the soil drains water. If the water drains quickly, the soil has good drainage; if it drains slowly, this may indicate poor drainage conditions.

Another effective method is the soil texture test. By examining the composition of the soil—whether it is sandy, clayey, or loamy—one can infer its drainage capabilities. Sandy soils typically drain well but may not retain enough moisture and nutrients for plant growth.

Conversely, clay soils often have poor drainage but are better at retaining moisture and nutrients.

Observing the natural vegetation can also offer clues about soil drainage. Certain plants, such as willows and mosses, thrive in wet conditions, suggesting poor drainage in that area. On the other hand, the presence of drought-tolerant plants may indicate well-drained soil.

Additionally, installing a simple drainage observation pit can help monitor water levels over time. This involves digging a deeper hole and observing how the water table fluctuates with rainfall and seasonal changes. This method can provide valuable long-term data on soil drainage patterns.

Lastly, consulting with a professional soil scientist or using advanced soil testing kits can offer more precise data on soil drainage conditions. These experts can provide detailed analyses and recommendations based on the specific characteristics of your soil.

In conclusion, assessing soil drainage conditions around a residential property involves a combination of simple observational methods and more scientific approaches. Recognizing soil drainage limitations is essential for effective property management, ensuring both the health of your garden and the stability of your home.

### **Overview of residential foundation repair services tailored to address drainage-related issues.**

Understanding soil drainage limitations is crucial when addressing residential foundation repair, particularly when drainage-related issues are involved. Drainage problems often stem from the soil's inability to adequately manage water, which can lead to foundation instability and damage over time.

Firstly, it's important to recognize that not all soils are created equal in terms of their drainage capabilities. Clay soils, for instance, are notorious for their poor drainage. They tend to hold onto water, which can create excessive pressure against a home's foundation. This pressure, known as hydrostatic pressure, can cause the foundation to crack or even shift.

On the other hand, sandy soils drain water more efficiently but may not provide enough support to the foundation, leading to settlement issues. Loamy soils, which are a mix of sand, silt, and clay, generally offer the best balance of drainage and support. However, even loamy soils can become problematic if they become compacted or if the drainage systems around the home are inadequate.

When it comes to residential foundation repair, identifying these soil drainage limitations is the first step. Professionals typically conduct a thorough assessment of the soil type and the existing drainage systems. This might involve soil testing to determine its composition and permeability.

Once the soil drainage limitations are understood, tailored solutions can be implemented. For clay soils, installing French drains or perimeter drainage systems can help redirect water away from the foundation. In sandy soils, additional support might be needed, such as installing piers or helical anchors to stabilize the foundation.

Moreover, ensuring that the grading around the home slopes away from the foundation can significantly improve drainage. This simple yet effective measure can prevent water from pooling near the foundation, reducing the risk of hydrostatic pressure.

In conclusion, recognizing soil drainage limitations is a fundamental aspect of effective residential foundation repair. By understanding the unique challenges posed by different soil types, homeowners and professionals can implement targeted solutions that not only address current drainage issues but also prevent future problems. This proactive approach ensures the longevity and stability of the home's foundation.

### **Case studies showcasing successful foundation repairs due to improved soil drainage management.**

Certainly! Here's a short essay on the topic:

---

Understanding and recognizing soil drainage limitations is crucial in the field of construction and foundation repair. It's a common scenario where homes and buildings suffer from foundation issues due to inadequate soil drainage. However, through improved soil drainage management, many have successfully repaired their foundations, showcasing the profound impact of proper drainage systems.

One notable case study involves a residential home in a suburban area that experienced significant foundation settlement. The homeowners noticed cracks in the walls and uneven floors, which were clear signs of foundation distress. Upon investigation, it was discovered that the soil beneath the foundation had poor drainage, leading to water accumulation and soil expansion during the rainy season. This expansion and subsequent contraction during dry periods caused the foundation to shift.

To address this issue, engineers implemented a comprehensive soil drainage management plan. They installed a French drain system around the perimeter of the house to redirect water away from the foundation. Additionally, they introduced permeable landscaping and improved the grading around the property to ensure water flowed away from the structure.

Over time, the results were remarkable. The foundation stabilized, and the cracks in the walls ceased to widen. The homeowners reported no further issues, highlighting the effectiveness of the drainage improvements. This case underscores the importance of recognizing soil drainage limitations and taking proactive measures to manage them.

Another example is a commercial building that faced similar foundation problems. The building's location in a low-lying area exacerbated its vulnerability to waterlogging. By installing sump pumps and enhancing the existing drainage systems, the property managers were able to mitigate the effects of poor soil drainage. The foundation repairs not only preserved the structural integrity of the building but also saved the owners from costly future repairs.

