Pit Houses

Pit houses are partially built into the ground. They historically provided warmth and shelter during the winter season for various Indigenous peoples in the Plateau region. While they are no longer common dwellings, they remain culturally important.

Advantages of pit house construction:

- Fire-resistant
- Excellent thermal insulation.

Potential drawbacks to be aware of:

- Risk of overheating, mold, and poor air quality due to poor ventilation.

Wildfire

Fire-resistant

Rain and Floods

Poor drainage can lead to flooding and rot. Mitigation measures are required.

Windy

Wind-resilient, but roof needs anchors.

Extreme temperatures

Good thermal insulation aids in heat retention.

Seismic

Reinforcements needed through bracing or panels.

Dodeca-Home under construction. Photo credit: Skeetchestn Dodeca-Homes

Recent information about the cost of construction pit houses in similar climates as BC's is unavailable. Estimates may be available through local suppliers.

Climate Resilience

Component	Pit Houses	Modular Building
Fire	✅Naturally fire-resistant. Can be further fire-proofed with steel roofing.	✅ / ⚠️ Short construction time can make it easier to avoid wildfires. Buildings can be made with fire-resilient materials.
Floods	⚠️Flooding can occur due to low structure (exact location of the house is important).	✅ Raising the foundation and waterproofing can improve flood resilience. Some modular buildings can float or be moved out of flood zones, such as Rotterdam's Floating Pavilion.
Moisture	⚠️Needs to be well ventilated to reduce buildup of moisture. Stagnant air can lead to mold growth.	⚠️Depending on materials used, buildings can be made to be more moisture resilient. Needs to be well ventilated to reduce buildup of moisture. Stagnant air can lead to mold growth.
Extreme Temperatures	✅Great natural insultation and less heat loss from wind due to low structure. For low to medium cost, roof overhangs or insulation (reflective roofing) can be added.	❗ Many modular homes reported overheating. Following energy modeling guidelines can mitigate this risk.
Wind	✅Natural protection due to being underground, and less affected by wind due to low structure. Resilient to high winds, hailstorms, and natural disasters such as hurricanes.	⚠️Wind resilience requires composite panels and robust connections. Debris-impact and connection fatigue may be issues.
Seismic	⚠️Reinforcements needed through bracing or panels, such as wood or metal frames or tyre foundations (earth-filled tires) below the walls.	⚠️Seismic performance dependent on design, particularly the strength of connections.

Cost-effective reinforcements to address moisture challenges

Gravel drainage surrounding the foundation, which prevents capillary rise and directs water away. *Low-medium cost*	**French Drain:** a pipe with gravel foundation to direct water away. They are implemented through exterior walls. *Low-medium cost*	**Water or moisture barrier,** such as lime plaster or clay (*low cost)* or EPDM liners underneath floors (*medium cost*).

Careful site selection can also reduce the risk of water damage. A site with natural drainage away from the building avoids water pressure against underground walls. Soil types that are permeable and allow water to drain efficiently are ideal.

Benefits & Risks

Aspect	Benefit of Pit Houses	Risk of Pit Houses
Environmental	Few materials needed and usually locally available. Low environmental impact.	Lack of proper drainage can cause degradation.
Durability	Provides protection against wind and extreme temperatures.	Risk of flooding, rot and cave-in if improperly constructed.
Energy Efficiency	Natural insulation and thermal abilities.	Without proper ventilation construction, poor air quality and moisture build-up are risks.
Economic	If local resources are available, can be a low-cost option.	Modern adaptations (insultation, HVAC systems etc.) can increase costs.
Social	Opportunities for community resilience and future capacity-building through labour, knowledge, and skill development.	Sometimes mislabelled as a non-permanent dwelling type.
Regulation & Codes	Standards could be included in nation-specific frameworks.	It is difficult to meet current code standards/regulations for attributes such as ventilation or ceiling height.

Technical Feasibility

Materials:
Typical material requirements include earth, timber, sod, natural insulation (moss, bark, etc.), and vapor barriers.

Lifespan:
Pit houses require moderate levels of maintenance. Their estimated lifespan ranges from 20-50+ years.

