

Foundation Types - Common Benefits, Issues and Risks

One of the most important parts of a house is the part it sits on: **Your Foundation**. The type, style, and condition of your foundation can determine a lot of what might happen with your home.

Let's take a look at the basic foundation types and the pro's and con's for each:

Full Basement:

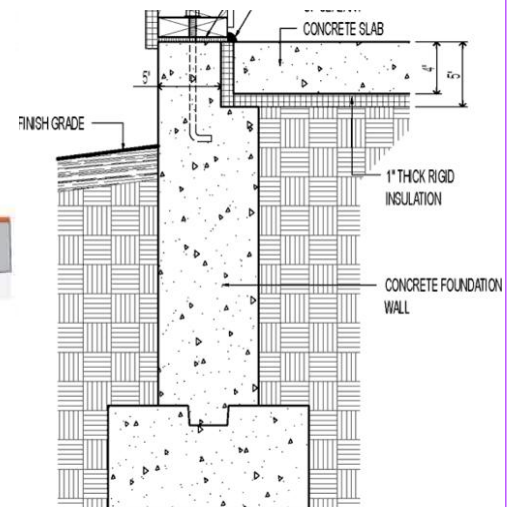
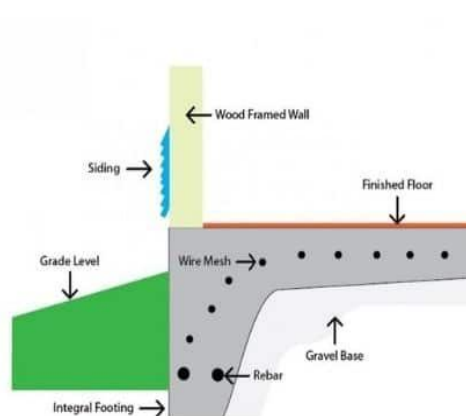
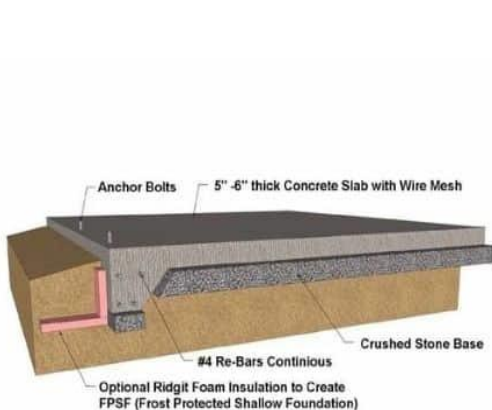
- **Pros:**
 - Provides **additional usable square footage** for living space, storage, or a workshop.
 - Offers **better protection from the elements**, including extreme temperatures and wind.
 - **Easier access** to plumbing and electrical systems for repairs or modifications.
 - May **increase the resale value** of the home in some areas.
- **Cons:**
 - **Most expensive** foundation type due to the additional excavation required.
 - Prone to **moisture problems** and requires good waterproofing to prevent basement flooding and **mold growth**.
 - Can be **cold and damp** in colder climates if not properly insulated and ventilated.



Example of a FULL Foundation

Slab-on-Grade:

- **Pros:**
 - **Most affordable** foundation type due to its simplicity.
 - **Faster and easier** to construct compared to other types.
 - **Good choice for warm climates** as the entire floor is in contact with the ground, promoting cooler temperatures.
- **Cons:**
 - **Limited to well-drained, stable soil conditions**.
 - Offers **no additional usable space**.
 - Plumbing repairs can be more complex and **expensive** because pipes are typically **buried in the concrete slab**.
 - Some pipes embedded in slabs may have a **reduced life-span** (*older metal pipes in concrete contact*).
 - **Less effective at insulating** against cold temperatures compared to basements with proper insulation.
 - **More prone to Termite attack** than other style foundations.