These case studies illustrate that successful foundation repairs often hinge on the recognition and management of soil drainage limitations. By investing in proper drainage solutions, property owners can prevent foundational damage, ensure the longevity of their structures, and avoid significant repair costs down the line. Recognizing these limitations and acting upon them is not just a matter of maintenance but a crucial aspect of sustainable and safe construction practices.

### **Tips for homeowners to maintain proper soil drainage and prevent future foundation problems.**

Maintaining proper soil drainage around your home is crucial to prevent future foundation problems. Poor soil drainage can lead to a variety of issues, including water accumulation, soil erosion, and even foundation settlement. Recognizing the limitations of your soil's drainage capacity is the first step in safeguarding your home. Here are some practical tips for homeowners to ensure effective soil drainage and maintain a stable foundation.

Firstly, understanding your soil type is essential. Different soils have varying drainage capabilities. Clay soils, for instance, tend to retain water and drain poorly, whereas sandy soils drain quickly but may not retain enough moisture for plant growth. Conducting a simple soil test can help you determine your soil type and its drainage properties. This knowledge will guide you in choosing the right strategies for improvement.

One effective method to enhance soil drainage is by installing a French drain. A French drain is a trench filled with gravel or rock that redirects water away from your foundation. This system can be particularly useful in areas prone to heavy rainfall or where the soil naturally drains poorly. Ensure the drain slopes away from your home and connects to a suitable discharge point, such as a storm drain or dry well.

Another important tip is to manage surface water runoff. Grading your yard properly can significantly reduce the risk of water pooling near your foundation. Create a gentle slope that directs water away from your home. This might involve regrading certain areas or installing swales-shallow, broad ditches that slow down and divert water flow.

Incorporating rain gardens into your landscaping is also a great way to improve soil drainage. Rain gardens are designed to capture and absorb rainwater, using native plants that thrive in moist conditions. These gardens not only enhance drainage but also add aesthetic value to your property.

Regularly maintaining your gutters and downspouts is crucial. Clogged gutters can overflow



and saturate the soil around your foundation, leading to drainage issues. Clean your gutters at least twice a year, especially before the heavy rainfall seasons. Ensure that downspouts extend at least four to six feet away from your home to disperse water effectively.

Finally, consider using permeable paving materials in driveways and walkways. Permeable pavers allow water to seep through, reducing surface runoff and promoting better soil drainage. This small change can make a significant difference in managing water around your home.

By recognizing the limitations of your soil's drainage and implementing these tips, you can maintain proper soil drainage and prevent future foundation problems. A well-drained soil not only protects your home's foundation but also contributes to a healthier landscape.



## About home repair

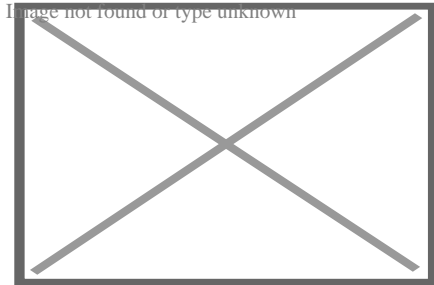
For the novel by Liz Rosenberg, see Home Repair (novel).

For other uses of "repair", see Maintenance.

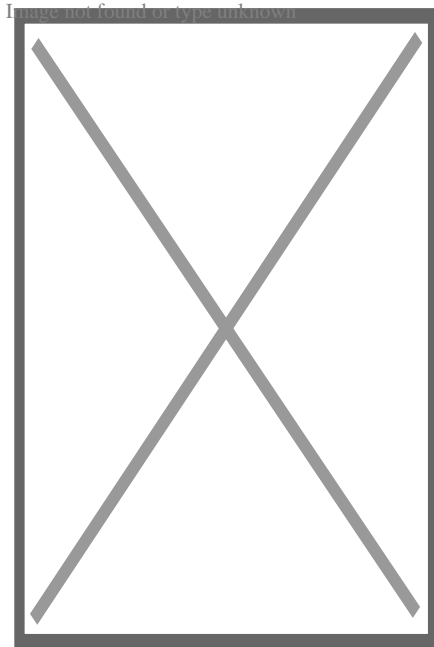
This article **needs additional citations for verification**. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed.



*Find sources: "Home repair" – news • newspapers • books • scholar • JSTOR (January 2017) (Learn how and when to remove this message)*



A mobile home being repaired in Oklahoma



A person making these repairs to a house after a flood

**Home repair** involves the diagnosis and resolution of problems in a home, and is related to home maintenance to avoid such problems. Many types of repairs are "do it yourself" (DIY) projects, while others may be so complicated, time-consuming or risky as to require the assistance of a qualified handyperson, property manager, contractor/builder, or other professionals.



Home repair is not the same as renovation, although many improvements can result from repairs or maintenance. Often the costs of larger repairs will justify the alternative of investment in full-scale improvements. It may make just as much sense to upgrade a home system (with an improved one) as to repair it or incur ever-more-frequent and expensive maintenance for an inefficient, obsolete or dying system.

