



- **Implementing Carbon Fiber Strips for Added Support**
Implementing Carbon Fiber Strips for Added Support Exploring the Function of Steel I Beams in Reinforcement Evaluating Helical Pier Installations for Stability Understanding the Role of Push Piers in Foundation Repair Assessing Poly Foam Injection as a Repair Option Addressing Wall Bowing with Specialized Bracing Systems Incorporating Reinforced Footings in Existing Structures Using Fiber Reinforced Polymers for Structural Upgrades Recognizing Different Methods for Load Bearing Enhancement Integrating Modern Engineering Software for Precise Calculations Exploring Innovative Jacking Mechanisms for Floor Leveling Seeking Guidance from Structural Engineers for Advanced Repairs
- **Obtaining Local Building Permits for Foundation Work**
Obtaining Local Building Permits for Foundation Work Meeting OSHA Regulations During Excavation Projects Understanding City Ordinances That Affect Repair Plans Coordinating Structural Engineer Reviews for Compliance Navigating Inspections from Municipal Authorities Adhering to Safety Protocols on Residential Job Sites Prioritizing Protective Equipment for Repair Crews Managing Noise and Debris Regulations in Urban Areas Recognizing Liability Concerns in Construction Zones Complying with Floodplain Requirements in Vulnerable Regions Satisfying Documentation Requirements for Property Records Maintaining Ethical Practices in Foundation Repair Services
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Records

* Choosing the Right Contractor for Carbon Fiber Foundation Repair

* Importance of thorough documentation in residential foundation repair.

Okay, let's talk about something that might not sound thrilling at first: documentation. Choosing between slab and pier foundations depends on soil and climate conditions **foundation repair service** load-bearing wall. But trust me, when it comes to fixing up your house, especially the foundation, keeping really good records is like having a superpower. We're talking about the kind of documentation that satisfies property record requirements.

Imagine you've just spent a good chunk of money repairing your foundation. Maybe you had cracks, settling issues, or even some serious water damage. You got the work done, the house *feels* solid again, and you're breathing a sigh of relief. But hold on a second. What if you decide to sell the house down the road? Or what if, years later, a new issue pops up and you need to prove the previous repairs were done correctly (or, heaven forbid, *in*correctly)?

This is where thorough documentation shines. We're not just talking about the initial contract with the repair company. We're talking about: detailed reports of the initial problem, engineering assessments (if you had them), permits pulled for the work, photographs (before, during, and after the repair), invoices showing what you paid, warranties on the materials and labor, and any certifications or qualifications of the contractors involved. Think of it like creating a complete history of the repair, a story told with facts and figures.

Why is this so important for property records? Because potential buyers, and their lenders, want to know the house is stable and that any past problems were addressed properly. Good documentation provides peace of mind. It assures them that the work was done according to code, that there are warranties in place, and that they're not inheriting a potential nightmare. Lack of documentation, on the other hand, raises red flags. It can lead to lower offers, difficulty securing financing, or even a deal falling through entirely.

And it's not just about selling. Good documentation can also be invaluable if you ever need to make an insurance claim related to foundation issues, or if you need to pursue legal action against a contractor. It's your proof, your evidence, your shield against potential problems down the line.

So, while it might seem like a hassle to gather and organize all this information, consider it an investment in your home's future. Thorough documentation of foundation repairs is a

crucial part of maintaining your property's value and ensuring a smooth transaction when the time comes to sell or refinance. It's about protecting yourself and your investment by creating a clear and verifiable record of the work that was done. It's boring, maybe, but incredibly powerful.

*** Essential property records for foundation repair projects.**

Okay, so you're thinking about foundation repair, huh? That's a big deal, and while you're probably focused on cracks, leveling, and all the actual fix-it stuff, there's a whole other side: the paperwork. Specifically, we're talking about those essential property records. Think of them as the foundation **for** your foundation repair project.

Why are they so important? Well, satisfying documentation requirements isn't just a bureaucratic hurdle. It's about protecting yourself, your property, and making sure everyone's on the same page. Imagine starting a major foundation repair, only to discover halfway through that you're encroaching on a neighbor's property line because you didn't have an accurate survey. Nightmare fuel, right?

So, what kind of records are we talking about? First, there's the deed. It's the official document proving you own the property. It's got all the legal descriptions and, crucially, it's the basis for any subsequent permits or agreements. Then, you need a current property survey. This isn't just a casual glance; it's a precise map showing the boundaries, easements, and any existing structures. It prevents those encroachment problems and helps the repair crew understand the lay of the land.

Depending on where you live, you might need plat maps showing the subdivision layout, zoning records to ensure your project complies with local regulations, and even previous repair records if there's a history of foundation issues. Access to these records can help the repair company understand the underlying cause of your foundation problems.