Monolithic Slab

Vs

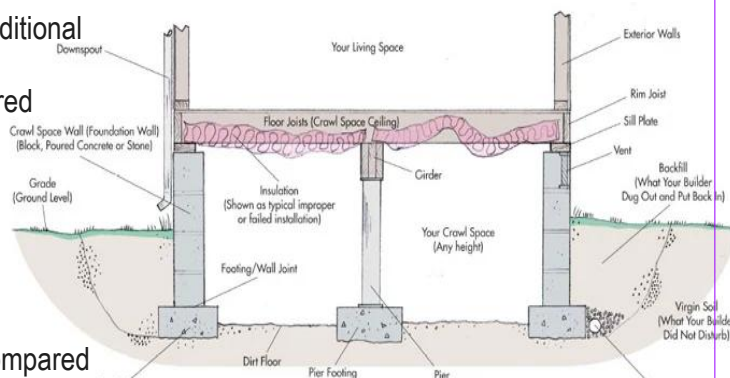
Floating Slab

Slab Foundation with Footings
(Most common for Residential)

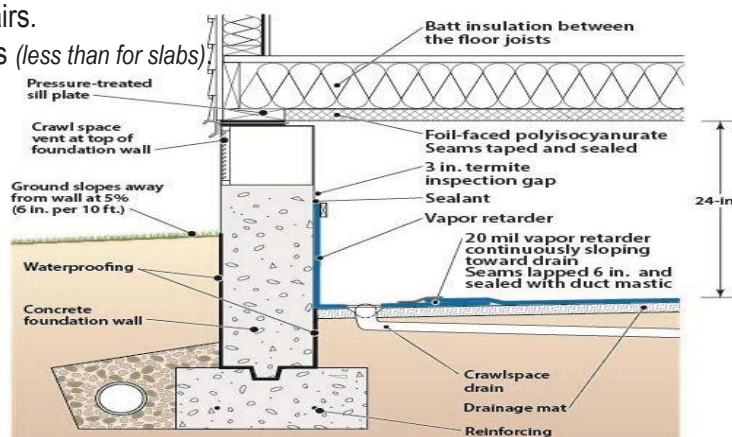
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Crawlspace:

- **Pros:**
 - **More affordable** than a full basement, but offers some additional space for storage or utilities.
 - **Easier access** to plumbing and electrical systems compared to a slab foundation.
 - **May help to prevent moisture problems in humid climates** by allowing air circulation beneath the floor.
- **Cons:**
 - Can be **susceptible to moisture problems** and requires proper ventilation to prevent **mold growth**.
 - More **vulnerable to pest infestations** from the ground compared to basements or slabs.
 - May feel **colder** in the winter if not properly insulated and weatherized.
 - Requires crawl space **access** for maintenance and repairs.
 - Slightly higher **potential for Termites** than full foundations (*less than for slabs*).



Crawlspaces with Exposed Soils or that Lack Vapor Barriers will typically have moisture / growth issues

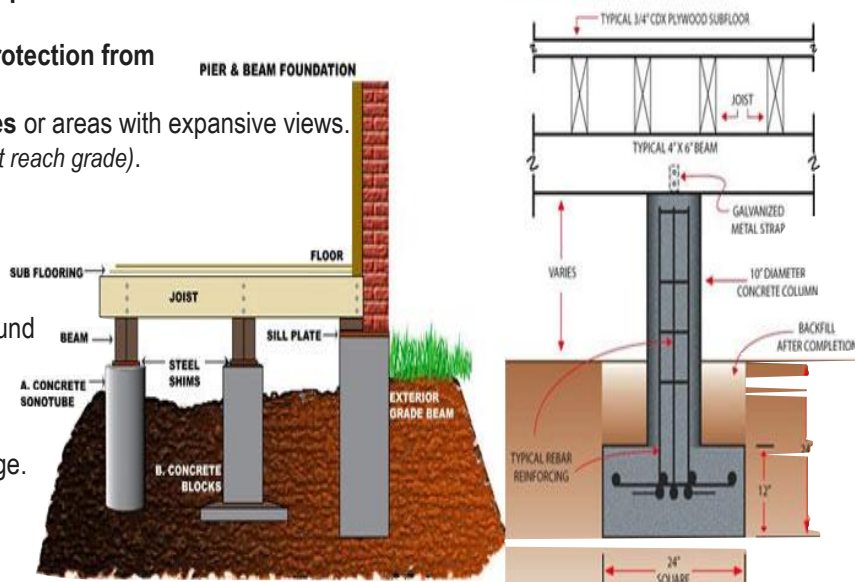


Good Ventilated Crawl Space Design with Vapor Barriers & Drain Example

Piers:

- **Pros:**
 - Ideal for **uneven or sloped terrain** or areas with **poor soil conditions**.
 - Elevates the home above the ground, offering **protection from flooding and pests**.
 - Can be a **good choice for waterfront properties** or areas with expansive views.
 - **VERY Termite resistant** (*if siding/framing does not reach grade*).
- **Cons:**
 - **More expensive** than slab or crawlspace foundations.
 - Can create a feeling of detachment from the ground and **may not be aesthetically pleasing** in all settings.
 - **Requires additional structural support** for the home, potentially impacting usable square footage.
 - May be **more susceptible to wind damage** compared to other foundation types.

What is Pier and Beam Foundation

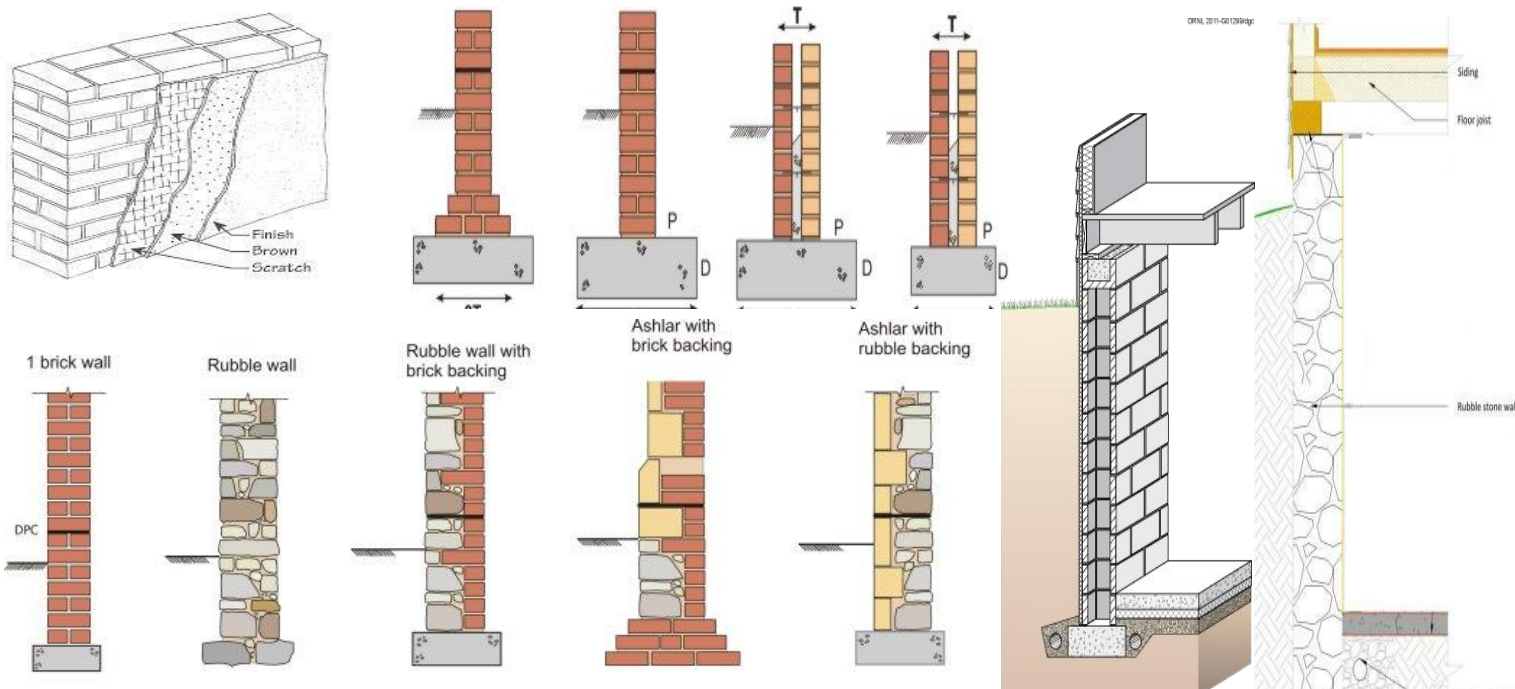


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WHAT the foundation is made of is also important.