### **Worn, consumed, dull, dirty, clogged**

[edit]

Repairs often mean simple replacement of worn or used components intended to be periodically renewed by a home-owner, such as burnt out light bulbs, worn out batteries, or overfilled vacuum cleaner bags. Another class of home repairs relates to restoring something to a useful condition, such as sharpening tools or utensils, replacing leaky faucet washers, cleaning out plumbing traps, rain gutters. Because of the required precision, specialized tools, or hazards, some of these are best left to experts such as a plumber. One emergency repair that may be necessary in this area is overflowing toilets. Most of them have a shut-off valve on a pipe beneath or behind them so that the water supply can be turned off while repairs are made, either by removing a clog or repairing a broken mechanism.

### **Broken or damaged**

[edit]

Perhaps the most perplexing repairs facing a home-owner are broken or damaged things. In today's era of built-in obsolescence for many products, it is often more convenient to replace something rather than attempt to repair it. A repair person is faced with the tasks of accurately identifying the problem, then finding the materials, supplies, tools and skills necessary to sufficiently effect the repair. Some things, such as broken windows, appliances or furniture can be carried to a repair shop, but there are many repairs that can be performed easily enough, such as patching holes in plaster and drywall, cleaning stains, repairing cracked windows and their screens, or replacing a broken electrical switch or outlet. Other repairs may have some urgency, such as broken water pipes, broken doors, latches or windows, or a leaky roof or water tank, and this factor can certainly justify calling for professional help. A home handyperson may become adept at dealing with such immediate repairs, to avoid further damage or loss, until a professional can be summoned.

### **Emergency repairs**

[edit]

Emergencies can happen at any time, so it is important to know how to quickly and efficiently fix the problem. From natural disasters, power loss, appliance failure and no water, emergency repairs tend to be one of the most important repairs to be comfortable and confident with. In most cases, the repairs are DIY or fixable with whatever is around the house. Common repairs would

be fixing a leak, broken window, flooding, frozen pipes or clogged toilet. Each problem can have a relatively simple fix, a leaky roof and broken window can be patched, a flood can be pumped out, pipes can be thawed and repaired and toilets can be unclogged with a chemical. For the most part, emergency repairs are not permanent. They are what you can do fast to stop the problem then have a professional come in to permanently fix it.<sup>[1]</sup> Flooding as a result of frozen pipes, clogged toilets or a leaky roof can result in very costly water damage repairs and even potential health issues resulting from mold growth if not addressed in a timely manner.

## **Maintenance**

[edit]

Periodic maintenance also falls under the general class of home repairs. These are inspections, adjustments, cleaning, or replacements that should be done regularly to ensure proper functioning of all the systems in a house, and to avoid costly emergencies. Examples include annual testing and adjustment of alarm systems, central heating or cooling systems (electrodes, thermocouples, and fuel filters), replacement of water treatment components or air-handling filters, purging of heating radiators and water tanks, defrosting a freezer, vacuum refrigerator coils, refilling dry floor-drain traps with water, cleaning out rain gutters, down spouts and drains, touching up worn house paint and weather seals, and cleaning accumulated creosote out of chimney flues, which may be best left to a chimney sweep.

Examples of less frequent home maintenance that should be regularly forecast and budgeted include repainting or staining outdoor wood or metal, repainting masonry, waterproofing masonry, cleaning out septic systems, replacing sacrificial electrodes in water heaters, replacing old washing machine hoses (preferably with stainless steel hoses less likely to burst and cause a flood), and other home improvements such as replacement of obsolete or ageing systems with limited useful lifetimes (water heaters, wood stoves, pumps, and asphaltic or wooden roof shingles and siding).

Often on the bottom of people's to-do list is home maintenance chores, such as landscaping, window and gutter cleaning, power washing the siding and hard-scape, etc. However, these maintenance chores pay for themselves over time. Often, injury could occur when operating heavy machinery or when climbing on ladders or roofs around your home, so if an individual is not in the proper physical condition to accomplish these chores, then they should consult a professional. Lack of maintenance will cost more due to higher costs associated with repairs or replacements to be made later. It requires discipline and learning aptitude to repair and maintain the home in good condition, but it is a satisfying experience to perform even seemingly minor repairs.

## **Good operations**

[edit]

Another related issue for avoiding costly repairs (or disasters) is the proper operation of a home, including systems and appliances, in a way that prevents damage or prolongs their usefulness. For example, at higher latitudes, even a clean rain gutter can suddenly build up an ice dam in winter, forcing melt water into unprotected roofing, resulting in leaks or even flooding inside walls or rooms. This can be prevented by installing moisture barrier beneath the roofing tiles. A wary home-owner should be alert to the conditions that can result in larger problems and take remedial action before damage or injury occurs. It may be easier to tack down a bit of worn carpet than repair a large patch damaged by prolonged misuse. Another example is to seek out the source of unusual noises or smells when mechanical, electrical or plumbing systems are operating—sometimes they indicate incipient problems. One should avoid overloading or otherwise misusing systems, and a recurring overload may indicate time for an upgrade.

