

Homeowners



- **Creating Consistent Follow Up Plans After Foundation Work**
Creating Consistent Follow Up Plans After Foundation Work Monitoring Seasonal Moisture Levels to Protect Repairs Inspecting Crawl Spaces for Ongoing Dampness Issues Checking Perimeter Drains to Prevent Clogging Maintaining Proper Landscaping to Minimize Soil Shifts Scheduling Preventive Assessments with Specialists Documenting Foundation Conditions After Weather Events Utilizing Moisture Meters for Accurate Measurements Identifying Early Signs of Reoccurring Settlement Updating Home Records with Maintenance Logs Encouraging Homeowners to Track Changes in Floor Elevation Sharing Maintenance Tips with Neighbors for Unified Care
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Identifying Components That Influence Repair Estimates Weighing Fixed Quote Versus Square Foot Rate Evaluating Progress Billing Arrangements in Construction Planning Down Payment and Final Installment Schedules Considering the Impact of Soil Testing on Total Costs Assessing Equipment Rental Fees for Heavier Machinery Factoring in Structural Engineer Consultations Clarifying the Expense of Permits and Administrative Tasks Adjusting Budgets for Additional Reinforcement Materials Tracking Potential Increases Due to Seasonal Demands Understanding Financing Options Offered by Contractors Prioritizing Repairs Based on Urgency and Budget Constraints
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Explanation of how seasonal moisture levels can impact the effectiveness of foundation repairs.

Seasonal moisture levels play a critical role in the effectiveness of foundation repairs. Obtaining permits is an essential step in any professional foundation repair service [foundation repair service market](#) home insurance. Understanding this relationship is essential for homeowners and contractors aiming to maintain the structural integrity of buildings. Here's a deeper look into how seasonal changes in moisture can impact foundation repairs.

During the wet seasons, such as spring and fall, increased rainfall can lead to higher moisture levels in the soil surrounding a foundation. This excess moisture can cause the soil to expand, a phenomenon known as soil heaving. When the soil expands, it can exert pressure on the foundation, potentially leading to cracks or shifts. For foundations that have recently undergone repairs, this additional pressure can compromise the integrity of the repair work. The materials used in repairs, such as epoxy injections or steel piers, may not hold as effectively under such conditions, leading to a recurrence of foundation issues.

Conversely, during the dry seasons, such as summer and winter, the soil can lose moisture and shrink, a process called soil shrinkage. This shrinkage can create voids beneath the foundation, causing it to settle unevenly. For a foundation that has been repaired, this settling can undo the work that has been done. The materials used in the repair might not be able to counteract the settling, leading to a relapse of the original problems.

Monitoring seasonal moisture levels is, therefore, crucial. By keeping an eye on the moisture content in the soil around the foundation, homeowners and contractors can take proactive measures to protect the repairs. This might involve installing drainage systems to redirect water away from the foundation during wet seasons or using moisture barriers to prevent soil from drying out excessively during dry seasons.

Additionally, regular inspections should be conducted to check the condition of the foundation throughout the year. Any signs of distress, such as new cracks or shifts, should be addressed promptly to prevent further damage.

In conclusion, seasonal moisture levels significantly impact the effectiveness of foundation repairs. By understanding and monitoring these changes, homeowners can take necessary steps to ensure that their foundation remains stable and secure, prolonging the lifespan of the repair work and maintaining the structural integrity of their home.

Overview of common methods used to monitor moisture levels in residential foundations.

When it comes to maintaining residential foundations, monitoring moisture levels is crucial, especially during different seasons. Seasonal changes can significantly impact the moisture content in and around the foundation, leading to potential issues like cracks, shifts, or even structural damage. Fortunately, there are several common methods homeowners and professionals use to keep tabs on

these moisture levels. Here's an overview of these methods.

One of the simplest and most direct ways to monitor moisture levels is through the use of moisture meters. These handy devices measure the moisture content in materials like wood and concrete by sending a low-voltage electrical signal through the material. The resistance to this signal indicates the moisture level, providing an instant readout. They're easy to use and can quickly identify areas with excessive moisture.

Another effective method is the installation of moisture sensors within the foundation or surrounding soil. These sensors can be connected to a monitoring system that provides real-time data on moisture levels. Some advanced systems even send alerts to your smartphone if moisture levels exceed a certain threshold. This method is particularly useful for continuous monitoring over long periods.

For a more visual approach, hygrometers can be used to measure the humidity levels in the air around the foundation. High humidity can indicate potential moisture issues, especially if the foundation is not properly sealed or ventilated. Placing hygrometers in basements or crawl spaces can help identify areas prone to moisture buildup.