Here is a comparison of foundation material types and the Pros, Cons and Pitfalls of each:

Material	Pros	Cons	Common Problems
Poured Concrete	<ul style="list-style-type: none"> • Very strong and durable • Excellent water resistance • Can be formed into complex shapes • Can be finished with a variety of materials 	<ul style="list-style-type: none"> • More expensive than other options • Requires skilled labor for proper installation • Prone to cracking if not properly cured 	<ul style="list-style-type: none"> • Cracks due to shrinkage or foundation movement • Leaks due to improper construction or drainage issues • Spalling (concrete surface deterioration)
Concrete Block	<ul style="list-style-type: none"> • More affordable than poured concrete • Faster and easier to install than poured concrete • Good thermal insulation properties • Provides some ventilation if hollow blocks are used 	<ul style="list-style-type: none"> • Less strong than poured concrete • Prone to moisture problems if not properly sealed • May be susceptible to cracking 	<ul style="list-style-type: none"> • Water leaks through cracks or gaps in block walls • Mold growth due to moisture intrusion • Deterioration of mortar joints between blocks
Brick	<ul style="list-style-type: none"> • Aesthetically pleasing • Very strong and durable • Excellent water resistance • Fire-resistant 	<ul style="list-style-type: none"> • Most expensive foundation material • Requires skilled labor for proper installation • Prone to efflorescence (mineral deposit buildup) 	<ul style="list-style-type: none"> • Cracking due to foundation movement or settlement • Spalling of the brick surface • Deterioration of mortar joints
Stone	<ul style="list-style-type: none"> • Natural and aesthetically unique • Very strong and durable • Excellent water resistance • Fire-resistant 	<ul style="list-style-type: none"> • Most expensive and time-consuming to install • Requires skilled stonemasons • May not be readily available in all areas 	<ul style="list-style-type: none"> • Difficulty in achieving level foundation due to irregular stone shapes • Water leaks through gaps between stones if not properly mortared • Spalling or cracking of stones due to weathering



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Types of Foundations: Pros, Cons, and Signs of Problems

Foundation Type	Pros	Cons	Radon Potential	Moisture Potential	Settlement Potential	Visible Signs of Problems
Slab-on-Grade	<ul style="list-style-type: none"> Affordable Easy to construct 	<ul style="list-style-type: none"> No basement Limited access to plumbing Cold floors (<i>in colder climates</i>) Higher Radon Potential 	High  <i>(if cracks present)</i>	High <i>(if not properly sealed)</i>	High <i>(expansive clay soils)</i>	<ul style="list-style-type: none"> Cracks in slab Uneven floors Foundation movement Water leaks
Basement	<ul style="list-style-type: none"> Additional living space Storage space Easier access to plumbing Less Radon Potential 	<ul style="list-style-type: none"> Most expensive Not suitable for high water tables 	Low <i>(if properly sealed)</i>	Moderate <i>(if not properly drained)</i>	Moderate	<ul style="list-style-type: none"> Cracks in foundation walls Bowing walls Damp basement Uneven floors
Crawl Space	<ul style="list-style-type: none"> More affordable than basement Easier access to plumbing than slab Can provide some ventilation 	<ul style="list-style-type: none"> Susceptible to moisture problems Limited headroom Not ideal for cold climates 	Moderate <i>(if not properly vented)</i>	High <i>(if not properly sealed)</i>	Moderate	<ul style="list-style-type: none"> Musty odor Wood rot Mold growth Floor joist damage Uneven floors
Pier & Beam	<ul style="list-style-type: none"> Good for uneven terrain Good for flood zones Allows for ventilation 	<ul style="list-style-type: none"> More expensive than slab Limited insulation for floors (<i>colder in winter</i>) Requires regular maintenance 	Moderate <i>(if not properly sealed)</i>	Low <i>(if properly ventilated)</i>	Moderate	<ul style="list-style-type: none"> Uneven floors Leaning piers Floor joist damage Rotting wood beams
Wood Foundation <i>(Less Common)</i>	<ul style="list-style-type: none"> Affordable Easy to work with 	<ul style="list-style-type: none"> Not as durable as concrete Susceptible to moisture damage Not allowed in all areas 	High  <i>(if not properly sealed)</i>	High <i>(if not properly waterproofed)</i>	High	<ul style="list-style-type: none"> Wood rot Insect damage Foundation wall failure Uneven floors
Stone Foundation <i>(Historic Homes)</i>	<ul style="list-style-type: none"> Very durable Adds architectural character 	<ul style="list-style-type: none"> Expensive to repair Difficult to modify May have drainage issues 	Moderate <i>(if not properly sealed)</i>	Moderate <i>(if not properly drained)</i>	Moderate	<ul style="list-style-type: none"> Crumbling stone Gaps between stones Uneven walls Leaning walls