Water infiltration is one of the most insidious sources of home damage. Small leaks can lead to water stains, and rotting wood. Soft, rotten wood is an inviting target for termites and other wood-damaging insects. Left unattended, a small leak can lead to significant structural damage, necessitating the replacement of beams and framing.

With a useful selection of tools, typical materials and supplies on hand, and some home repair information or experience, a home-owner or handyperson should be able to carry out a large number of DIY home repairs and identify those that will need the specialized attention of others.

## Remediation of environmental problems

[edit]

When a home is sold, inspections are performed that may reveal environmental hazards such as radon gas in the basement or water supply or friable asbestos materials (both of which can cause lung cancer), peeling or disturbed lead paint (a risk to children and pregnant women), in-ground heating oil tanks that may contaminate ground water, or mold that can cause problems for those with asthma or allergies. Typically the buyer or mortgage lender will require these conditions to be repaired before allowing the purchase to close. An entire industry of environmental remediation contractors has developed to help home owners resolve these types of problems.

## See also

[edit]

-  not found or type unknown Housing portal
- Electrical wiring
- Handyperson
- Housekeeping
- Home improvement
- Home wiring

- HVAC
- Maintenance, repair, and operations
- Plumbing
- Right to repair
- Smoke alarm
- Winterization

## References

[edit]

1. ^ *Reader's Digest New Complete Do-it-yourself Manual. Montreal, Canada: Reader's Digest Association. 1991. pp. 9–13. ISBN 9780888501783. OCLC 1008853527.*

- v
- t
- e

## Rooms and spaces of a house

### Shared rooms

- Bonus room
- Common room
- Den
- Dining room
- Family room
- Garret
- Great room
- Home cinema
- Kitchen
  - dirty kitchen
  - kitchenette
- Living room
- Gynaecium
  - harem
- Andron
  - man cave
- Recreation room
  - billiard room
- Shrine
- Study
- Sunroom

## **Private rooms**

- Bathroom
  - toilet
- Bedroom / Guest room
  - closet
- Bedsit / Miniflat
- Boudoir
- Cabinet
- Nursery

## **Spaces**

- Atrium
- Balcony
- Breezeway
- Conversation pit
- Cubby-hole
- Deck
- Elevator
  - dumbwaiter
- Entryway/Genkan
- Fireplace
  - hearth
- Foyer
- Hall
- Hallway
- Inglenook
- Lanai
- Loft
- Loggia
- Overhang
- Patio
- Porch
  - screened
  - sleeping
- Ramp
- Secret passage
- Stairs/Staircase
- Terrace
- Veranda
- Vestibule

**Technical, utility  
and storage**

- Attic
- Basement
- Carport
- Cloakroom
- Closet
- Crawl space
- Electrical room
- Equipment room
- Furnace room / Boiler room
- Garage
- Janitorial closet
- Larder
- Laundry room / Utility room / Storage room
- Mechanical room / floor
- Pantry
- Root cellar
- Semi-basement
- Storm cellar / Safe room
- Studio
- Wardrobe
- Wine cellar
- Wiring closet
- Workshop



## **Great house areas**

- Antechamber
- Ballroom
- Kitchen-related
  - butler's pantry
  - buttery
  - saucery
  - scullery
  - spicery
  - still room
- Conservatory / Orangery
- Courtyard
- Drawing room
- Great chamber
- Great hall
- Library
- Long gallery
- Lumber room
- Parlour
- Sauna
- Servants' hall
- Servants' quarters
- Smoking room
- Solar
- State room
- Swimming pool
- Turret
- Undercroft

## **Other**

- Furniture
- Hidden room
- House
  - house plan
  - styles
  - types
- Multi-family residential
- Secondary suite
- Duplex
- Terraced
- Detached
- Semi-detached
- Townhouse
- Studio apartment

**Architectural  
elements**

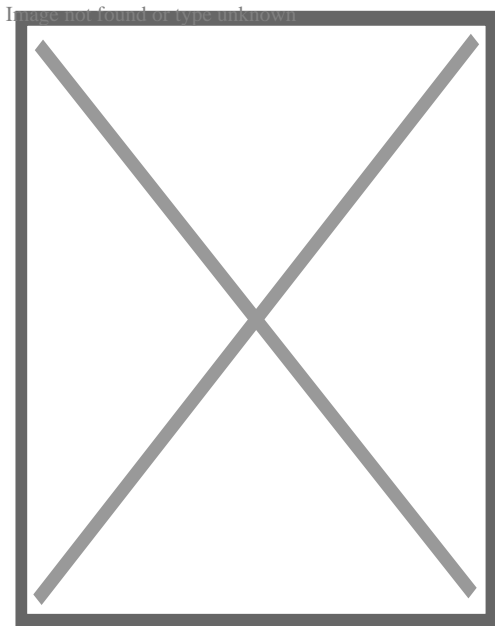
- Arch
- Balconet
- Baluster
- Belt course
- Bressummer
- Ceiling
- Chimney
- Colonnade / Portico
- Column
- Cornice / Eaves
- Dome
- Door
- Ell
- Floor
- Foundation
- Gable
- Gate
  - Portal
- Lighting
- Ornament
- Plumbing
- Quoins
- Roof
  - shingles
- Roof lantern
- Sill plate
- Style
  - list
- Skylight
- Threshold
- Transom
- Vault
- Wall
- Window