Barrier: Building Codes

There are various code barriers to pit house construction, including concerns about egress (exit points from a building), ventilation, structural safety, ceiling height, and moisture control. Additionally, **there are little to no standards or guidelines for integrating pit houses into modern design** using Indigenous Knowledges.

- The National Building Code of Canada and other codes do not recognise pit houses as a valid, regulated building form.
- There are little to no precedents for pit houses in residential zoning and safety laws.
- Limited or single points of access can violate fire safety codes, as can the lack of fire safety systems like sprinklers and alarms.
- Mechanical ventilation as required under code can be hard to implement.
- Walls and roofs for pit houses are often not covered in building codes.
- Plumbing and electrical systems are often not included in pit house design the way they are in modern codes.

This barrier might be addressed through codes that enable traditional architecture and designs with guidelines and standards specific to Indigenous cultures, traditions, and practices. Additionally, hybrid designs and modern adaptations can ensure pit houses meet building code requirements.

Constructing Pit Houses

Skills: Pit house construction requires traditional ecological knowledge (TEK), excavation skills, and basic carpentry. Further knowledge may be necessary for modern adaptations to improve insultation.

Equipment: Typical equipment requirements include shovels, digging equipment, chainsaws or axes, and tools for water drainage systems.

Time

- Construction time using traditional methods: 1-2 months.
- Construction time with modern adaptations: 2-3 months.

Methods: Pit house construction requires site-specific planning for drainage and heating/cooling purposes. Topography and microclimate affect site suitability and excavation needs. Proper excavation and soil stability analysis are both important considerations before beginning pit house construction. Granular soils that compact well and are permeable (and therefore will allow for efficient drainage) are preferred over cohesive soils that may expand when wet.

Improper construction can lead to:

- *Flooding, mold, and rot if waterproofing and drainage systems are insufficient.*
- *Roof collapse under snow and rain*
- *Smoke buildup, condensation, and poor air quality if there is a lack of ventilation.*
- *Wall deterioration, poor air quality, and pests if there is a lack of a moisture barrier.*
- *Soil cave-in or wall collapse if structural planning is poor.*

Maintenance & Retrofits

As pit houses are a less common building form now, retrofits are often focused on conserving archaeological and heritage sites. Priorities include non-intrusive maintenance and stabilization, moisture resilience, seismic/structural resilience, ventilation.

Retrofit & Reinforcement Guidelines
Starting Point
To obtain guidance on culturally and technically appropriate conservation strategies, consult local communities and the BC Heritage Branch if you are working on an archaeological or heritage site.

Priority: Moisture Resilience
The low structure of a pit house and its earthern material can make it vulnerable to moisture damage. Retrofits such as waterproof membranes, drainage systems, and rainscreens can addess this risk.

Priority: Ventilation
Poorly ventilated pit homes are more vulnerable to moisture build-up. Moisture sensors can help with monitoring the dwelling. A mechanical ventilation system may be necessary.

Priority: Structural and Seismic Resilience
The structural integrity of a pit house may be improved through tying the roof to the walls with anchors and/or the addition of steel and concrete rods.

Dodeca-Home under construction. Photo credit: Skeetchestn Dodeca-Homes

Cost Analysis

Recent information about the cost of construction pit houses in similar climates as BC's is unavailable. Estimates may be available through local suppliers. The form and material of pit houses (and other forms of earth-sheltered housing) varies greatly, and initial costs of construction can be greater than a conventional house.

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. Pit houses may be better suited for rural Indigenous areas where there is room for excavation and better soil suitability compared to urban areas. They are particularly cost-effective in climates with low humidity (reducing risk of damage from moisture) and temperature extremes, as the earth's temperature will vary much less than air temperatures, maintaining comfortable temperatures within the home.

Dodeca-Homes (Skeetchestn, BC)

Dodeca-Homes is a business developed by Skeetchestn community members that builds 12-sided post-and-beam buildings. They are not traditional pit houses but are inspired by traditional Secwepemc pit house design. Round homes are more energy efficient than square homes. Construction can be complete in 3-4 weeks and costs $220-250/square foot.

- Business website
- Feature from the Fraser Basin Council (First Nations Home EnergySave)

Dodeca-Home under construction. Photo credit: Skeetchestn Dodeca-Homes

Note Space: *Community & Personal Knowledge*