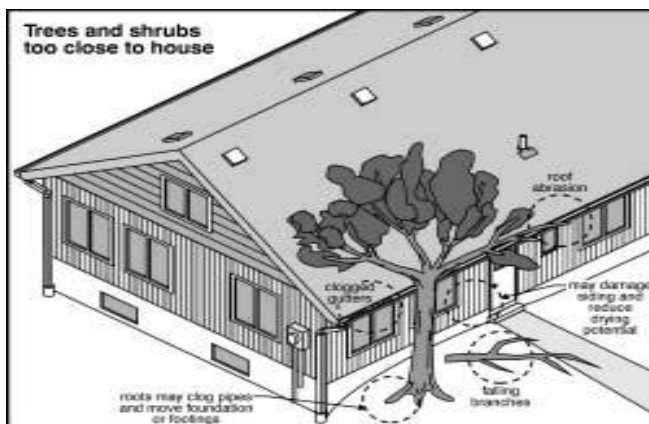
Additional Notes:

- Radon potential can be mitigated with proper ventilation systems regardless of foundation type.
- Moisture issues can be addressed with proper drainage and sealing techniques for all foundation types.
- Settlement is a natural process, but the extent can be minimized with proper foundation design and soil preparation.
- Consulting a foundation professional is highly recommended to assess the specific condition of your foundation.

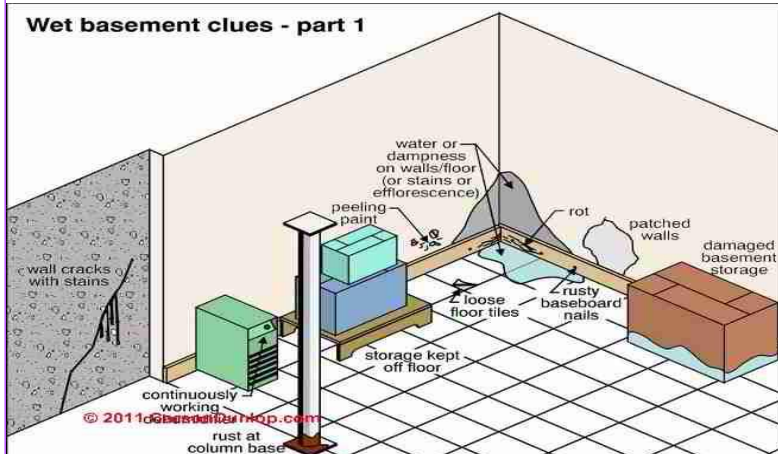
This chart is a general guide, and specific considerations may apply depending on your location and soil conditions.

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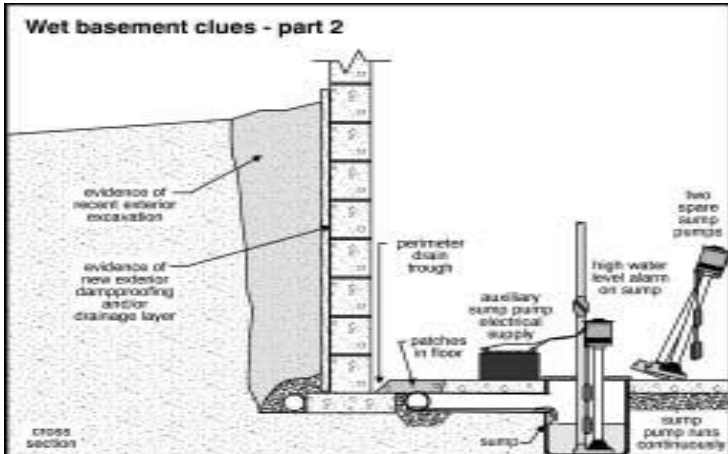
Additional Informative Foundation Illustrations:



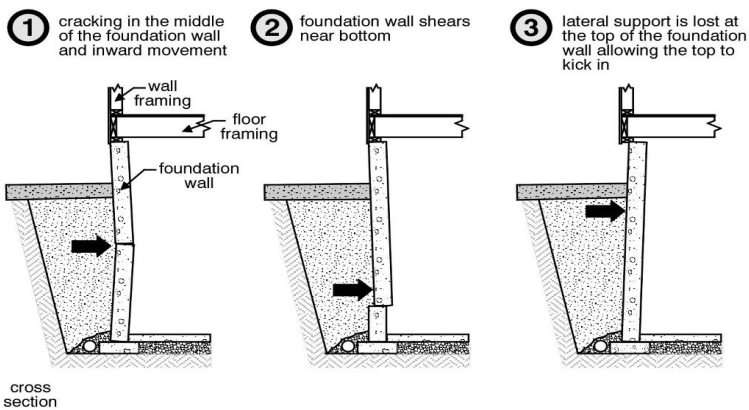
Wet basement clues - part 1



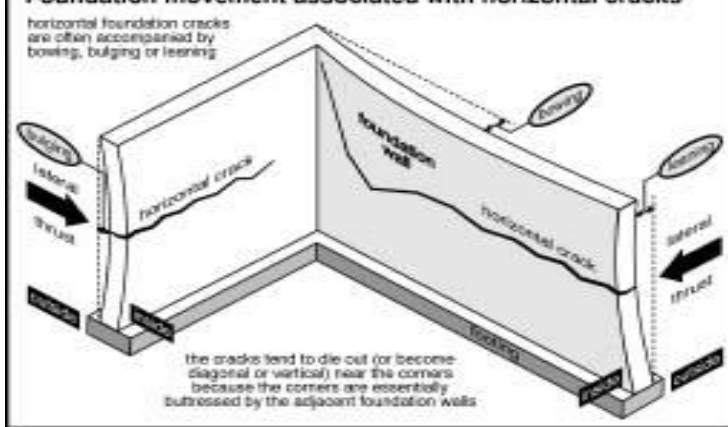
Wet basement clues - part 2



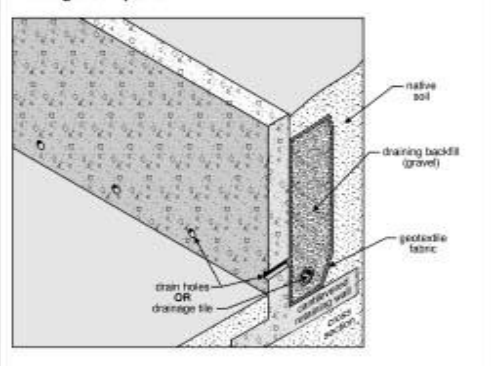
Horizontal cracks and movement - 3 different possibilities



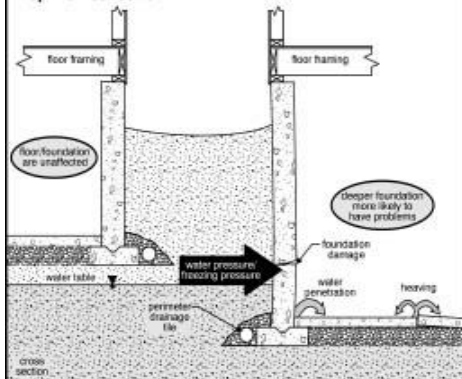
Foundation movement associated with horizontal cracks



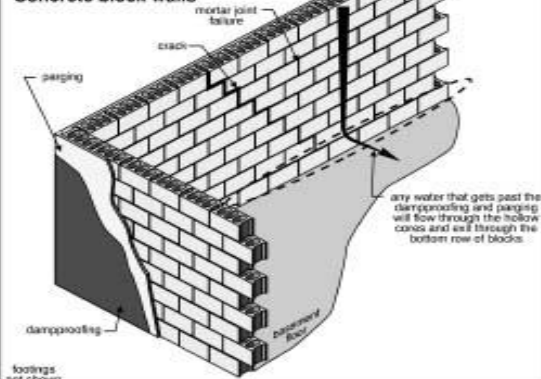
Drainage is important



Depth of foundation



Concrete block walls



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A word about **CONTAMINATED CONCRETE** and **CONTAMINATED FILL**:

*Concrete Foundations Can **PREMATURELY FAIL** if Contaminated*

Pyrite and Pyrrhotite: The Silent Destroyers of Concrete and Fill

Pyrite and pyrrhotite, often referred to as "fool's gold" due to their metallic luster, are iron sulfide minerals that, when present in concrete or fill, can cause significant structural damage. This issue has become a growing concern in many regions, leading to property devaluation and costly repairs.