- Backyard
- Driveway
- Front yard
- Garden
  - roof garden
- Home
- Home improvement
- Home repair
- Shed
- Tree house

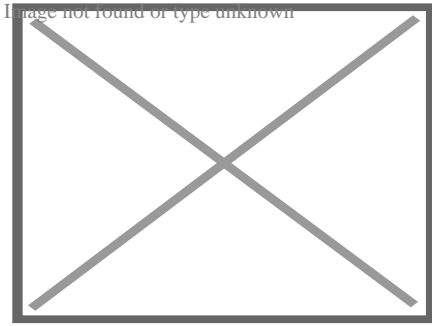
## Related

-  Category: Rooms

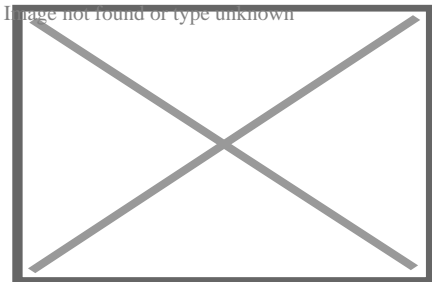
## About geotechnical engineering



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.<sup>[1]</sup>

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.<sup>[1][2]</sup>

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 the soil friction,  $\sigma \tan(\phi)$ , where  $\sigma$  is the normal stress on the slip plane and  $\phi$  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.<sup>[3]</sup>

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.<sup>[1][2]</sup> 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 *Erdbaumechnik* 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.<sup>[4]</sup> 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.<sup>[1][3][5]</sup> 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.<sup>[6]</sup>

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.<sup>[7][8]</sup>

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.<sup>[9]</sup>

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.<sup>[10]</sup>

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

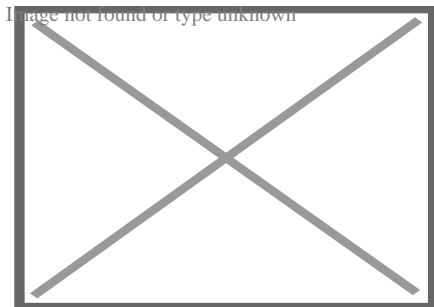
[edit]

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.<sup>[11]</sup>

## 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,<sup>[11]</sup> slope stabilization, and slope stability analysis.

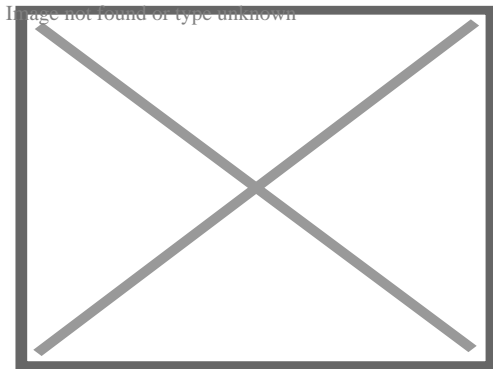
## Ground improvement

[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.<sup>[12]</sup>

## 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.<sup>[13]</sup> 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.

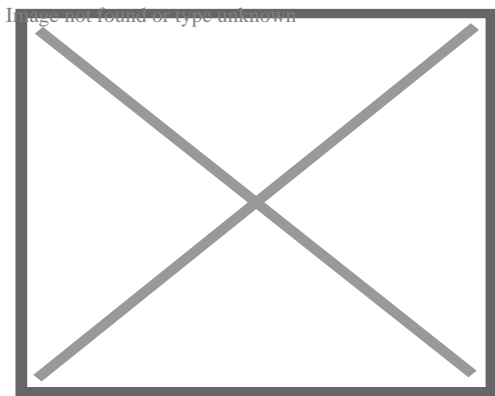
## Sub-disciplines

[edit]

# Geosynthetics

[edit]

Main article: Geosynthetics



A collage of geosynthetic products.

