Aluminum Frame

Raw Materials

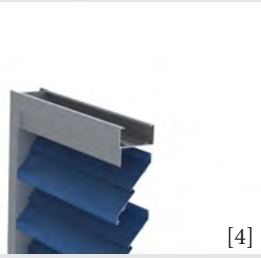

[1]

Bauxite
It is a wealthy metal which can be found in the earth's crust by (8.3% by weight) just after Oxygen and Silicon at (45.5%) and (25.7%) respectively. [2]


[3]

Alumina
The first appearing of aluminum was in Greece and Rome ancients. The first production of the metal was named as alum which was been utilized for medical purposes. [2]

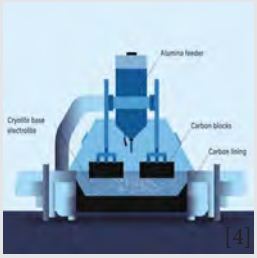
Manufacturing process


[4]

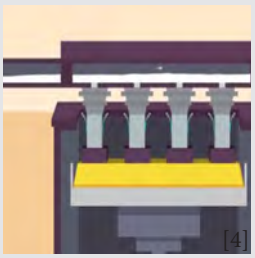
1. Mining Process
In this process we able to get Bauxite. [5]


[4]

2. Bayer Process
From Bauxite we able to get Aluminum in powder form (Al□O□) by coal and caustic soda suppliances operation. Obtaining 1Kg Aluminum we need 2kg coal & 0.5Kg caustic soda. [5]

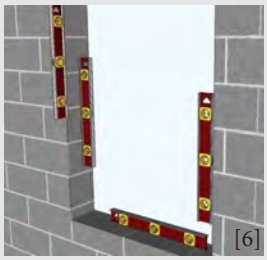

[4]

3. Smelting Process
It is an electrolysis process (Hall-Heroult) to obtain metallic Aluminum. [5]


[4]

4. Extrusion Process
Construction utilizations: Fast process. Aluminum ingot treated (heating & cooling). Varieties of shapes can be provided, the width range (10 - 800 mm) & with length ranging up to 40m. [5]

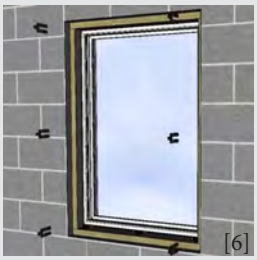
Construction Process


[6]

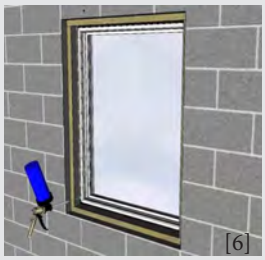
1. The Rough Opening
Cleaning and checking the rough opening area (should be larger than the aluminum framing dimensions). [6]


[6]

2. Preparing Process
Installing any type of water proving member (liquid – flashing) which differs in methodology according to the type of wall construction. [6]


[6]

3. Frame installation
Fitting the window frame in the rough area and centralize it by using packers. [6]


[6]

4. Finishing up
Filling the gapes between the frame and the surfaces by using foams from exterior and silicon from interior. [6]

End of Life Stage


[7]

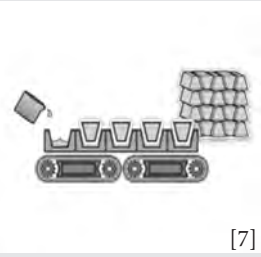
1. Collecting & Sorting
Collections classified in two categories (new scrap – old scrap) then each category will be grouped as coated and uncoated. The other components should be removed. [7]


[7]

2. Crushing Process
The result from the previous stage is crushed for reducing the size which is making the shipping and storing easier. [7]


[7]

3. Remelting Process
The uncoated is moved directly to re-melter process to obtain the molten form, while the coated should be prepared before that through a gas fired rotary. [7]


[7]

4. Remelting Process
The recycled molten needs around 700°C to gain the ingots form. [7]

Aluminum Frame

[7]

Cool Story

Usually, the aluminum's scraps contain different components of materials, such as papers, plastics…etc. Eliminating these components is raising the price of recycling process of aluminum but it is still comparable with the primary production. In spite the fact that aluminum is one of the widespread materials in the nature, the recycling process is more environment friendly than the primary production because of its saving energy at 95% which is declining the emissions proportion. On the other hand, there are many reasons for companies attempting to get the primary metal rather than scraped for manufacturing, such as there is no significant difference on the price between them. If there are fees against using the primary metal, that can let them to turn toward recycling. Moreover, what is making the recycled aluminum not widespread is the less numbers of producers because of the challenges that they are facing, such as the operation time of recycling which led them to have a large space to storage the scrapes and all of that bring risks to their business. [8]