Gathering all this stuff might seem like a chore, but trust me, it's an investment in a smoother, less stressful repair process. It ensures that the work is done legally, correctly, and with a clear understanding of your property's unique situation. Think of it as building a solid foundation **for** your foundation repair. It's the paperwork that prevents headaches down the road.

*** Detailed pre-repair assessment documentation.**

Okay, let's talk about "Detailed pre-repair assessment documentation" in the context of keeping your property records shipshape. Imagine you're dealing with a leaky roof, a cracked foundation, or maybe even just some persistent plumbing issues. The first instinct might be to just call someone to fix it, right? But before the repair crew even unpacks their tools, there's a crucial step that too often gets skipped: thoroughly documenting the problem

beforehand.

Think of this pre-repair assessment as creating a "before" picture, but with words, photos, and maybe even videos. It's about painting a clear picture of the damage *before* anything gets touched. Why is this so important for your property records? Well, for starters, it acts as a baseline. Later, when you're reviewing the repair invoice, you can easily verify that the work actually addressed the issues you initially identified. No more vague descriptions or relying on memory alone.

Beyond that, detailed documentation is your shield against disputes, especially if you're dealing with insurance claims or potential legal issues. If you have solid evidence of the pre-existing damage, you're in a much stronger position to argue for fair compensation or defend against unwarranted claims. Did the contractor cause additional damage during the repair? Your pre-repair assessment is your proof.

Finally, let's not forget the long game. Good property records, including detailed pre-repair documentation, increase the value of your property. A potential buyer will be far more confident knowing you've meticulously maintained the property and have a clear history of any repairs that have been carried out. It demonstrates responsibility and transparency, qualities that translate directly into increased market value. So, next time something breaks, grab your camera, your notepad, and document that problem like a pro before the repair even begins. It's an investment in your property's long-term health and value.

*** Permitting and regulatory compliance records.**

Okay, so when we're talking about keeping good property records, it's not just about deeds and mortgages and fancy legal jargon. A huge, and I mean HUGE, part of the puzzle is making sure you've got all your ducks in a row when it comes to permits and regulations. Think of it this way: you might own the prettiest piece of land, but if you built a shed without the right permits, or you're not complying with environmental regulations, you're basically sitting on a ticking time bomb of potential fines, legal headaches, and even the possibility of having to tear something down.

Permitting and regulatory compliance records are like your alibi. They show that you've dotted your i's and crossed your t's. They prove that you followed the rules when you built that addition, installed that septic system, or made any other changes to the property. These records aren't just some paperwork to shove in a drawer; they are essential for demonstrating due diligence and protecting your investment. We're talking building permits, environmental impact assessments, zoning approvals, certificates of occupancy, and anything else that says, "Yep, this was done the right way."

Think about selling your property down the line. A potential buyer is going to want to know that everything is above board. Imagine trying to explain why you can't find the permit for that major renovation you did five years ago. It's going to raise red flags and potentially

scare off buyers. Having a clear and complete set of permitting and regulatory compliance records not only ensures a smoother transaction but also increases the value of your property. It's peace of mind, both for you and for anyone who might be interested in buying it from you someday. So, don't underestimate these documents. They're more important than you might think.

*** Repair process documentation and material specifications.**

Okay, so when we talk about "Satisfying Documentation Requirements for Property Records," it's easy to get bogged down in legal jargon. But really, at its heart, it's about clarity and accountability. Think about it: property records are the history book of a building, a piece of land, whatever. And "Repair process documentation and material specifications" is a crucial chapter in that book.

Why? Because imagine you're looking at a record that says "Repairs were made." Great, but what repairs? Was it patching a leak with duct tape, or a full-scale roof replacement with architectural-grade shingles? The difference matters, not just for current value, but for predicting future maintenance needs.

That's where detailed documentation comes in. We're talking about outlining *exactly* what was done: Step-by-step descriptions of the repair process, ideally with photos or diagrams. What steps were taken to diagnose the issue? How was the problem rectified? Who performed the work? This level of detail paints a much clearer picture.

And then there are the material specifications. This isn't just about saying "we used wood." It's about specifying the type of wood (pressure-treated pine, cedar, redwood?), its grade, its dimensions. It's about noting the manufacturer of the roofing tiles, the PSI of the concrete, the brand and type of sealant used. Why? Because material quality directly impacts the longevity and integrity of the repair. Knowing these details allows future owners, inspectors, or even just interested parties to understand the quality of the work and plan accordingly.

Ultimately, thorough repair documentation and precise material specifications aren't just about satisfying some bureaucratic requirement. They're about responsible stewardship of property. They're about ensuring transparency, preventing future disputes, and preserving the value and integrity of the asset for years to come. It's about creating a property record that tells a complete and accurate story, one that benefits everyone involved.