Soil moisture probes are another valuable tool. These probes are inserted into the ground around the foundation to measure the moisture content in the soil. They're particularly useful in identifying areas where water might be pooling or where the soil is retaining too much moisture, which can lead to foundation issues.

Lastly, regular visual inspections can't be overlooked. Keeping an eye out for signs of moisture, such as damp spots, mold, or mildew, can provide early warnings of potential problems. Additionally, checking for cracks or shifts in the foundation can indicate moisture-related issues that need attention.

In conclusion, monitoring moisture levels in residential foundations is essential for protecting repairs and maintaining structural integrity. By using a combination of moisture meters, sensors, hygrometers, soil moisture probes, and regular visual inspections, homeowners can stay ahead of potential issues and ensure their foundations remain in top condition throughout the seasons.

Discussion of the role of professional foundation repair services in assessing and addressing moisture-related issues.

When it comes to preserving the integrity of your home, especially after undergoing foundation repair, the role of professional foundation repair services becomes paramount. One of the critical aspects they focus on is the monitoring of seasonal moisture levels to protect repairs. Moisture is a silent but potent adversary that can undermine even the most robust repairs if not adequately managed.

Professional foundation repair services bring a wealth of expertise and specialized tools to the table. They are trained to identify and assess moisture-related issues that could potentially jeopardize the foundation's stability. Seasonal changes often bring fluctuations in moisture levels, and understanding these patterns is crucial. For instance, spring rains can saturate the soil, leading to increased hydrostatic pressure against the foundation, while summer heat can cause the soil to shrink and pull away from the foundation, leading to cracks.

These experts use advanced equipment like moisture meters and soil probes to measure moisture content in and around the foundation. They also employ techniques such as thermal imaging to detect moisture that might not be immediately visible. This meticulous approach allows them to pinpoint problem areas and implement targeted solutions.

Moreover, professional services don't just stop at assessment. They offer comprehensive solutions to mitigate moisture-related issues. This could involve installing drainage systems to redirect water away from the foundation, applying waterproof coatings, or even adjusting the landscape grading to ensure proper water flow. They also provide recommendations for maintaining these systems, ensuring long-term protection.

In conclusion, the role of professional foundation repair services in assessing and addressing moisture-related issues is indispensable. Their expertise, coupled with advanced technology, ensures that your home remains protected, not just from immediate threats but also from the subtle, seasonal changes that could otherwise compromise its foundation.

Tips for homeowners on how to monitor and manage moisture levels around their foundation to protect repairs.

Certainly! Here's a short essay on tips for homeowners on how to monitor and manage moisture levels around their foundation to protect repairs:

Taking care of your home's foundation is crucial for maintaining the structural integrity of your house. One of the key factors that can affect your foundation is moisture. Seasonal changes can lead to fluctuations in moisture levels, which, if not properly managed, can undermine recent repairs and lead to further damage. Here are some practical tips for homeowners to monitor and manage moisture levels around their foundation effectively.

Firstly, it's important to understand the sources of moisture around your foundation. Common sources include rainfall, irrigation systems, and natural groundwater. During wetter seasons, such as spring and fall, be especially vigilant about how water is interacting with your foundation. Installing a reliable drainage system, such as French drains, can help redirect water away from your foundation. Ensure that downspouts are extended away from the house to prevent water from pooling near the foundation.

Regularly inspecting your foundation for signs of moisture is another critical step. Look for cracks, dampness, or mold growth, which can indicate excessive moisture. If you notice any of these signs, it's important to address them promptly to prevent further damage. Using a moisture meter can help you quantify the moisture levels in and around your foundation, providing a more accurate assessment of the situation.

Maintaining a consistent landscape grade is also essential. The ground around your home should slope away from the foundation to facilitate proper drainage. Avoid planting large trees or shrubs too close to your foundation, as their roots can absorb moisture and potentially cause shifts in the soil.

In addition to external measures, consider implementing interior solutions to manage moisture levels. Dehumidifiers can help reduce indoor humidity, which can otherwise seep into your foundation walls.

Ensure that your home's ventilation system is efficient and well-maintained to prevent moisture buildup.

Lastly, consider consulting with a professional if you're unsure about how to manage moisture levels around your foundation. Experts can provide tailored advice and solutions based on your home's specific needs and local climate conditions.

By staying proactive and informed, homeowners can effectively monitor and manage moisture levels around their foundation, ensuring that repairs remain intact and the structural integrity of their home is preserved.

Case studies or examples of how monitoring seasonal moisture levels has helped protect foundation repairs.

