Straw Bale

In this type of construction, straw bales are used as a component of the external wall of a building – either as a structural element or as infill within a timber frame.

Extraction and manufacture	
Impact of extraction	When it's not used for construction, straw is often a waste product.
Energy and resource use	Embodied energy of baled straw is quoted[1] as 0.24 MJ/kg Some energy is used in transport – it depends on distance of site from straw source.
By-products/emissions	None from straw bales. Cement, which may be used as a plaster finish to ensure weathertightness, emits CO_2 during manufacture.
Sourcing	
Material sources	Straw is locally grown. Cement is made in NZ or imported. Sand can be obtained locally.
Availability	Straw is readily available in arable cropping regions of New Zealand.
Cost	Materials costs are relatively low. Labour costs are medium to high.
Transport to site	Straw is bulky to transport.
Construction/installation	
Health and safety during construction/installation	No issues identified
Ease of construction	Straw bale construction requires careful design and workmanship. Once delivered, materials can be handled by site labour. Straw must be kept dry.
Adaptability	Straw bale construction is relatively easy to adapt, particularly where the straw is used as infill to a timber structural frame. It is harder where the straw forms part of the structure. Straw bale buildings require specialist knowledge for alteration.
Performance	
Health and safety during life of building	Straw bales are inert. There is a potential impact on health if the straw is affected by moisture.
Structural capability	Straw bales can be used as a structural wall. Most designers incorporate a structural timber frame so that the straw is non-load-bearing, allowing the roof to be built first and the bales to be kept dry during construction in all weather. As there are no straw bale design standards in New Zealand, all Building Code clause B1 structural compliance design must be done by a Chartered Professional Engineer. Straw bales can absorb seismic energy.
Expected durability (assuming correct installation and maintenance)	Durability depends on the straw being kept dry throughout its lifetime. This depends on building design, correct installation, and maintenance. Some straw bale houses overseas have lasted over a century, so far.
Maintenance rating	Straw bales are high maintenance – regular maintenance of the weatherproof coating is essential.

Moisture resistance	Moisture resistance relies entirely on rain and other water being kept away from the straw at all times for the total life of the building. Designs incorporating good weather protection such as a drained ventilated cavity behind a separate cladding can achieve this. Fail-safe roof-drainage and plumbing systems that are anywhere near straw are also essential. External plaster direct onto straw cannot be relied upon to keep the straw dry in the long term, unless it is restricted to well sheltered sites and combined with site-specific specially designed generous roof overhangs and other weather shielding systems which take into account changing climate and weather patterns.
Rot, mould and corrosion	Damp straw will rot.
Thermal performance	The thickness of the wall and the R-value of the straw combine to give very good resistance to heat loss/gain. The applied internal finish to the straw may give a small amount of thermal mass.
Sound insulation	Straw bales provide good sound insulation due to the thickness of the wall.
Fire performance	Straw is combustible.
Waste disposal/recycling/re-use	
Re-use	Straw can't readily be re-used.
Recycling	Straw can't readily be recycled.
Waste disposal	Straw is biodegradable and non-toxic.

1. Embodied energy figures taken from work © J. Andrew Alcorn, 2010. (Alcorn, J. Andrew, Global Sustainability and the New Zealand House, a thesis submitted to Victoria University of Wellington in fulfilment of the requirements for the degree of Doctor of Philosophy in Architecture, Wellington, 2010.)