*** Post-repair inspection reports and engineer certifications.**

Okay, let's talk about "Post-repair inspection reports and engineer certifications" in the context of keeping your property records shipshape. Think of it this way: after you've tackled a repair, especially a significant one, you're essentially creating a new chapter in your property's story. This chapter needs to be documented clearly and reliably.

Post-repair inspection reports are your starting point. These are the detailed accounts of what was fixed, how it was fixed, and if the fix actually, you know, *fixed* the problem. They're like the doctor's notes after a surgery, outlining the procedure and the patient's recovery. They're crucial because they provide concrete evidence of the work done, going beyond just a receipt or invoice. A good inspection report will often include photos, specific details about materials used, and any observations about the overall condition of the repaired area.

Then you have engineer certifications. These are a step up, reserved for more complex or structural repairs. Imagine reinforcing a foundation or replacing a load-bearing wall. In those cases, you need a qualified engineer to assess the work and certify that it meets safety standards and building codes. Their certification is essentially a professional stamp of approval, assuring future buyers (or even just yourself!) that the repair was done correctly and won't lead to bigger problems down the line.

Why are these documents so important for your property records? Well, beyond the obvious (proving you actually *did* the repair), they offer peace of mind. They can be invaluable when you eventually sell the property, demonstrating to potential buyers that you've maintained it responsibly. They can also be crucial if you ever need to make an insurance claim related to the repaired area. Think of them as your property's health record – the more complete and accurate, the better you can understand and protect your investment. So, don't skimp on getting those post-repair documents in order. It's an investment in the long-term value and security of your property.

*** Warranty documentation and transferability.**

Okay, so you're wading through all the paperwork for your property, right? Deeds, surveys, the whole shebang. But don't skim past the warranty documentation! Seriously, it's more valuable than you might think, especially when you're talking about satisfying all those documentation requirements. Consider it this way: you've just bought a house with a brand-new roof. The roofing company offers a 25-year warranty. That's fantastic! But where's the paperwork? Is it just a handshake deal? Nope. You need that warranty meticulously documented. Think of it as insurance against future headaches.

And that brings us to transferability. Let's say you decide to sell the property down the line. A transferable warranty on that roof (or the HVAC system, or the windows) becomes a serious selling point. It's added assurance for the potential buyer, potentially bumping up your property value. But here's the catch: If you can't prove the warranty exists, or if the documentation doesn't clearly outline how it transfers to a new owner, it's basically worthless. So, keep those warranty documents safe, know the terms of transferability, and make sure they're easily accessible. They're not just pieces of paper; they're potential assets tied to your property. Getting this right upfront can save you (or the future owner) a whole lot of grief and money.

*** Maintaining organized documentation for future reference and property value.**

Okay, so you've got all these property records, right? Deeds, surveys, permits, the whole shebang. Tossing them in a box in the attic might feel like "done," but trust me, future you (or the next owner) will hate you for it. Think of it this way: maintaining organized documentation isn't just about satisfying some legal requirement; it's about protecting your investment and making life easier down the road.

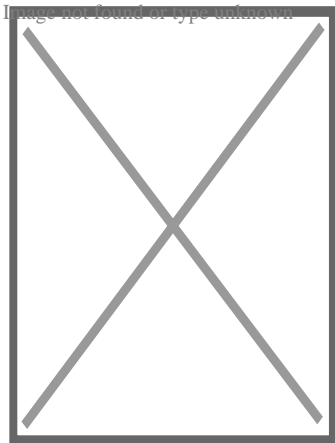
Imagine selling your house. A potential buyer asks about that extension you did five years ago. If you can whip out the permits and approved plans, you're golden. You've addressed their concern, shown you followed the rules, and potentially even increased the perceived value of your property. But if you're scrambling, digging through dusty boxes, and can't find a thing? That raises red flags. They might wonder what else you've been hiding, and suddenly that offer price drops.

Beyond sales, organized documentation is invaluable for things like insurance claims, resolving boundary disputes with neighbors, or even just remembering when you last replaced the roof. It's a detailed history of your property, a resource you can tap into whenever you need it. So, put in the effort now to keep things organized. Whether it's digital files, well-labeled folders, or a combination of both, future you will thank you for taking the time to maintain a clear and accessible record of your property's story. It's an investment in peace of mind and, potentially, a bigger return on your biggest asset.

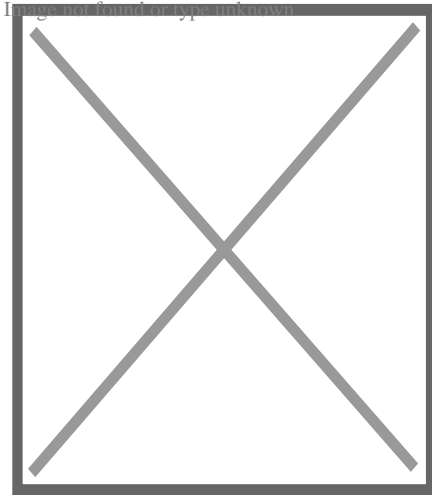
About bedrock

For other uses, see [Bedrock \(disambiguation\)](#).

