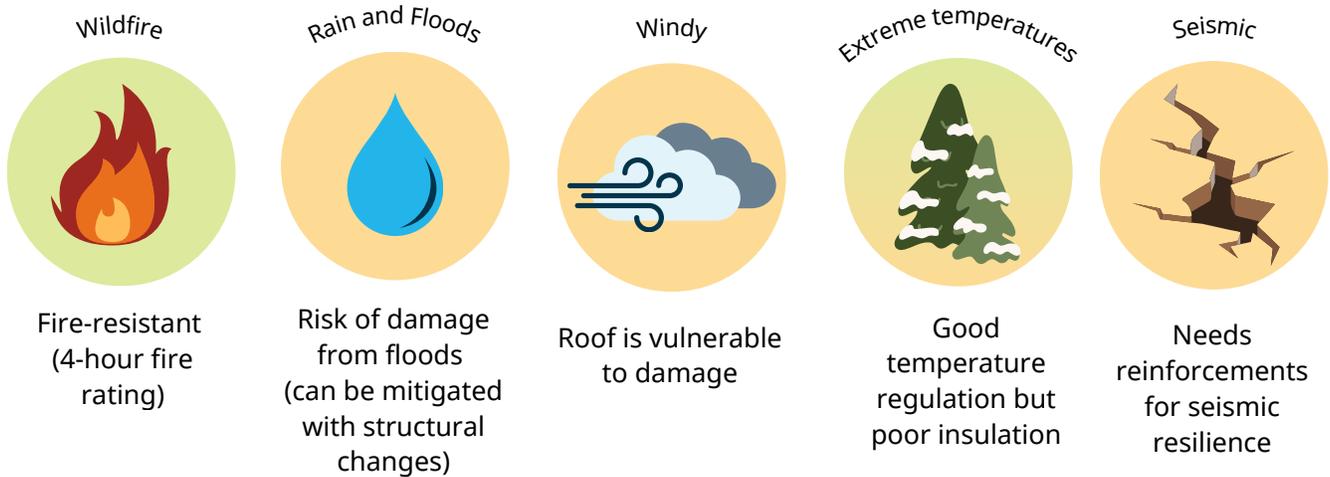


Rammed Earth

Building with rammed earth involves compressing earth - a mix of sand, gravel, and clay, often with stabilisers such as lime or cement - into vertical *formworks* layer by layer. This approach produces strong, compact walls.

Formworks are temporary wooden or plywood frames used to shape the wall.

Hazard Resilience



Cost Analysis

Cost estimates for rammed earth vary depending on many factors, including site, soil type, and labour/transportation costs. [innovative earth](#), a company based in Alberta, Canada, estimates rammed earth construction costs \$250-350 per square foot (estimate accessed in 2025).

Generally, costs for rammed earth are likely to be higher upfront compared to conventional materials, with a long-term return because of its sustainability.



Hazard Resilience of Rammed Earth

Hazard	Level of Resilience
Wildfire	<p>✅ Naturally fire-resistant, with a fire rating of up to four hours (meaning it can withstand fire for up to four hours).</p>
Floods and rain	<p>⚠️ Rammed earth is vulnerable to flood/moisture damage. Sealing and drainage systems are needed.</p> <p>If seals are inadequate, a raised design can reduce vulnerability to floods. However, rammed earth buildings are generally best for dry or temperate climates.</p>
Extreme Temperatures	<p>✅ Good thermal mass aids in natural temperature regulation.</p> <p>⚠️ Need reinforcements for insulation.</p>
Wind	<p>⚠️ Roof is vulnerable to damage.</p>
Earthquakes	<p>⚠️ Reinforcements are needed to improve seismic resilience, such as bracing or panels:</p> <ul style="list-style-type: none"> • Wood or metal frames (medium cost) • Cross-bracing (medium cost) • Tyre Foundations (earth-filled tires) below the walls (low cost)

Cost-effective reinforcements to address moisture challenges

<p>Gravel drainage surrounding the foundation, which prevents capillary rise and directs water away.</p> <p><i>Low-medium cost</i></p>	<p>French Drain: a pipe with gravel foundation to direct water away. They are implemented through exterior walls.</p> <p><i>Low-medium cost</i></p>	<p>Water or moisture barrier, such as lime plaster or clay (<i>low cost</i>) or EPDM liners (rubber membranes) underneath floors (<i>medium cost</i>).</p>	<p>A mix of clay, lime, and cement can reduce the risk of erosion and provide moisture control.</p> <p><i>Low cost</i></p>
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Benefits & Risks

Aspect	Benefit of Rammed Earth	Risk of Rammed Earth
Environmental	Low carbon emissions, local materials can be used, little to no waste produced.	Soil sourcing can be unsustainable if done poorly, which could affect ecological landscapes.
Durability	50-100 year lifespan, fire-resistant.	Erosion and moisture damage can occur if no reinforcements are implemented.
Energy Efficiency	Good thermal mass improves temperature regulation. Passive solar design can also lower energy usage.	Lacks insulation. Reinforcements for extra layers in cold climates can address this drawback.
Economic	Little to no long-term maintenance and costs.	Higher initial costs for labour.
Social	Opportunities for capacity-building through labour, knowledge, and skill development, although this can also be a challenge if capacity does not currently exist.	
Regulation & Codes		There are currently many gaps in codes and approvals.