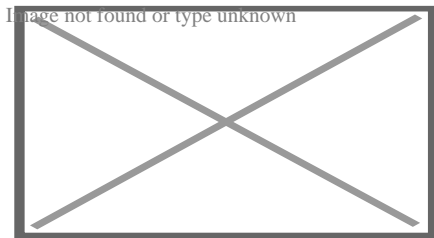
Geosynthetics are a type of plastic polymer products used in geotechnical engineering that improve engineering performance while reducing costs. This includes geotextiles, geogrids, geomembranes, geocells, and geocomposites. The synthetic nature of the products make them suitable for use in the ground 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.<sup>[14]</sup> 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.<sup>[15]</sup>

# 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.<sup>[16]</sup>

There are a number of significant differences between onshore and offshore geotechnical engineering.<sup>[16][17]</sup> 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.<sup>[18][19]</sup> 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.<sup>[20]</sup>

## 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.<sup>[21]</sup> 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".<sup>[22]</sup>

The observational method may be described as follows:<sup>[22]</sup>

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.<sup>[22]</sup>

## See also

[edit]

-  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]

1. ^ **a b c d** Das, Braja (2006). *Principles of Geotechnical Engineering*. Thomson Learning.
2. ^ **a b** Budhu, Muni (2007). *Soil Mechanics and Foundations*. John Wiley & Sons, Inc. ISBN 978-0-471-43117-6.
3. ^ **a b** Disturbed soil properties and geotechnical design, Schofield, Andrew N., Thomas Telford, 2006. ISBN 0-7277-2982-9
4. ^ Guerriero V., Mazzoli S. (2021). "Theory of Effective Stress in Soil and Rock and Implications for Fracturing Processes: A Review". *Geosciences*. **11** (3): 119. Bibcode:2021Geosc..11..119G. doi:10.3390/geosciences11030119.
5. ^ Soil Mechanics, Lambe, T. William and Whitman, Robert V., Massachusetts Institute of Technology, John Wiley & Sons., 1969. ISBN 0-471-51192-7
6. ^ Soil Behavior and Critical State Soil Mechanics, Wood, David Muir, Cambridge University Press, 1990. ISBN 0-521-33782-8
7. ^ Terzaghi, K., Peck, R.B. and Mesri, G. (1996), *Soil Mechanics in Engineering Practice* 3rd Ed., John Wiley & Sons, Inc. ISBN 0-471-08658-4
8. ^ Holtz, R. and Kovacs, W. (1981), *An Introduction to Geotechnical Engineering*, Prentice-Hall, Inc. ISBN 0-13-484394-0
9. ^ Deep Scan Tech (2023): Deep Scan Tech uncovers hidden structures at the site of Denmark's tallest building.
10. ^ "Geofrost Coring". *GEOFROST*. Retrieved 20 November 2020.
11. ^ **a b** Han, Jie (2015). *Principles and Practice of Ground Improvement*. Wiley. ISBN 9781118421307.
12. ^ RAJU, V. R. (2010). *Ground Improvement Technologies and Case Histories*. Singapore: Research Publishing Services. p. 809. ISBN 978-981-08-3124-0. *Ground Improvement – Principles And Applications In Asia*.
13. ^ Pariseau, William G. (2011). *Design analysis in rock mechanics*. CRC Press.
14. ^ Hegde, A.M. and Palsule P.S. (2020), Performance of Geosynthetics Reinforced Subgrade Subjected to Repeated Vehicle Loads: Experimental and Numerical Studies. *Front. Built Environ.* 6:15. <https://www.frontiersin.org/articles/10.3389/fbuil.2020.00015/full>.
15. ^ Koerner, Robert M. (2012). *Designing with Geosynthetics (6th Edition, Vol. 1 ed.)*. Xlibris. ISBN 9781462882892.
16. ^ **a b** Dean, E.T.R. (2010). *Offshore Geotechnical Engineering – Principles and Practice*. Thomas Telford, Reston, VA, 520 p.



17. ^ Randolph, M. and Gourvenec, S., 2011. Offshore geotechnical engineering. Spon Press, N.Y., 550 p.
18. ^ Das, B.M., 2010. Principles of geotechnical engineering. Cengage Learning, Stamford, 666 p.
19. ^ Atkinson, J., 2007. The mechanics of soils and foundations. Taylor & Francis, N.Y., 442 p.
20. ^ Floating Offshore Wind Turbines: Responses in a Sea state – Pareto Optimal Designs and Economic Assessment, P. Slavounos et al., October 2007.
21. ^ Nicholson, D, Tse, C and Penny, C. (1999). The Observational Method in ground engineering – principles and applications. Report 185, CIRIA, London.
22. ^ **a b c** Peck, R.B (1969). Advantages and limitations of the observational method in applied soil mechanics, Geotechnique, 19, No. 1, pp. 171-187.