"[Subsurface](#)" redirects here. For other uses, see [Subsurface \(disambiguation\)](#).



Soil with broken rock fragments overlying bedrock, Sandside Bay, Caithness, Scotland



Soil profile with bedrock labeled R

In geology, **bedrock** is solid rock that lies under loose material (regolith) within the crust of Earth or another terrestrial planet.

Definition

[edit]

Bedrock is the solid rock that underlies looser surface material.^[1] An exposed portion of bedrock is often called an outcrop.^[2] The various kinds of broken and weathered rock material, such as soil and subsoil, that may overlie the bedrock are known as regolith.^{[3][4]}

Engineering geology

[edit]

The surface of the bedrock beneath the soil cover (regolith) is also known as *rockhead* in engineering geology,^{[5][6]} and its identification by digging, drilling or geophysical methods is an important task in most civil engineering projects. Superficial deposits can be very thick, such that the bedrock lies hundreds of meters below the surface.^[7]

Weathering of bedrock

[edit]

Exposed bedrock experiences weathering, which may be physical or chemical, and which alters the structure of the rock to leave it susceptible to erosion. Bedrock may also experience subsurface weathering at its upper boundary, forming saprolite.^[8]









Geologic map

[edit]

A geologic map of an area will usually show the distribution of differing bedrock types, rock that would be exposed at the surface if all soil or other superficial deposits were removed. Where superficial deposits are so thick that the underlying bedrock cannot be reliably mapped, the superficial deposits will be mapped instead (for example, as alluvium).^[9]

See also

[edit]

-   [Geology portal](#)
-   [Geography portal](#)
-   [Maps portal](#)
-   [Minerals portal](#)

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[edit]

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Further reading

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External links

[edit]





















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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
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- Permeability
- Specific storage
- Shear strength
- Sensitivity

**Structures
(Interaction)**

Natural features

- Topography
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 - Retaining walls
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 - Ground freezing
 - Mechanically stabilized earth
 - Pressure grouting
 - Slurry wall
 - Soil nailing
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- Cut
- Causeway
- Terracing
- Cut-and-cover
- Cut and fill
- Fill dirt
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- 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

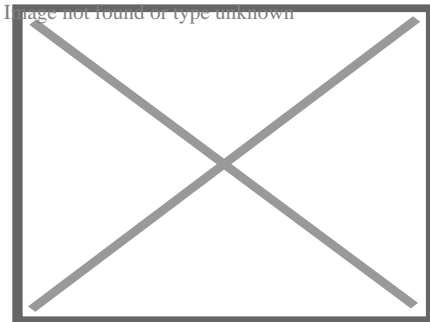
- SEEP2D
- STABL
- SVFlux
- SVSlope
- UTEXAS
- Plaxis

Related fields

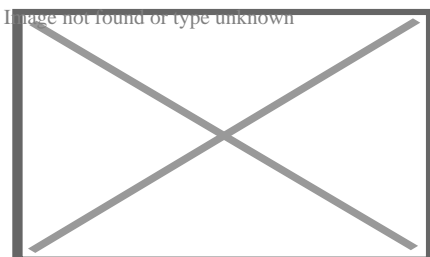
- Geology
- Geochemistry
- Petrology
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- Geomorphology
- Soil science
- Hydrology
- Hydrogeology
- Biogeography
- Earth materials
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- Agricultural science
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About concrete slab



Suspended slab under construction, with the formwork still in place



Suspended slab formwork and rebar in place, ready for concrete pour.

A **concrete slab** is a common structural element of modern buildings, consisting of a flat, horizontal surface made of cast concrete. Steel-reinforced slabs, typically between 100 and 500 mm thick, are most often used to construct floors and ceilings, while thinner *mud slabs* may be used for exterior paving (see below).[¹][²]

In many domestic and industrial buildings, a thick concrete slab supported on foundations or directly on the subsoil, is used to construct the ground floor. These slabs are generally classified as *ground-bearing* or *suspended*. A slab is ground-bearing if it rests directly on the foundation, otherwise the slab is suspended.[³] For multi-story buildings, there are several common slab designs (

see § Design for more types):

- Beam and block, also referred to as *rib and block*, is mostly used in residential and industrial applications. This slab type is made up of pre-stressed beams and hollow blocks and are temporarily propped until set, typically after 21 days.[⁴]
- A hollow core slab which is precast and installed on site with a crane
- In high rise buildings and skyscrapers, thinner, pre-cast concrete slabs are slung between the steel frames to form the floors and ceilings on each level. Cast in-situ slabs are used in high rise buildings and large shopping complexes as well as houses. These in-situ slabs are cast on site using shutters and reinforced steel.