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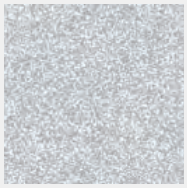
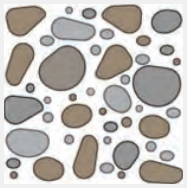
BIO-Concrete

Raw Materials



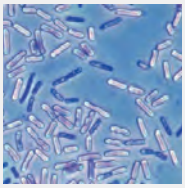
Cement
When cement meet the water it can bear the weight



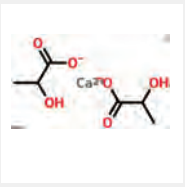
Aggregate
Aggregate plays filling and skeleton work

Water
Water can combine the materials and promote chemical reactions

Wind
Wind can help to work together



Bacillus pseudofirmus
Bacillus pseudofirmus repair agent which can live for 200 years



Calcium lavtate
Calcium lavtate which can provide nutrients

Manufacturing process

1. Preparation
Preparation for concrete materials

2. BIO-Concrete
Put the bacillus psedofirmus and calcium lactate into the concrete and it lies domant in the concrete for up to 200 years[1]

3. Cracks happen[2]
The water gets into the concrete which can activating the bacterial inside

4. Filling[2]
The bacteria then start producing limestone to fill in the cracks naturally

Construction Process

1. Prepare bio liquid
Prepare liquid which add bacterial and calcium lactate

2. Finding[5]
Finding concrete which have cracks

3. Sparying[3]
Spary liquid containing bacteria on cracked concrete to repair cracks

4. Self-healing[3]
The cracks are fixed

End of life stage

Lasting
It can help concrete extend for 200 years

BIO-Concrete

Cool story

Nowadays, concrete is the most commonly used construction material in the world, and the life of concrete is generally 30-100 years. However, in a extreme environment, such as humid environment, the lifespan of concrete is greatly reduced.[5] Thereby, environmentally friendly and long-lasting treatmetn methods are in high demand.[4]

Now by adding bacteria, bacillus psedofirmus, and other chemiclas to the concrete, these bacteria can lie dormant in the concrete for up to 200 years after construction. When the cracks happen and rain enters, these bacteria will be activated to form limestone to fill these cracks which happens only 3 weeks.[6]

By using bio-concrete, it will protect bridges, roads, tunnels and other concrete structures,[4] and the amount of steel can be reduced, thereby reducing construction consts, extending the lifespan of concrete and saving maintenance costs.[1]

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Ceramic Tiles

Raw Materials

Clay
Natural soil or rock material from the earth.

Feldspar
Group of minerals distinguished, includes potassium, or lime. It is the single most abundant mineral group on Earth.

Barium carbonate
Chemical compound. Used as additive in clay bodies, reducing scumming.

Quartz
Chemical compound / abundant mineral found at earth's surface.

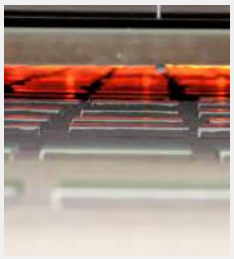
Sand
Addition of proportion of sand to reduce firing contraction.

Manufacturing process

1. Grinding
Dry or wet milling. The comminution process to achieves particle sizes of 2mm or more.

2. Forming
The fundamental stage, Use moulding process for formation of the piece, made by semi-dry pressing or extrusion.

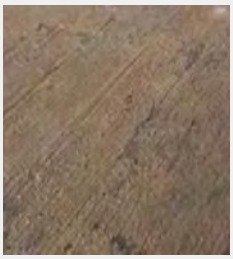
3. Drying
Use drying equipment for water removal from the ceramic body. Also to avoid tile breakage and deformation.



4. Firing
To controls the properties of the finished ware, such as fire resistance and mechanical strength.

5. Sorting, Packaging and storage
Manual operations on sorting and packaging. Regular shaped ceramic tiles are normally strapped into standard sized packs.

Construction Process



Surface preparation
Make sure surface are clean and dry before laying ceramic floor tiles to permit solid bond formation.

Setting out tiling
Plan layout and patterns without mortar , cut tiles to fit the pattern.

Laying Tiles
adhesive or mortar applied on both the slab and back surface of tile.