Understanding the Problem

Pyrite and pyrrhotite react with oxygen and water, a process known as oxidation, producing sulfuric acid. This acid attacks the concrete or fill, causing it to deteriorate and weaken. Over time, the damage can become severe, leading to cracks, spalling, and even structural collapse.

Concrete: When these minerals are present in the aggregate used to make concrete, the resulting mixture is prone to premature failure. Buildings, homes, and other structures built with contaminated concrete may experience issues such as:

- **Cracking and spalling:** Visible signs of concrete deterioration.



- **Efflorescence:** White powdery deposits on concrete surfaces.



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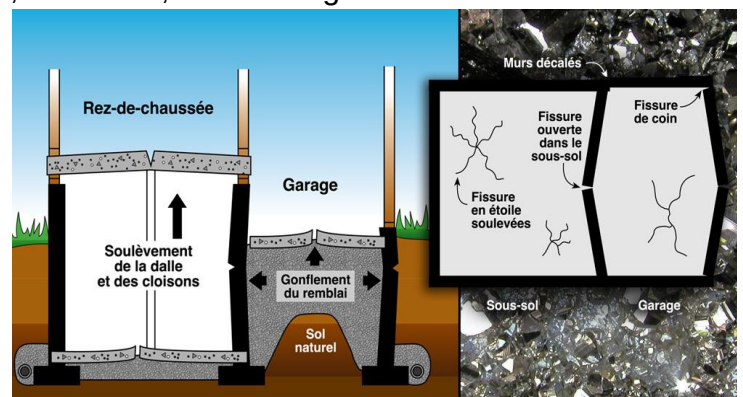
- **Corrosion of reinforcing steel:** Weakening of the concrete's structural integrity.



The corrosion cycle of steel begins with the rust expanding on the surface of the bar and causing cracking near the steel/concrete interface. As time marches on, the corrosion products build up and cause more extensive cracking until the concrete breaks away from the bar, eventually causing spalling.



Fill: Pyrite and pyrrhotite in *fill material* (the soils and crushed stone used under and around the foundation and slab) can cause similar problems, leading to unstable foundations, sinkholes, and other ground-related issues.



Identifying the Problem

Unfortunately, the presence of pyrite and pyrrhotite in concrete and fill is often difficult to detect before construction or during a home inspection. However, there are some signs that may indicate a potential problem:

- **Premature concrete deterioration:** Unusual cracking, spalling, or efflorescence.
- **History of mining or industrial activity in the area:** These areas may have higher concentrations of pyrite and pyrrhotite.
- **Geographic location:** Certain regions, like parts of Massachusetts and Connecticut, have been identified as having higher risks of pyrrhotite contamination.
- **Sampling or Testing:** Can determine the current concrete strength and composition

REBOUND HAMMER TEST



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What Can Be Done?

If you suspect your property may be affected by pyrite or pyrrhotite contamination, it's essential to consult with a qualified engineer or geologist. They can conduct tests to determine the extent of the problem and recommend appropriate remediation measures.