On technical drawings, reinforced concrete slabs are often abbreviated to "r.c.c. slab" or simply "r.c.". Calculations and drawings are often done by structural engineers in CAD software.

Thermal performance

[edit]

Energy efficiency has become a primary concern for the construction of new buildings, and the prevalence of concrete slabs calls for careful consideration of its thermal properties in order to minimise wasted energy.[⁵] Concrete has similar thermal properties to masonry products, in that it has a relatively high thermal mass and is a good conductor of heat.

In some special cases, the thermal properties of concrete have been employed, for example as a heatsink in nuclear power plants or a thermal buffer in industrial freezers.[⁶]

Thermal conductivity

[edit]

Thermal conductivity of a concrete slab indicates the rate of heat transfer through the solid mass by conduction, usually in regard to heat transfer to or from the ground. The coefficient of thermal conductivity, k , is proportional to density of the concrete, among other factors.^[5] The primary influences on conductivity are moisture content, type of aggregate, type of cement, constituent proportions, and temperature. These various factors complicate the theoretical evaluation of a k -value, since each component has a different conductivity when isolated, and the position and proportion of each components affects the overall conductivity. To simplify this, particles of aggregate may be considered to be suspended in the homogeneous cement. Campbell-Allen and Thorne (1963) derived a formula for the theoretical thermal conductivity of concrete.^[6] In practice this formula is rarely applied, but remains relevant for theoretical use. Subsequently, Valore (1980) developed another formula in terms of overall density.^[7] However, this study concerned hollow concrete blocks and its results are unverified for concrete slabs.

The actual value of k varies significantly in practice, and is usually between 0.8 and $2.0 \text{ W m}^{-1} \text{ K}^{-1}$.^[8] This is relatively high when compared to other materials, for example the conductivity of wood may be as low as $0.04 \text{ W m}^{-1} \text{ K}^{-1}$. One way of mitigating the effects of thermal conduction is to introduce insulation (

see § Insulation).

Thermal mass

[edit]

The second consideration is the high thermal mass of concrete slabs, which applies similarly to walls and floors, or wherever concrete is used within the thermal envelope. Concrete has a relatively high thermal mass, meaning that it takes a long time to respond to changes in ambient temperature.^[9] This is a disadvantage when rooms are heated intermittently and require a quick response, as it takes longer to warm the entire building, including the slab. However, the high thermal mass is an advantage in climates with large daily temperature swings, where the slab acts as a regulator, keeping the building cool by day and warm by night.

Typically concrete slabs perform better than implied by their R-value.^[5] The R-value does not consider thermal mass, since it is tested under constant temperature conditions. Thus, when a concrete slab is subjected to fluctuating temperatures, it will respond more slowly to these changes and in many cases increase the efficiency of a building.^[5] In reality, there are many factors which contribute to the effect of thermal mass, including the depth and composition of the slab, as well as other properties of the building such as orientation and windows.

Thermal mass is also related to thermal diffusivity, heat capacity and insulation. Concrete has low thermal diffusivity, high heat capacity, and its thermal mass is negatively affected by insulation (e.g. carpet).^[5]

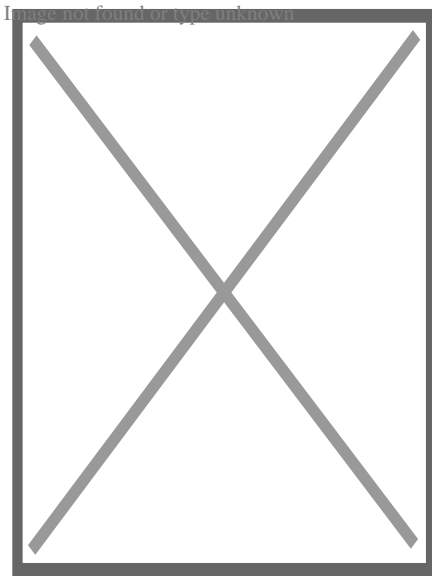
Insulation

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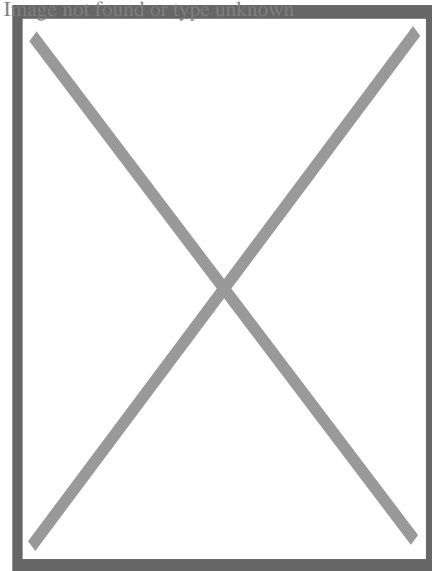
Without insulation, concrete slabs cast directly on the ground can cause a significant amount of extraneous energy transfer by conduction, resulting in either lost heat or unwanted heat. In modern construction, concrete slabs are usually cast above a layer of insulation such as expanded polystyrene, and the slab may contain underfloor heating pipes.^[10] However, there are still uses for a slab that is not insulated, for example in outbuildings which are not heated or cooled to room temperature (