## References

[edit]

- Bates and Jackson, 1980, Glossary of Geology: American Geological Institute.
- Krynine and Judd, 1957, Principles of Engineering Geology and Geotechnics: McGraw-Hill, New York.
- Ventura, Pierfranco, 2019, Fondazioni, Volume 1, Modellazioni statiche e sismiche, Hoepli, Milano

- Holtz, R. and Kovacs, W. (1981), *An Introduction to Geotechnical Engineering*, Prentice-Hall, Inc. ISBN 0-13-484394-0
- Bowles, J. (1988), *Foundation Analysis and Design*, McGraw-Hill Publishing Company. ISBN 0-07-006776-7
- Cedergren, Harry R. (1977), *Seepage, Drainage, and Flow Nets*, Wiley. ISBN 0-471-14179-8
- Kramer, Steven L. (1996), *Geotechnical Earthquake Engineering*, Prentice-Hall, Inc. ISBN 0-13-374943-6
- Freeze, R.A. & Cherry, J.A., (1979), *Groundwater*, Prentice-Hall. ISBN 0-13-365312-9
- Lunne, T. & Long, M., (2006), *Review of long seabed samplers and criteria for new sampler design*, Marine Geology, Vol 226, p. 145–165
- Mitchell, James K. & Soga, K. (2005), *Fundamentals of Soil Behavior* 3rd ed., John Wiley & Sons, Inc. ISBN 978-0-471-46302-3
- Rajapakse, Ruwan., (2005), "Pile Design and Construction", 2005. ISBN 0-9728657-1-3
- Fang, H.-Y. and Daniels, J. (2005) *Introductory Geotechnical Engineering : an environmental perspective*, Taylor & Francis. ISBN 0-415-30402-4
- NAVFAC (Naval Facilities Engineering Command) (1986) *Design Manual 7.01, Soil Mechanics*, US Government Printing Office
- NAVFAC (Naval Facilities Engineering Command) (1986) *Design Manual 7.02, Foundations and Earth Structures*, US Government Printing Office
- NAVFAC (Naval Facilities Engineering Command) (1983) *Design Manual 7.03, Soil Dynamics, Deep Stabilization and Special Geotechnical Construction*, US Government Printing Office
- Terzaghi, K., Peck, R.B. and Mesri, G. (1996), *Soil Mechanics in Engineering Practice* 3rd Ed., John Wiley & Sons, Inc. ISBN 0-471-08658-4
- Santamarina, J.C., Klein, K.A., & Fam, M.A. (2001), "Soils and Waves: Particulate Materials Behavior, Characterization and Process Monitoring", Wiley, ISBN 978-0-471-49058-6
- Firuziaan, M. and Estorff, O., (2002), "Simulation of the Dynamic Behavior of Bedding-Foundation-Soil in the Time Domain", Springer Verlag.

## External links

[edit]

- Worldwide Geotechnical Literature Database

- v
- t
- e

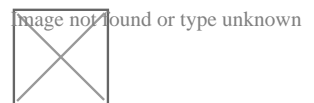
Engineering

- History
- Outline
- List of engineering branches

**Specialties  
and  
interdisciplinarity**

**Electrical**

- Architectural
- Coastal
- Construction
- Earthquake
- Ecological
- Environmental
  - Sanitary
- Geological
- Geotechnical
- Hydraulic
- Mining
- Municipal/urban
- Offshore
- River
- Structural
- Transportation
  - Traffic
  - Railway
- Acoustic
- Aerospace
- Automotive
- Biomechanical
- Energy
- Manufacturing
- Marine
- Naval architecture
- Railway
- Sports
- Thermal
- Tribology
- Broadcast
  - outline
- Control
- Electromechanics
- Electronics
- Microwaves
- Optical
- Power
- Radio-frequency
- Signal processing
- Telecommunications
- Biochemical/bioprocess



## **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

-  **Category**
-  **Commons**
-  **WikiProject**
-  **Portal**

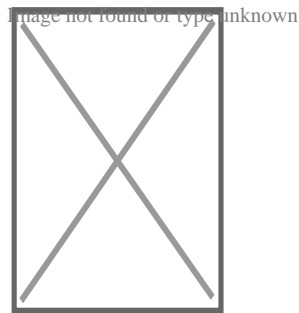
- **v**
- **t**
- **e**

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



## **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**
- **e**

## 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

## **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

-  Wikipedia:WikiProject Soil
-  Category soil
- Category soil science
-  List of soil scientists





















- v
- t
- e

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
-  Sample series
-  Screw plate test
- Deformation monitoring
  -  Inclinometer
  -  Settlement recordings
-  Shear vane test
-  Simple sounding
-  Standard penetration test
-  Total sounding
-  Trial pit
-  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