Monitoring seasonal moisture levels to protect foundation repairs is a critical practice that has proven its worth in numerous case studies across various regions. By consistently tracking changes in soil moisture, homeowners and professionals can preemptively address potential issues, thereby extending the life of foundation repairs and ensuring structural integrity.

One notable case study involves a residential property located in a humid, coastal region. The homeowner had previously experienced significant foundation settlement due to fluctuating moisture levels. After initial repairs, a comprehensive moisture monitoring system was installed. Sensors were placed around the foundation to measure soil moisture content in real-time. During the rainy season, the data indicated a rise in moisture levels, prompting the homeowner to activate a drainage system specifically designed to redirect excess water away from the foundation. This proactive measure prevented further settlement and maintained the stability of the repair.

In another example, a commercial building in a region with distinct wet and dry seasons faced recurrent issues with its foundation. Engineers implemented a seasonal moisture monitoring program, which involved regular soil sampling and the use of advanced sensors. The data collected revealed a pattern: moisture levels peaked during the monsoon season, leading to increased hydrostatic pressure on the foundation. In response, the building's management installed a perimeter drainage system and ensured that the landscaping around the building was designed to facilitate proper water runoff. These adjustments, informed by continuous moisture monitoring, significantly reduced the stress on the foundation and minimized the need for frequent repairs.

A third case study highlights the importance of community-wide approaches to moisture management. In a suburban area prone to heavy rainfall, several homes experienced foundation issues simultaneously. Local authorities and homeowners' associations collaborated to install a network of moisture sensors throughout the neighborhood. The collected data was shared among residents, allowing them to coordinate their efforts in managing stormwater. This collective action led to the development of shared drainage solutions and the implementation of soil aeration techniques during dry periods to maintain consistent moisture levels. As a result, the entire community saw a marked decrease in foundation-related problems.

These case studies underscore the value of monitoring seasonal moisture levels as a strategic approach to protecting foundation repairs. By leveraging technology and data, homeowners and

professionals can make informed decisions that enhance the longevity and stability of foundational structures, ultimately saving time and resources in the long run.

Recommendations for regular maintenance and monitoring practices to ensure the longevity of foundation repairs.

Certainly! Ensuring the longevity of foundation repairs is crucial for the overall stability and safety of any structure. One essential aspect of maintaining these repairs is monitoring seasonal moisture levels. Here's a detailed look at why this practice is vital and how it can be effectively implemented.

Firstly, understanding the impact of seasonal moisture on foundation repairs is key. Different seasons bring varying levels of moisture, which can significantly affect the integrity of repaired foundations. For instance, spring and fall often see increased rainfall, leading to higher soil moisture levels. This can cause the soil to expand, exerting pressure on the foundation and potentially compromising repair work. Conversely, summer's heat can lead to soil drying and shrinkage, which might cause the foundation to settle unevenly.

Regular monitoring of moisture levels around the foundation is, therefore, a proactive step in maintenance. This can be achieved through simple yet effective methods. Installing moisture sensors around the perimeter of the foundation allows for real-time monitoring of soil moisture levels. These sensors can alert homeowners or maintenance personnel to significant changes, enabling timely intervention.

Additionally, observing the landscape around the foundation is important. Ensuring proper drainage away from the foundation prevents water accumulation, which is a common cause of moisture-related damage. This might involve checking and cleaning gutters and downspouts, especially before the rainy season, to ensure they are functioning correctly.

Another practice is to maintain a consistent landscape grade around the foundation. The ground should slope away from the house to facilitate water runoff. This simple adjustment can significantly reduce the risk of water pooling near the foundation, which is particularly crucial in areas with heavy seasonal rainfall.

Furthermore, it's beneficial to conduct regular visual inspections of the foundation and surrounding area. Look for signs of moisture such as dampness, mold, or mildew, which can indicate excessive moisture levels. These inspections should be more frequent during seasons with extreme moisture variations.

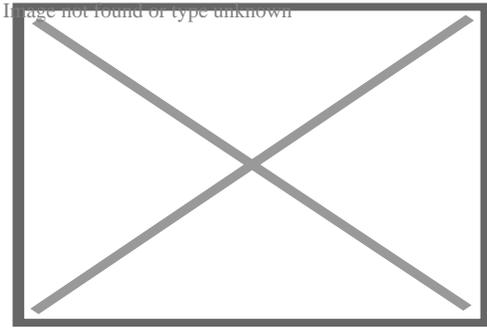
In conclusion, monitoring seasonal moisture levels is a vital component of regular maintenance for foundation repairs. By employing moisture sensors, ensuring proper drainage, maintaining the landscape grade, and conducting regular inspections, homeowners can significantly extend the lifespan of their foundation repairs. This proactive approach not only preserves the structural integrity of the building but also provides peace of mind, knowing that the foundation is well-protected against the natural challenges posed by changing seasons.