see § Mud slabs). In these cases, casting the slab directly onto a substrate of aggregate will maintain the slab near the temperature of the substrate throughout the year, and can prevent both freezing and overheating.

A common type of insulated slab is the beam and block system (mentioned above) which is modified by replacing concrete blocks with expanded polystyrene blocks.^[11] This not only allows for better insulation but decreases the weight of slab which has a positive effect on load bearing walls and foundations.



Formwork set for concrete pour.



Concrete poured into formwork. This slab is ground-bearing and reinforced with steel rebar.

Design

[edit]

Further information: Marcus' method

Ground-bearing slabs

[edit]

See also: Shallow foundation § Slab on grade

Ground-bearing slabs, also known as "on-ground" or "slab-on-grade", are commonly used for ground floors on domestic and some commercial applications. It is an economical and quick construction method for sites that have non-reactive soil and little slope.^[12]

For ground-bearing slabs, it is important to design the slab around the type of soil, since some soils such as clay are too dynamic to support a slab consistently across its entire area. This results in cracking and deformation, potentially leading to structural failure of any members attached to the floor, such as wall studs.^[12]

Levelling the site before pouring concrete is an important step, as sloping ground will cause the concrete to cure unevenly and will result in differential expansion. In some cases, a naturally sloping site may be levelled simply by removing soil from the uphill site. If a site has a more significant grade, it may be a candidate for the "cut and fill" method, where soil from the higher ground is removed, and the lower ground is built up with fill.^[13]

In addition to filling the downhill side, this area of the slab may be supported on concrete piers which extend into the ground. In this case, the fill material is less important structurally as the dead weight of the slab is supported by the piers. However, the fill material is still necessary to support the curing concrete and its reinforcement.

There are two common methods of filling - *controlled fill* and *rolled fill*.^[13]

- **Controlled fill:** Fill material is compacted in several layers by a vibrating plate or roller. Sand fills areas up to around 800 mm deep, and clay may be used to fill areas up to 400 mm deep. However, clay is much more reactive than sand, so it should be used sparingly and carefully. Clay must be moist during compaction to homogenise it.^[13]
- **Rolled fill:** Fill is repeatedly compacted by an excavator, but this method of compaction is less effective than a vibrator or roller. Thus, the regulations on maximum depth are typically stricter.

Proper curing of ground-bearing concrete is necessary to obtain adequate strength. Since these slabs are inevitably poured on-site (rather than precast as some suspended slabs are), it can be difficult to control conditions to optimize the curing process. This is usually aided by a membrane, either plastic (temporary) or a liquid compound (permanent).^[14]

Ground-bearing slabs are usually supplemented with some form of reinforcement, often steel rebar. However, in some cases such as concrete roads, it is acceptable to use an unreinforced slab if it is adequately engineered (

see below).

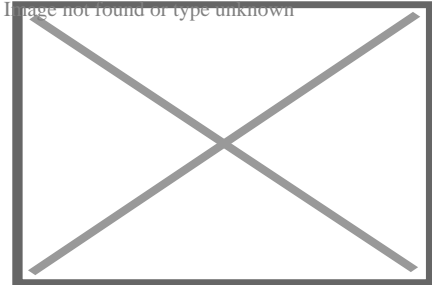
Suspended slabs

[edit]

For a suspended slab, there are a number of designs to improve the strength-to-weight ratio. In all cases the top surface remains flat, and the underside is modulated:

- A *corrugated slab* is designed when the concrete is poured into a corrugated steel tray, more commonly called decking. This steel tray improves strength of the slab, and prevents the slab from bending under its own weight. The corrugations run in one direction only.
- A *ribbed slab* gives considerably more strength in one direction. This is achieved with concrete beams bearing load between piers or columns, and thinner, integral ribs in the perpendicular direction. An analogy in carpentry would be a subfloor of bearers and joists. Ribbed slabs have higher load ratings than corrugated or flat slabs, but are inferior to waffle slabs.^[15]

- A *waffle slab* gives added strength in both directions using a matrix of recessed segments beneath the slab.^[16] This is the same principle used in the ground-bearing version, the waffle slab foundation. Waffle slabs are usually deeper than ribbed slabs of equivalent strength, and are heavier hence require stronger foundations. However, they provide increased mechanical strength in two dimensions, a characteristic important for vibration resistance and soil movement.^[17]



