

**Glass**

Silica sand, the main ingredient, is mixed with lime and soda and heated to approximately 1500 °C using typically using natural gas. The molten glass is passed over a bed of molten tin (at 1000°C) and then cooled in a controlled manner to form a continuous sheet. Float glass is normally manufactured in thicknesses from 2 – 25 mm. Several other additives are put into the mix (magnesium and aluminium oxide) to help melting and make it run properly, and other oxides are added for colour. Float glass technology is continuing to develop with the refinement of the process to reduce energy use and by-products.

Float glass can be:

- polished
- toughened
- laminated
- coated
- tinted
- manufactured into components such as insulating glass units (IGUs, ommonly called double or triple glazing).

These processes provide sheet glass with widely differing properties suitable for a wide variety of end uses.

Recycled glass use is increasing, but specialist glasses are not recycled (for example, toughened or laminated).

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Extraction and manufacture	
<b>Impact of extraction</b>	A raw material for glass is silica sand. It is typically extracted from natural sand features such as dunes and beaches, which means there’s potential for damage to local ecosystems.
<b>Embodied carbon and embodied energy</b>	<p>Significant amounts of energy are required in glass manufacture and in recycling.</p> <p>Embodied carbon of clear float glass is calculated at 1.18 kg CO<sub>2</sub>eq/kg</p> <p>Embodied energy (total) is calculated at 15.05 MJ(NCV)/kg</p> <p>The figures are taken from BRANZ CO<sub>2</sub>NSTRUCT v1 June 2019. You can download the data and find explanatory details at: <a href="http://www.branz.co.nz/environment-zero-carbon-research/framework/branz-co2nstruct/">www.branz.co.nz/environment-zero-carbon-research/framework/branz-co2nstruct/</a></p> <p>Substantially more data is embedded (but not visible) in the BRANZ tool LCA Quick: <a href="http://www.branz.co.nz/environment-zero-carbon-research/framework/lcaquick/">www.branz.co.nz/environment-zero-carbon-research/framework/lcaquick/</a></p>
Sourcing	
<b>Material sources</b>	Glass is fully imported.
<b>Availability</b>	<p>Clear and tinted glass is readily available in most parts of New Zealand.</p> <p>Specialised glass may be available ex-stock or imported to order.</p>
<b>Cost</b>	Cost varies significantly with thickness and glass type – float glass is a lower cost product.
<b>Transport to site</b>	<p>The distance of the building site from a port will influence delivery costs. Bulk glass is heavy to transport – larger single sheets are difficult to transport without specialist vehicles.</p> <p>Glass requires careful handling during transport to reduce risk of breakage.</p>

Construction/installation	
<b>Health and safety during construction/installation</b>	<p>Glass is inert, non-toxic and not prone to off-gassing volatile materials.</p> <p>Glass can be hazardous to installers if broken and is classified by Building Code clause F2 as a hazardous building material – see NZS 4223 Part 3 for safety glazing requirements.</p>
<b>Ease of construction/installation</b>	Float and laminated glass are fragile to install and transport.
<b>Adaptability</b>	Older glass is difficult to re-cut without breaking. Laminated glass is difficult to cut while toughened glass cannot be re-cut.
Performance	
<b>Health and safety during life of building</b>	<p>Glass is inert, non-toxic and not prone to off-gassing volatile materials.</p> <p>Glass is suitable for roof water catchment</p> <p>Glass can be hazardous to building occupants if broken.</p>
<b>Structural capability</b>	<p>Glass is generally used as a non-structural element.</p> <p>Glass has high compression strength but performs poorly in tension.</p>
<b>Expected durability</b> (assuming correct installation and maintenance)	100+ years
<b>Maintenance rating</b>	Glass requires regular cleaning.
<b>Moisture resistance</b>	Glass is generally unaffected by moisture unless it gets between stored panes in a stack, but can be affected by alkaline runoff from cement plaster, uncured concrete, or mortar.
<b>Rot, mould and corrosion</b>	Not affected
<b>Thermal performance</b>	<p>Single panes don't contribute significantly to a wall system's thermal insulation. Thermal insulation can be improved by specifying:</p> <ul style="list-style-type: none"> <li>• insulating glass units (IGUs)</li> <li>• gas rather than air filling of IGUs – argon is a gas that works best with a 10-12 mm thick gap between panes</li> <li>• timber, uPVC or fibreglass frames, or aluminium frames that incorporate a thermal break</li> <li>• glass with a low emittance (low-E), a spectrally selective coating</li> <li>• glass that permits the entry of infrared wavelengths allowing exposed interior thermal mass surfaces to be heated. Glass does not add to a building's thermal mass.</li> </ul>
<b>Sound insulation</b>	Sound insulation increases with glass thickness. Sound insulation can be improved with laminated glass using different thicknesses of glass, having one pane installed on an angle and lining the reveal with a sound absorbing material
<b>Fire performance</b>	Limited to use of wired glass and special laminates in tested steel-framed glazed panels.

Waste disposal/recycling/re-use	
<b>Re-use</b>	Limited
<b>Recycling</b>	<p>Most glass can be recycled – used in the manufacture of fibreglass insulation.</p> <p>Crushed (colour-sorted) glass (cullet) can be used as a raw material for the manufacture of new glass containers.</p> <p>Waste glass has been used in highway construction overseas as an aggregate substitute.</p>
<b>Waste disposal</b>	Some glass can be re-used.