About building code

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Not to be confused with Zoning laws.



Code Violation: This fire-rated concrete block wall is penetrated by cable trays and electrical cables. The hole should be firestopped to restore the fire-resistance rating of the wall. Instead, it is filled with flammable polyurethane foam.

A **building code** (also **building control** or **building regulations**) is a set of rules that specify the standards for construction objects such as buildings and non-building structures. Buildings must conform to the code to obtain planning permission, usually from a local council. The main purpose of building codes is to protect public health, safety and general welfare as they relate to the construction and occupancy of buildings and structures^[1] —^[2] for example, the building codes in many countries require engineers to consider the effects of soil liquefaction in the design of new buildings.^[1] The building code becomes law of a particular jurisdiction when formally enacted by the appropriate governmental or private authority.^[2]

Building codes are generally intended to be applied by architects, engineers, interior designers, constructors and regulators but are also used for various purposes by safety inspectors, environmental scientists, real estate developers, subcontractors, manufacturers of building products and materials, insurance companies, facility managers, tenants, and others. Codes regulate the design and construction of structures where adopted into law.

Examples of building codes began in ancient times.^[3] In the USA the main codes are the International Building Code or International Residential Code [IBC/IRC], electrical codes and plumbing, mechanical codes. Fifty states and the District of Columbia have adopted the I-Codes at the state or jurisdictional level.^[4] In Canada, national model codes are published by the National Research Council of Canada.^[5] In the United Kingdom, compliance with Building Regulations is monitored by building control bodies, either Approved Inspectors or Local Authority Building Control departments. Building Control regularisation charges apply in case work is undertaken which should have had been inspected at the time of the work if this was not done.^[6]

Types

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The practice of developing, approving, and enforcing building codes varies considerably among nations. In some countries building codes are developed by the government agencies or quasi-governmental standards organizations and then enforced across the country by the central government. Such codes are known as the **national building codes** (in a sense they enjoy a

mandatory nationwide application).

In other countries, where the power of regulating construction and fire safety is vested in local authorities, a system of model building codes is used. Model building codes have no legal status unless adopted or adapted by an authority having jurisdiction. The developers of model codes urge public authorities to reference model codes in their laws, ordinances, regulations, and administrative orders. When referenced in any of these legal instruments, a particular model code becomes law. This practice is known as 'adoption by reference'. When an adopting authority decides to delete, add, or revise any portions of the model code adopted, it is usually required by the model code developer to follow a formal adoption procedure in which those modifications can be documented for legal purposes.

There are instances when some local jurisdictions choose to develop their own building codes. At some point in time all major cities in the United States had their own building codes. However, due to ever increasing complexity and cost of developing building regulations, virtually all municipalities in the country have chosen to adopt model codes instead. For example, in 2008 New York City abandoned its proprietary *1968 New York City Building Code* in favor of a customized version of the International Building Code.^[7] The City of Chicago remains the only municipality in America that continues to use a building code the city developed on its own as part of the *Municipal Code of Chicago*.

In Europe, the Eurocode: Basis of structural design, is a pan-European building code that has superseded the older national building codes. Each country now has National Annexes to localize the contents of the Eurocodes.

Similarly, in India, each municipality and urban development authority has its own building code, which is mandatory for all construction within their jurisdiction. All these local building codes are variants of a National Building Code,^[8] which serves as model code proving guidelines for regulating building construction activity.

Scope

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The purpose of building codes is to provide minimum standards for safety, health, and general welfare including structural integrity, mechanical integrity (including sanitation, water supply, light, and ventilation), means of egress, fire prevention and control, and energy conservation.^[9]^{10]} Building codes generally include:

- Standards for structure, placement, size, usage, wall assemblies, fenestration size/locations, egress rules, size/location of rooms, foundations, floor assemblies, roof structures/assemblies, energy efficiency, stairs and halls, mechanical, electrical, plumbing,

- site drainage & storage, appliance, lighting, fixtures standards, occupancy rules, and swimming pool regulations
- o Rules regarding parking and traffic impact
- o Fire code rules to minimize the risk of a fire and to ensure safe evacuation in the event of such an emergency^[citation needed]
- o Requirements for earthquake (seismic code), hurricane, flood, and tsunami resistance, especially in disaster prone areas or for very large buildings where a failure would be catastrophic^[citation needed]
- o Requirements for specific building uses (for example, storage of flammable substances, or housing a large number of people)
- o Energy provisions and consumption
- o Grandfather clauses: Unless the building is being renovated, the building code usually does not apply to existing buildings.
- o Specifications on components
- o Allowable installation methodologies
- o Minimum and maximum room ceiling heights, exit sizes and location
- o Qualification of individuals or corporations doing the work
- o For high structures, anti-collision markers for the benefit of aircraft

Building codes are generally separate from zoning ordinances, but exterior restrictions (such as setbacks) may fall into either category.