The exposed underside of a waffle slab used in a multi-storey building

Unreinforced slabs

[edit]

Unreinforced or "plain"^[18] slabs are becoming rare and have limited practical applications, with one exception being the mud slab (

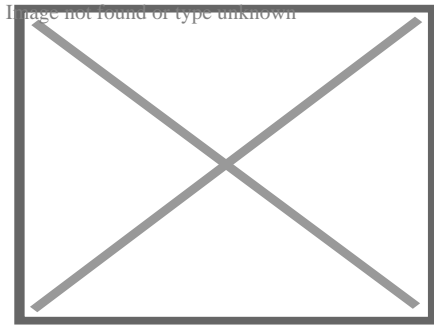
see below). They were once common in the US, but the economic value of reinforced ground-bearing slabs has become more appealing for many engineers.^[10] Without reinforcement, the entire load on these slabs is supported by the strength of the concrete, which becomes a vital factor. As a result, any stress induced by a load, static or dynamic, must be within the limit of the concrete's flexural strength to prevent cracking.^[19] Since unreinforced concrete is relatively very weak in tension, it is important to consider the effects of tensile stress caused by reactive soil, wind uplift, thermal expansion, and cracking.^[20] One of the most common applications for unreinforced slabs is in concrete roads.

Mud slabs

[edit]

Mud slabs, also known as *rat slabs*, are thinner than the more common suspended or ground-bearing slabs (usually 50 to 150 mm), and usually contain no reinforcement.^[21] This makes them economical and easy to install for temporary or low-usage purposes such as subfloors, crawlspaces, pathways, paving, and levelling surfaces.^[22] In general, they may be used for

any application which requires a flat, clean surface. This includes use as a base or "sub-slab" for a larger structural slab. On uneven or steep surfaces, this preparatory measure is necessary to provide a flat surface on which to install rebar and waterproofing membranes.^[10] In this application, a mud slab also prevents the plastic bar chairs from sinking into soft topsoil which can cause spalling due to incomplete coverage of the steel. Sometimes a mud slab may be a substitute for coarse aggregate. Mud slabs typically have a moderately rough surface, finished with a float.^[10]



Substrate and rebar prepared for pouring a mud slab

Axes of support

[edit]

One-way slabs

[edit]

A *one-way slab* has moment-resisting reinforcement only in its short axis, and is used when the moment in the long axis is negligible.^[23] Such designs include corrugated slabs and ribbed slabs. Non-reinforced slabs may also be considered one-way if they are supported on only two opposite sides (i.e. they are supported in one axis). A one-way reinforced slab may be stronger than a two-way non-reinforced slab, depending on the type of load.

The calculation of reinforcement requirements for a one-way slab can be extremely tedious and time-consuming, and one can never be completely certain of the best design.^[citation needed] Even minor changes to the project can necessitate recalculation of the reinforcement requirements. There are many factors to consider during the structural structure design of one-way slabs, including:

- Load calculations
- Bending moment calculation
- Acceptable depth of flexure and deflection
- Type and distribution of reinforcing steel

Two-way slabs

[edit]

A *two-way slab* has moment resisting reinforcement in both directions.^[24] This may be implemented due to application requirements such as heavy loading, vibration resistance, clearance below the slab, or other factors. However, an important characteristic governing the requirement of a two-way slab is the ratio of the two horizontal lengths. If l_x is the short dimension and l_y is the long dimension, then moment in both directions should be considered in design.^[25] In other words, if the axial ratio is greater than two, a two-way slab is required.

A non-reinforced slab is two-way if it is supported in both horizontal axes.

Construction

[edit]

A concrete slab may be prefabricated (precast), or constructed on site.

Prefabricated

[edit]

Prefabricated concrete slabs are built in a factory and transported to the site, ready to be lowered into place between steel or concrete beams. They may be pre-stressed (in the factory), post-stressed (on site), or unstressed.^[10] It is vital that the wall supporting structure is built to the correct dimensions, or the slabs may not fit.

On-site

[edit]

On-site concrete slabs are built on the building site using formwork, a type of boxing into which the wet concrete is poured. If the slab is to be reinforced, the rebars, or metal bars, are positioned within the formwork before the concrete is poured in.^[26] Plastic-tipped metal or plastic bar chairs, are used to hold the rebar away from the bottom and sides of the form-work, so that when the concrete sets it completely envelops the reinforcement. This concept is known

as concrete cover. For a ground-bearing slab, the formwork may consist only of side walls pushed into the ground. For a suspended slab, the formwork is shaped like a tray, often supported by a temporary scaffold until the concrete sets.