Technical Feasibility & Construction

Materials:

Typical material requirements include soil (sand, silt, and/or clay), and water. Lime or cement may be added to address the risk of erosion and moisture damage.

Lifespan: Estimated lifespan of 50-100 years. External walls rarely need resealing and no painting is required.

Construction

Building with rammed earth requires knowledge of soil composition, compaction techniques, formwork, and frameworks. Indigenous Knowledges may also be relevant, as earthen structures were key components of the social, cultural, and economic practices of many civilizations. Construction is estimated to take 2-4 months for a single-family home.

Typical equipment requirements include pneumatic tampers, mixing equipment, shovels, and concrete mixers.

Specific expertise is needed for soil mixing, high-pressure pneumatic tamping tools, and overall labour. Construction time can be lengthened by the time needed to cure walls. Walls are susceptible to flooding if they are not sealed properly.

Improper construction can lead to:

- Weak walls prone to shrinkage, cracking, and swelling if constructed with the wrong soil mix.
- Weak structure/erosion and poor load bearing if soil is insufficiently compact.
- Mold, erosion, or structural failure if waterproofing and drainage is poor.
- Collapse if seismic reinforcement is insufficient.

Barrier: Building Codes

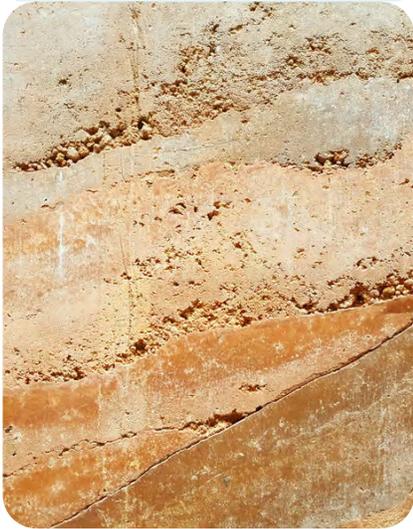
There are various code barriers to rammed earth construction:

- There are few accepted and clear universal standards for seismic protection, insulation, and load-bearing.
- It is unclear how soil composition and compaction affect building code standards.
- There is a lack of data to show that seismic requirements are met, and strategies for reinforcing rammed earth are not standardised.
- Additional layers may be necessary to meet thermal insulation requirements.
- Moisture resistance is not included in codes.
- Codes lack variability for geography and climate.

Maintenance & Retrofits

Addressing cracks and peels in the wall:

cracks and peels can be repaired through earth mortars or mixes compatible with the house



Priority: Moisture Reinforcement

The general goal of reinforcements is to prevent moisture from moving into the building.

- Capillary breaks can stop water from moving into the building.
- Breathable lime plasters can also provide moisture protection.
- Avoid cement renders, which can trap moisture, unless it's part of a stabilizing mix.

Priority: Seismic Reinforcement

The general goal of reinforcements is to strengthen the material and structure.

- Confining bands and steel plates can help reduce the risk of collapse and promote strength.
- Steel anchors can support the foundation.
- The soil mix plays a significant role in the material's strength.



Rammed earth wall

Cost Estimates

Keep in mind that many factors can affect end costs. For rammed earth, soil type will affect foundation costs. Sloping land may require retaining walls, adding expense. Design choices (including the number of windows and doors, fixtures, fittings, home size, and wall height) will also influence construction costs.

Cost estimates for rammed earth vary depending on many factors, including site, soil type, and labour/transportation costs. [innovative earth](#), a company based in Alberta, Canada, estimates rammed earth construction costs \$250-350 per square foot (estimate accessed in 2025).

Geographic variance:

Costs may vary due to higher transportation costs in remote and special access areas. In Coastal BC communities with more moisture, the need for increased moisture barriers would increase costs. Northern BC villages would require extra insulation to address extreme cold temperatures, which would increase costs as well.

Example: Nk'Mip – Desert Cultural Centre (Osoyoos, BC)

Constructed in 2006, this semi-underground structure is made from rammed earth walls. As the center's website explains, "each layer is made of concrete mixed with local soil and mineral pigment, is poured and tamped down separately. The thick walls have a layer of insulation and steel reinforcement, greatly increasing energy efficiency and earthquake resistance." The building also has many other ecologically sustainable design features, including a 'green roof' with desert vegetation, a radiant heating and cooling system that eliminates the need for air conditioning, and the use of pine-beetle damaged wood for the decorative accents.

[Learn more about the Centre.](#)

*Photo credit: Nk'Mip
Desert Cultural Centre*



Example: Terra Firma Builders Ltd.

Terra Firma Builders is based on Salt Spring Island in British Columbia and specialises in SIREWALL (Structural Insulated Rammed Earth wall) construction, a proprietary form of modern rammed earth. The company both builds with rammed earth, including the Nk'Mip Desert Cultural Centre, amongst many other projects, and provides courses on working with the material.

[Learn more about Terra Firma Builders.](#)

Note Space: Community & Personal Knowledge