Designers use building code standards out of substantial reference books during design. Building departments review plans submitted to them before construction, issue permits [or not] and inspectors verify compliance to these standards at the site during construction.

There are often additional codes or sections of the same building code that have more specific requirements that apply to dwellings or places of business and special construction objects such as canopies, signs, pedestrian walkways, parking lots, and radio and television antennas.

Criticism

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Building codes have been criticized for contributing to housing crisis and increasing the cost of new housing to some extent, including through conflicting code between different administrators.^[11] Proposed improvements include regular review and cost-benefit analysis of building codes,^[12] promotion of low-cost construction materials and building codes suitable to mass production,^[11] reducing bureaucracy, and promoting transparency.^[13]

History

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Antiquity

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Building codes have a long history. The earliest known written building code is included in the Code of Hammurabi,^[3] which dates from circa 1772 BC.

The book of Deuteronomy in the Hebrew Bible stipulated that parapets must be constructed on all houses to prevent people from falling off.^[14]

In the Chinese book of rites it mentions that ancestral temples and houses should be a certain standard length in ancient China they measured land in the chu or well field system so it was important to be precise though most of the actual lengths are lost or obscure.^{[15][16]}

In ancient Japan a certain official destroyed a courtiers house because the size was above his rank.^[17]

Modern era

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France

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In Paris, under the reconstruction of much of the city under the Second Empire (1852–70), great blocks of apartments were erected^[18] and the height of buildings was limited by law to five or six stories at most.

United Kingdom

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After the Great Fire of London in 1666, which had been able to spread so rapidly through the densely built timber housing of the city, the Rebuilding of London Act 1666 was passed in the same year as the first significant building regulation.^[19] Drawn up by Sir Matthew Hale, the act regulated the rebuilding of the city, required housing to have some fire resistance capacity and authorised the City of London Corporation to reopen and widen roads.^[20] The Laws of the Indies were passed in the 1680s by the Spanish Crown to regulate the urban planning for colonies throughout Spain's worldwide imperial possessions.

The first systematic national building standard was established with the Metropolitan Buildings Act 1844. Among the provisions, builders were required to give the district surveyor two days' notice before building, regulations regarding the thickness of walls, height of rooms, the materials

used in repairs, the dividing of existing buildings and the placing and design of chimneys, fireplaces and drains were to be enforced and streets had to be built to minimum requirements.[²¹]

The Metropolitan Buildings Office was formed to regulate the construction and use of buildings throughout London. Surveyors were empowered to enforce building regulations, which sought to improve the standard of houses and business premises, and to regulate activities that might threaten public health. In 1855 the assets, powers and responsibilities of the office passed to the Metropolitan Board of Works.

United States

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The City of Baltimore passed its first building code in 1891.[²²] The Great Baltimore Fire occurred in February 1904. Subsequent changes were made that matched other cities.[²³] In 1904, a Handbook of the Baltimore City Building Laws was published. It served as the building code for four years. Very soon, a formal building code was drafted and eventually adopted in 1908.

The structural failure of the tank that caused the Great Molasses Flood of 1919 prompted the Boston Building Department to require engineering and architectural calculations be filed and signed. U.S. cities and states soon began requiring sign-off by registered professional engineers for the plans of major buildings.[²⁴]

More recently, the 2015 Berkeley balcony collapse has prompted updates to California's balcony building codes, set for 2025, which include stricter material requirements, enhanced load-bearing standards, and mandatory inspections which known as SB326 and SB721.[²⁵] These laws mandate regular inspections every six years for multifamily buildings. Property owners and HOAs are required to address any structural or waterproofing issues identified during inspections to ensure compliance and safety. Failure to comply can result in fines, increased liability, and legal consequences. The updates aim to prevent tragedies like the Berkeley collapse, which was caused by dry rot and structural failure, by ensuring the long-term safety and durability of elevated structures.[²⁶]

Energy codes

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The current energy codes^[*clarification needed*] of the United States are adopted at the state and municipal levels and are based on the International Energy Conservation Code (IECC). Previously, they were based on the Model Energy Code (MEC). As of March 2017, the following residential codes have been partially or fully adopted by states:[²⁷]