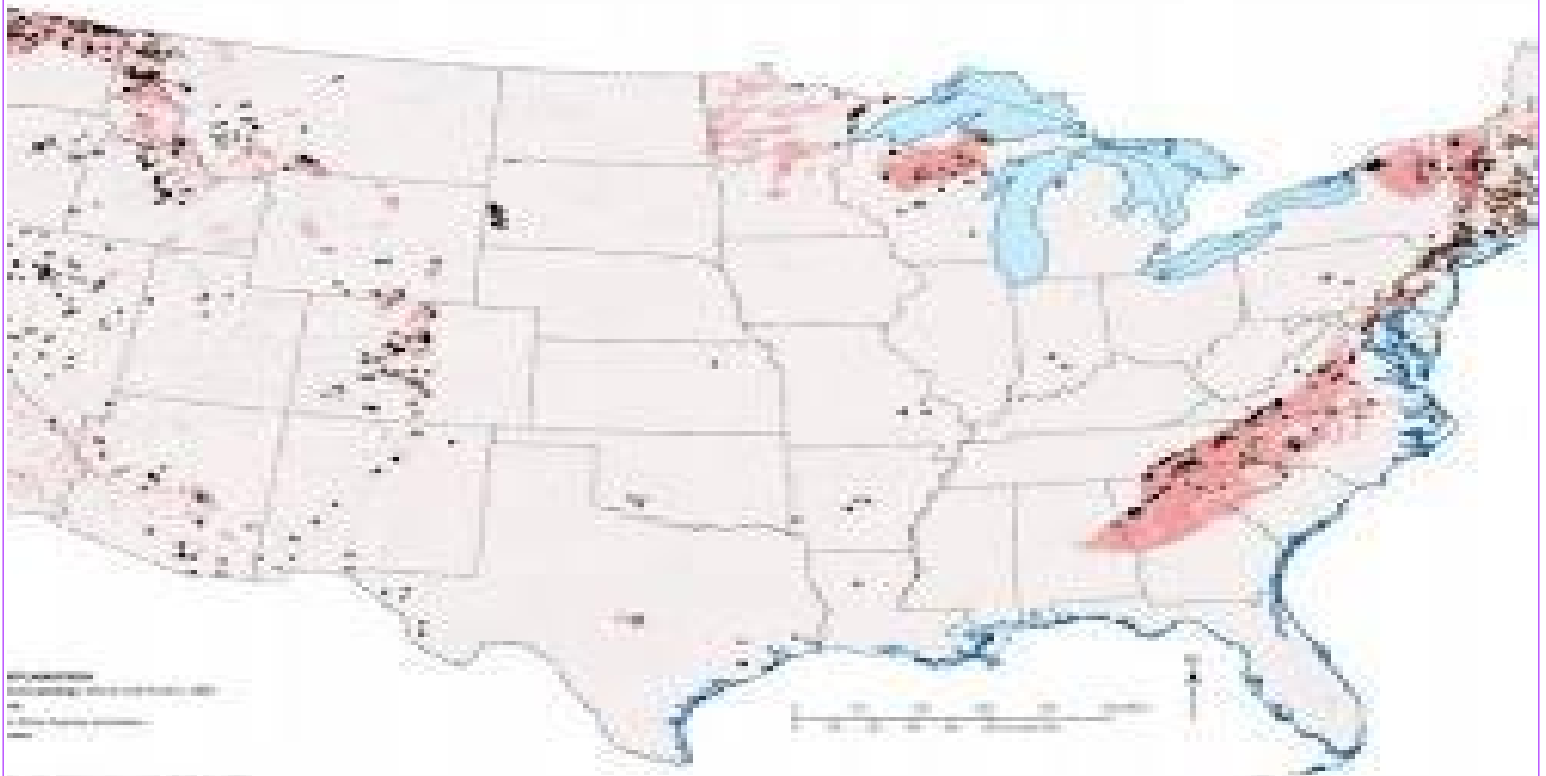
While there is no definitive cure for pyrite and pyrrhotite contamination, several approaches can help mitigate the damage:

- **Concrete repair:** Addressing visible damage through patching, sealing, or replacing affected concrete. *(note: this is only effective for a limited time)*
- **Fill stabilization:** Using specialized techniques to improve the stability of contaminated fill.
- **Drainage improvements:** Reducing water infiltration can slow down the oxidation process.

Additional Resources

For more information on pyrite and pyrrhotite contamination, please refer to the following resources:

USGS Map of Pyrrhotite Occurrence:



USGS Map of Pyrrhotite Occurrences In USA

Boston 25 News Report on Tainted Concrete: <https://www.boston25news.com/news/local/25-investigates-tainted-concrete-aggregate-may-have-been-distributed-by-least-one-mass-quarry/4BS666G57BGWJGRNBMPFSBC6QM/>

Crumbling Foundations: Understanding Pyrrhotite-Infected Concrete and Its Impact on Homeowners - Lamacchia Realty