Straw Bale

Straw is a grain stalk (such as wheat, rice, rye, or oats) without the head. Straw-bale can be used as infill for post and beam/timber framing walls. Straw can also be compressed into agriboard or blocks.

Hazard Resilience

Wildfire

Fire-resistant when paired with plaster (2 hour fire rating).

Rain and Floods

Risk of moisture retention & mold, especially if exposed to water during construction

Windy

Panels filled with straw bale, if constructed well, are resilient against wind

Extreme temperatures

Low thermal mass but a great insulator

Seismic

Seismic-resilient due to energy absorption and wide footprint

Costs

For a straw bale wall, costs are estimated at $180-208 per square foot (number based on an American website accessed in 2025). This does not include components other than the straw bale, such as the foundation, roof, doors, windows, and plumbing.

Straw bale is generally more affordable and easier to work with compared to other materials. However, as with all other building projects, actual costs will vary based on many regional and site-specific factors.

Climate Resilience

Component	Straw Bale
Fire	✅ Although straw is combustible, if combined with plaster, straw bale has a 2-hour fire rating, which means it can withstand fire for about two hours before it is destroyed. This is twice as fire resilient compare to frame walls. The compression of straw into blocks minimises oxygen, limiting combustion potential.
Floods	❗ Straw bale is vulnerable to flooding. High moisture or lack of ventilation can lead to mold. Straw bale should be kept 2-3 feet above the ground to prevent moisture from seeping upwards.
Moisture	❗ Straw bales must be waterproof and breathable. Moisture levels should be below 15% (ideally 10%), and levels about 20% can lead to rot. Load capacity is also reduced under high moisture. Straw bale must be 2-3 feet above the ground to prevent moisture from seeping upwards. Plaster can also protect the bales from moisture.
Extreme Temperatures	⚠️ Low density means they do not store much heat and have low thermal mass (low temperature regulation abilities). ✅ Long thermal lag, which means straw bale can delay temperature changes. Straw bale also has higher insulation values than standard walls filled with fiberglass, cellulose, or rock wool.
Wind	✅ Straw bale walls can withstand substantial dynamic force with minimal movement (see the BaleHaus@Bath case study for more detail)
Seismic	✅Straw bale absorbs energy well and straw bale walls have wide footprints. Both these attributes make straw bale seismic-resilient - a study from the University of Nevada showed straw bale was able to withstand 200% greater shakes than a simulated 6.7 magnitude earthquake.

Benefits & Risks

Aspect	Benefit of Straw Bale	Risk of Straw Bale
Environmental	Straw bales are locally available in most parts of BC.	The plasters used with straw bale often have embodied greenhouse gas emissions, meaning their production emits CO_2 or its equivalents.
Durability	The long-term durability of straw bale is dependent on preventing moisture build-up. If built correctly to minimise moisture exposure, then straw bale walls will last.	Insect infestation and mold are both potential issues. Adequate sealing and resealing can protect bales from both risks. Straw bale can rot if moisture levels are above 20%.
Energy Efficiency	Very energy efficient, with higher insulation value than standard walls filled with fiberglass, cellulose, or rock wool.	
Economic	Relatively affordable material	Construction is labour intensive, which can increase prices.
Regulation & Codes		Straw bale buildings fall under non-conventional building methods in the BC Building Code, which means they need approval from a structural engineer before a building permit is issued. However, recent increases in cob and straw bale construction has led to more testing being completed.

Technical Feasibility

Materials:
Compressed straw is the primary material used in straw bale. Plaster may be added to protect the straw from moisture and improve fire resilience. A pure lime or earth-lime hybrid is best for breathability (although cement-lime plaster mixes resist erosion, they trap moisture and worsen decay).

Straw bales will typically make up 14-20% of a building. Other materials are necessary.

Maintenance and Lifespan:
Straw bale homes can be durable if they are built correctly. Generally, the long-term durability of straw bale relies on preventing moisture build-up. If straw bale walls are constructed correctly in ways that minimise moisture exposure and if a breathable plaster and/or rainscreens are used, then straw bale can last for decades.

Any cracks in plaster must be filled promptly.

Barrier: Building Codes
Straw bale buildings are classified as a ‘non-conventional’ building method in the BC Building Code, which can make it more difficult to obtain a building permit. Approval from a structural engineer is required. However, the recent increase in cob and straw bale construction is leading to more testing being completed.

Construction Methods

Construction Methods:
Straw bales can be used for:

Load bearing: straw bales are used to support vertical loads, which are important for structural stability.	**Frame infill:** straw bales fill a structural frame.	**Prefabricated panel systems:** straw bales are used in pre-made wall units.

Compared to other building materials, straw bale is a 'beginner-friendly' material and accessible to newer builders with relatively little training. That said, there are still precise steps and guidelines, particularly strict storage standards to minimise moisture exposure, proper compaction to promote fire resilience, and the use of plaster to support resilience and structural longevity.

Construction can take 9-12 months or more because working with straw bale is labour intensive. The cost of straw bale is estimated at $180-208/square foot. Costs may be cheaper close to the time of harvest.

Minimise moisture!
It is important to design straw bale homes to minimise moisture exposure. This can be done through:

- Using **moisture sensors** to detect potential issues early.
- **Overhangs** that prevent moisture from entering from wall cracks.
- **Avoiding exposed sites.**
- **Flashing**: thin strips of impervious material that will prevent water infiltration at joints and seams.
- Vapour-permeable construction through lime or earth-based **plasters** that prevent trapped moisture. Repair and replace any failed renders.
- A **mechanical ventilation system** to extract moisture and warm incoming fresh air.
- Proper air **sealing** is essential to prevent internal condensation.

Example: BaleHaus@Bath

BaleHaus @ Bath is a two-storey project made from straw and hemp cladding panels that were locally manufactured in a factory and then delivered to the site. The University of Bath's BRE Centre for Innovative Construction Materials monitored the house for two years and found it maintained heat through frigid winters, stayed dry, and had good sound insulation.

More information about BaleHaus can be found on the ModCell website and the University of Bath's feature of the building.

***Note Space:** Community & Personal Knowledge*

Photo credit: Agile Property and Homes Ltd and ModCell.