- 2015 IECC or equivalent (California, Illinois, Maryland, Massachusetts, Michigan, Pennsylvania, New Jersey, New York, Vermont, Washington)
- 2012 IECC or equivalent (Alabama, Connecticut, Delaware, District of Columbia, Florida, Iowa, Minnesota, Nevada, Rhode Island, Texas)
- 2009 IECC or equivalent (Arkansas, Georgia, Idaho, Indiana, Kentucky, Louisiana, Montana, Nebraska, New Hampshire, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, South Carolina, Tennessee, Virginia, West Virginia, Wisconsin)
- 2006 IECC or equivalent (Utah)
- 2006 IECC or no statewide code (Alaska, Arizona, Colorado, Kansas, Maine, Mississippi, Missouri, North Dakota, South Dakota, Wyoming)

Australia

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Australia uses the National Construction Code.

See also

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- Building officials
- Construction law
- Earthquake-resistant structures
- Energy Efficiency and Conservation Block Grants
- Outline of construction
- Seismic code
- Uniform Mechanical Code
- Variance (land use) – permission to vary zoning and sometimes building to code

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[edit]

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- National Kitchen & Bath Association (NKBA)
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- Urban planning

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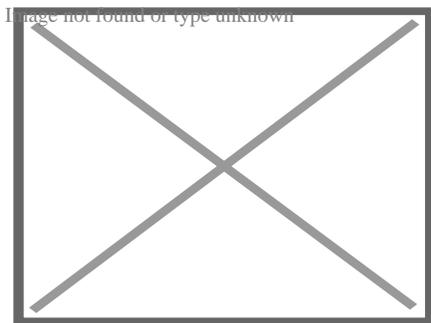
About soil compaction

For soil compaction in agriculture and compaction effects on soil biology, see soil compaction (agriculture), for natural compaction on a geologic scale, see compaction (geology); for consolidation near the surface, see consolidation (soil).

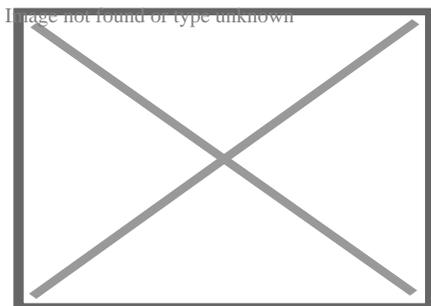
In geotechnical engineering, **soil compaction** is the process in which stress applied to a soil causes densification as air is displaced from the pores between the soil grains. When stress is applied that causes densification due to water (or other liquid) being displaced from between the soil grains, then consolidation, not compaction, has occurred. Normally, compaction is the result of heavy machinery compressing the soil, but it can also occur due to the passage of, for example, animal feet.

In soil science and agronomy, **soil compaction** is usually a combination of both engineering compaction and consolidation, so may occur due to a lack of water in the soil, the applied stress being internal suction due to water evaporation^[1] as well as due to passage of animal feet. Affected soils become less able to absorb rainfall, thus increasing runoff and erosion. Plants have difficulty in compacted soil because the mineral grains are pressed together, leaving little space for air and water, which are essential for root growth. Burrowing animals also find it a hostile environment, because the denser soil is more difficult to penetrate. The ability of a soil to recover from this type of compaction depends on climate, mineralogy and fauna. Soils with high shrink–swell capacity, such as vertisols, recover quickly from compaction where moisture conditions are variable (dry spells shrink the soil, causing it to crack). But clays such as kaolinite, which do not crack as they dry, cannot recover from compaction on their own unless they host ground-dwelling animals such as earthworms—the Cecil soil series is an example.

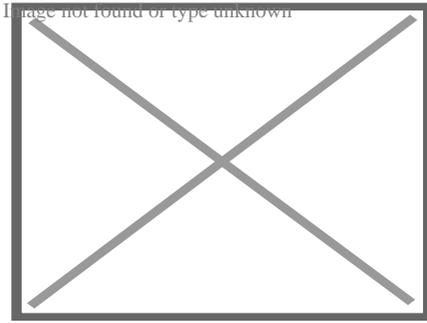
Before soils can be compacted in the field, some laboratory tests are required to determine their engineering properties. Among various properties, the maximum dry density and the optimum moisture content are vital and specify the required density to be compacted in the field.^[2]



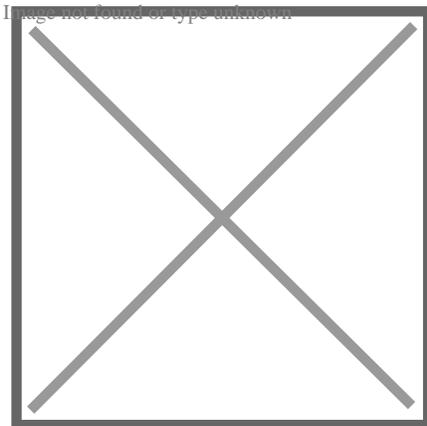
A 10 tonne excavator is here equipped with a narrow sheepsfoot roller to compact the fill over newly placed sewer pipe, forming a stable support for a new road surface.