- v
- t
- e

## **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

<b>Organizations</b>	<ul style="list-style-type: none"> <li>○ American Institute of Constructors (AIC)</li> <li>○ American Society of Civil Engineers (ASCE)</li> <li>○ Asbestos Testing and Consultancy Association (ATAC)</li> <li>○ Associated General Contractors of America (AGC)</li> <li>○ Association of Plumbing and Heating Contractors (APHC)</li> <li>○ Build UK</li> <li>○ Construction History Society</li> <li>○ Chartered Institution of Civil Engineering Surveyors (CICES)</li> <li>○ Chartered Institute of Plumbing and Heating Engineering (CIPHE)</li> <li>○ Civil Engineering Contractors Association (CECA)</li> <li>○ The Concrete Society</li> <li>○ Construction Management Association of America (CMAA)</li> <li>○ Construction Specifications Institute (CSI)</li> <li>○ FIDIC</li> <li>○ Home Builders Federation (HBF)</li> <li>○ Lighting Association</li> <li>○ National Association of Home Builders (NAHB)</li> <li>○ National Association of Women in Construction (NAWIC)</li> <li>○ National Fire Protection Association (NFPA)</li> <li>○ National Kitchen &amp; Bath Association (NKBA)</li> <li>○ National Railroad Construction and Maintenance Association (NRC)</li> <li>○ National Tile Contractors Association (NTCA)</li> <li>○ Railway Tie Association (RTA)</li> <li>○ Royal Institution of Chartered Surveyors (RICS)</li> <li>○ Scottish Building Federation (SBF)</li> <li>○ Society of Construction Arbitrators</li> </ul>
<b>By country</b>	<ul style="list-style-type: none"> <li>○ India</li> <li>○ Iran</li> <li>○ Japan</li> <li>○ Romania</li> <li>○ Turkey</li> <li>○ United Kingdom</li> <li>○ United States</li> </ul>
<b>Regulation</b>	<ul style="list-style-type: none"> <li>○ Building code</li> <li>○ Construction law</li> <li>○ Site safety</li> <li>○ Zoning</li> </ul>

## **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

- 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

## Other topics

 Outline  Category

Authority control databases: National

- Germany
- United States
- Czech Republic
- Israel

About Cook County

Photo

Image not found or type unknown

Photo

Image not found or type unknown

Photo

Image not found or type unknown

Photo

Image not found or type unknown

Things To Do in Cook County

---

Photo

Image not found or type unknown

Sand Ridge Nature Center

4.8 (96)

Photo

Image not found or type unknown

## River Trail Nature Center

4.6 (235)

### Photo

Image not found or type unknown

## 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

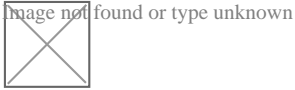
<https://www.google.com/maps/dir/Navy+Pier/United+Structural+Systems+of+Illinois%2C+Inc./87.6050944,14z/data=!3m1!4b1!4m14!4m13!1m5!1m1!1sunknown!2m2!1d-87.6050944!2d41.8918633!1m5!1m1!1sChIJ-wSxDtinD4gRiv4kY3RRh9U!2m2!1d-88.1396465!2d42.0637725!3e0>

<https://www.google.com/maps/dir/Lake+Katherine+Nature+Center+and+Botanic+Gardens/United+Structural+Systems+of+Illinois%2C+Inc./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+LLC+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

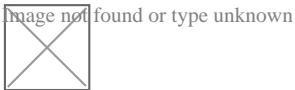
---



**Jeffery James**

**(5)**

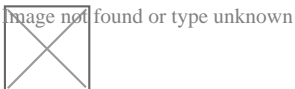
Very happy with my experience. They were prompt and followed through, and very helpful in fixing the crack in my foundation.



**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.

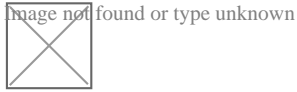


**Jim de Leon**

**(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,

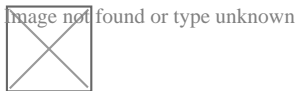
6 & 7). Please notice that they also sealed two large cracks and steel plated these cracks from expanding further (which you can see under my sliding glass door). I, as well as my wife, are extremely happy that we chose United Structural Systems for our contractor. I would happily tell any of my friends and family to use this contractor should the opportunity arise!



**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



**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.

Recognizing Soil Drainage Limitations [View GBP](#)

**Check our other pages :**

- [Identifying Areas Vulnerable to Soil Erosion](#)
- [Setting Up Sump Pumps to Prevent Basement Flooding](#)
- [Techniques for Addressing Soil Heave Issues](#)
- [Examining Sandy Loam for Residential Support](#)
- [Excavation Basics for Residential Construction Projects](#)

United Structural Systems of Illinois, Inc

Phone : +18473822882

City : Hoffman Estates

State : IL

Zip : 60169



Address : 2124 Stonington Ave

## **Google Business Profile**

Company Website : <https://www.unitedstructuralsystems.com/>

### **USEFUL LINKS**

## **Residential Foundation Repair Services**

### **home foundation repair service**

## **Foundation Repair Service**

## **Sitemap**

## **Privacy Policy**

## **About Us**