The formwork is commonly built from wooden planks and boards, plastic, or steel. On commercial building sites, plastic and steel are gaining popularity as they save labour.^[27] On low-budget or small-scale jobs, for instance when laying a concrete garden path, wooden planks are very common. After the concrete has set the wood may be removed.

Formwork can also be permanent, and remain in situ post concrete pour. For large slabs or paths that are poured in sections, this permanent formwork can then also act as isolation joints within concrete slabs to reduce the potential for cracking due to concrete expansion or movement.

In some cases formwork is not necessary. For instance, a ground slab surrounded by dense soil, brick or block foundation walls, where the walls act as the sides of the tray and hardcore (rubble) acts as the base.

See also

[edit]

- Shallow foundation (Commonly used for ground-bearing slabs)
- Hollow-core slab (Voided slab, one-way spanning)
- Beam and block (voided slab, one way spanning)
- Voided biaxial slab (Voided slab, two-way spanning)
- Formwork
- Precast concrete
- Reinforced concrete
- Rebar
- Concrete cover

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[edit]

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External links

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- *Concrete Basics: A Guide to Concrete Practice*
- *Super Insulated Slab Foundations*
- *Design of Slabs on Ground* Archived 2021-05-08 at the Wayback Machine

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Concrete

History

- Ancient Roman architecture
- Roman architectural revolution
- Roman concrete
- Roman engineering
- Roman technology

- Cement
 - Calcium aluminate
 - Energetically modified
 - Portland
 - Rosendale
- Water
- Composition**
- Water–cement ratio
- Aggregate
- Reinforcement
- Fly ash
- Ground granulated blast-furnace slag
- Silica fume
- Metakaolin

- Plant
- Concrete mixer
- Volumetric mixer
- Reversing drum mixer
- Slump test
- Flow table test
- Curing
- Concrete cover
- Cover meter
- Rebar

- Precast
- Cast-in-place
- Formwork
- Climbing formwork
- Slip forming
- Screed
- Power screed
- Construction**
- Finisher
- Grinder
- Power trowel
- Pump
- Float
- Sealer
- Tremie

Science

- Properties
- Durability
- Degradation
- Environmental impact
- Recycling
- Segregation
- Alkali–silica reaction

Types

- AstroCrete
- Fiber-reinforced
- Filigree
- Foam
- Lunarcrete
- Mass
- Nanoconcrete
- Pervious
- Polished
- Polymer
- Prestressed
- Ready-mix
- Reinforced
- Roller-compacting
- Self-consolidating
- Self-leveling
- Sulfur
- Tabby
- Translucent
- Waste light
- Aerated
 - AAC
 - RAAC

Applications

- Slab
 - waffle
 - hollow-core
 - voided biaxial
 - slab on grade
- Concrete block
- Step barrier
- Roads
- Columns
- Structures

Organizations

- American Concrete Institute
- Concrete Society
- Institution of Structural Engineers
- Indian Concrete Institute
- Nanocem
- Portland Cement Association
- International Federation for Structural Concrete

Standards

- Eurocode 2
- EN 197-1
- EN 206-1
- EN 10080

See also

- Hempcrete

-  **Category:Concrete**

About Cook County

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Things To Do in Cook County

Photo

Sand Ridge Nature Center

4.8 (96)

Photo

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River Trail Nature Center

4.6 (235)

Photo

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Palmisano (Henry) Park

4.7 (1262)

Driving Directions in Cook County

Driving Directions From Palmisano (Henry) Park to

Driving Directions From Lake Katherine Nature Center and Botanic Gardens to

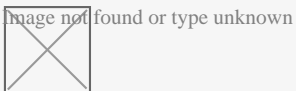
Driving Directions From Navy Pier to

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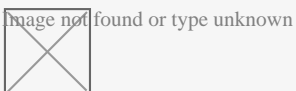
Reviews for



Jeffery James

(5)

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

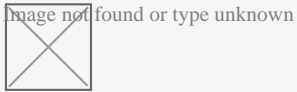


Sarah McNeily

(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

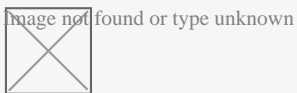
meticulously clean. The crew was on time and friendly. I'd recommend them any day! Thanks to Jessie and crew.



Jim de Leon

(5)

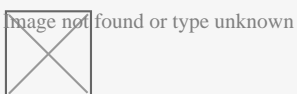
It was a pleasure to work with Rick and his crew. From the beginning, Rick listened to my concerns and what I wished to accomplish. Out of the 6 contractors that quoted the project, Rick seemed the MOST willing to accommodate my wishes. His pricing was definitely more than fair as well. I had 10 push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

Frequently Asked Questions

Will I receive documentation showing the materials used and the specific repair methods implemented?

Yes, the contract and invoices should detail this.

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

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