A compactor/roller fitted with a sheepsfoot drum, operated by U.S. Navy Seabees



Vibrating roller with plain drum as used for compacting asphalt and granular soils



Vibratory rammer in action

In construction

[edit]

Soil compaction is a vital part of the construction process. It is used for support of structural entities such as building foundations, roadways, walkways, and earth retaining structures to name a few. For a given soil type certain properties may deem it more or less desirable to perform adequately for a particular circumstance. In general, the preselected soil should have adequate strength, be relatively incompressible so that future settlement is not significant, be stable against volume change as water content or other factors vary, be durable and safe against deterioration, and possess proper permeability.[³]

When an area is to be filled or backfilled the soil is placed in layers called lifts. The ability of the first fill layers to be properly compacted will depend on the condition of the natural material being covered. If unsuitable material is left in place and backfilled, it may compress over a long period under the weight of the earth fill, causing settlement cracks in the fill or in any structure supported by the fill.[⁴] In order to determine if the natural soil will support the first fill layers, an area can be proofrolled. Proofrolling consists of utilizing a piece of heavy construction equipment to roll across the fill site and watching for deflections to be revealed. These areas will be indicated by the development of rutting, pumping, or ground weaving.[⁵]

To ensure adequate soil compaction is achieved, project specifications will indicate the required soil density or degree of compaction that must be achieved. These specifications are generally

recommended by a geotechnical engineer in a geotechnical engineering report.

The soil type—that is, grain-size distributions, shape of the soil grains, specific gravity of soil solids, and amount and type of clay minerals, present—has a great influence on the maximum dry unit weight and optimum moisture content.^[6] It also has a great influence on how the materials should be compacted in given situations. Compaction is accomplished by use of heavy equipment. In sands and gravels, the equipment usually vibrates, to cause re-orientation of the soil particles into a denser configuration. In silts and clays, a sheep'sfoot roller is frequently used, to create small zones of intense shearing, which drives air out of the soil.

Determination of adequate compaction is done by determining the in-situ density of the soil and comparing it to the maximum density determined by a laboratory test. The most commonly used laboratory test is called the Proctor compaction test and there are two different methods in obtaining the maximum density. They are the **standard Proctor** and **modified Proctor** tests; the modified Proctor is more commonly used. For small dams, the standard Proctor may still be the reference.^[5]

While soil under structures and pavements needs to be compacted, it is important after construction to decompact areas to be landscaped so that vegetation can grow.

Compaction methods

[edit]

There are several means of achieving compaction of a material. Some are more appropriate for soil compaction than others, while some techniques are only suitable for particular soils or soils in particular conditions. Some are more suited to compaction of non-soil materials such as asphalt. Generally, those that can apply significant amounts of shear as well as compressive stress, are most effective.

The available techniques can be classified as:

1. Static – a large stress is slowly applied to the soil and then released.
2. Impact – the stress is applied by dropping a large mass onto the surface of the soil.
3. Vibrating – a stress is applied repeatedly and rapidly via a mechanically driven plate or hammer. Often combined with rolling compaction (see below).
4. Gyration – a static stress is applied and maintained in one direction while the soil is subjected to a gyratory motion about the axis of static loading. Limited to laboratory applications.
5. Rolling – a heavy cylinder is rolled over the surface of the soil. Commonly used on sports pitches. Roller-compactors are often fitted with vibratory devices to enhance their effectiveness.
6. Kneading – shear is applied by alternating movement in adjacent positions. An example, combined with rolling compaction, is the 'sheep'sfoot' roller used in waste compaction at landfills.

The construction plant available to achieve compaction is extremely varied and is described elsewhere.

Test methods in laboratory

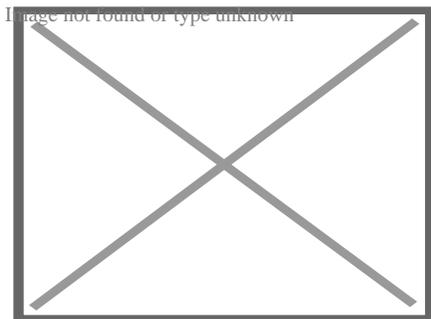
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Soil compactors are used to perform test methods which cover laboratory compaction methods used to determine the relationship between molding water content and dry unit weight of soils. Soil placed as engineering fill is compacted to a dense state to obtain satisfactory engineering properties such as, shear strength, compressibility, or permeability. In addition, foundation soils are often compacted to improve their engineering properties. Laboratory compaction tests provide the basis for determining the percent compaction and molding water content needed to achieve the required engineering properties, and for controlling construction to assure that the required compaction and water contents are achieved. Test methods such as EN 13286-2, EN 13286-47, ASTM D698, ASTM D1557, AASHTO T99, AASHTO T180, AASHTO T193, BS 1377:4 provide soil compaction testing procedures.^[7]

See also

[edit]

- Soil compaction (agriculture)
- Soil degradation
- Compactor
- Earthwork
- Soil structure
- Aeration
- Shear strength (soil)



Multiquip RX1575 Rammax Sheepsfoot Trench Compaction Roller on the jobsite in San Diego, California

References

[edit]

1. ^ Soil compaction due to lack of water in soil
2. ^ Jia, Xiaoyang; Hu, Wei; Polaczyk, Pawel; Gong, Hongren; Huang, Baoshan (2019). "Comparative Evaluation of Compacting Process for Base Materials using Lab Compaction Methods". *Transportation Research Record: Journal of the Transportation Research Board*. **2673** (4): 558–567. doi:10.1177/0361198119837953. ISSN 0361-1981.
3. ^ McCarthy, David F. (2007). *Essentials of Soil Mechanics and Foundations*. Upper Saddle River, NJ: Pearson Prentice Hall. p. 595. ISBN 978-0-13-114560-3.
4. ^ McCarthy, David F. (2007). *Essentials of Soil Mechanics and Foundations*. Upper Saddle River, NJ: Pearson Prentice Hall. pp. 601–602. ISBN 978-0-13-114560-3.
5. ^ **a b** McCarthy, David F. (2007). *Essentials of Soil Mechanics and Foundations*. Upper Saddle River, NJ: Pearson Prentice Hall. p. 602. ISBN 978-0-13-114560-3.
6. ^ Das, Braja M. (2002). *Principles of Geotechnical Engineering*. Pacific Grove, CA: Brooks/Cole. p. 105. ISBN 0-534-38742-X.
7. ^ "Automatic Soil Compactor". cooper.co.uk. Cooper Research Technology. Archived from the original on 27 August 2014. Retrieved 8 September 2014.

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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
-  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

Forces

- Effective stress
- Pore water pressure
- Lateral earth pressure
- Overburden pressure
- Preconsolidation pressure

Mechanics

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
 - Agrolology

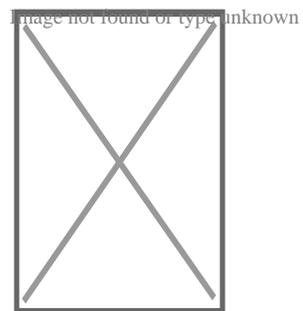
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Soil science

- History
- Index

Main fields

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



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**
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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

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

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About Cook County

Photo

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Things To Do in Cook County

Photo

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Sand Ridge Nature Center

4.8 (96)

Photo

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River Trail Nature Center

4.6 (235)

Photo

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

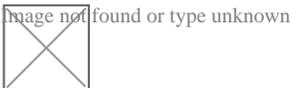
Driving Directions From Navy Pier to

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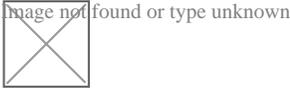
Reviews for



Jeffery James

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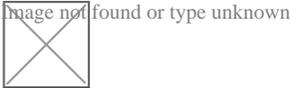
Very happy with my experience. They were prompt and followed through, and very helpful in fixing the crack in my foundation.



Sarah McNeily

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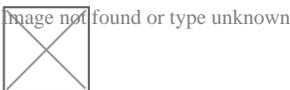
USS was excellent. They are honest, straightforward, trustworthy, and conscientious. They thoughtfully removed the flowers and flower bulbs to dig where they needed in the yard, replanted said flowers and spread the extra dirt to fill in an area of the yard. We've had other services from different companies 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)

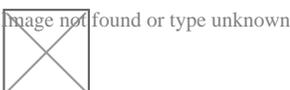
It was a pleasure to work with Rick and his crew. From the beginning, Rick listened to my concerns and what I wished to accomplish. Out of the 6 contractors that quoted the project, Rick seemed the MOST willing to accommodate my wishes. His pricing was definitely more than fair as well. I had 10 push 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.

Monitoring Seasonal Moisture Levels to Protect Repairs [View GBP](#)

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/>

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