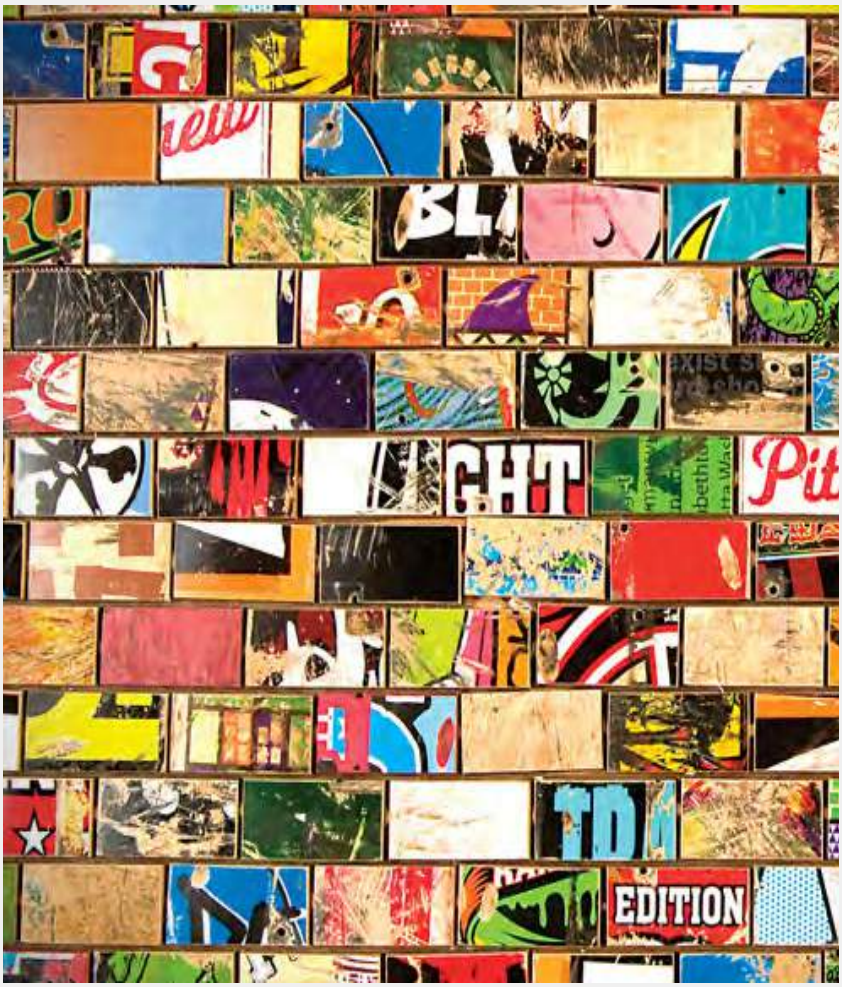
Grouting
Grout to fill in the space between tiles.

End of life stage

Recycling
Tiles can be reuse in the building or around garden.

Landfill waste
Tiles are classed as Inert Waste and can be sent to landfill

Ceramic Tiles



Cool story

Ceramic tiles are important construction material in all buildings. The estimated yearly waste of ceramic tiles is more than 3 million tons.The production process of ceramic tiles generates waste at different stages and point in which each residue is produced. For example, fired scraps are one of the primary wastes generated during the production process. During this stage, broken tiles, defective tiles and poor quality tile that prevent sale are produced.

Ceramic tiles can be crushed and recycled into valuable products, and this is beneficial in developing new products from an environmental life cycle perspective. There are approximately 65% of raw materials waste recycled, and the other 35% of waste was landfilled or used as aggregate. Tile is produced from natural materials, and there are no harmful chemicals. Some waste tiles can be re-used as urban flooring materials. The manufactures could develop a recycled-content formulation that can produce outdoor ceramic tiles. Thus, there is an economic value for the tile factory fields.

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Chipboard

Raw Materials & Resource Extraction

Forestry
Harvested from forests, with around 80% of the timber used being pinewood.

Mechanical Harvest
Capable of cutting down hundreds of trees daily. Crane loads logs onto trucks which transport the timber to manufacturing plants.

Sawmill Residues
Bark is removed from the logs as it is considered to be an impurity in the final product.

Particle Production
Shaving machines and chippers cut the debarked logs into flakes of a desired size.

Manufacturing Process

1. Wood Preparation
The particles from the silos are dried in driers through direct contact with hot gas from the burners.

2. Forming (chemicals)
The binder, usually resin or adhesive, and its dosage play a key role in the stability of the final board.

3. Board Shaping
The preformed mats made up of glued particles are transported to the hot press for pressing to reduce thickness.

4. Board Finishing
The cooled board is directed to the sander to form smooth flat surfaces which are covered in veneers from various timber patterns for enhanced aesthetics.

Construction Process

1. Cutting
Boards are cut to desired size using any mechanical saw such as a band saw, table saw, circular saw or jigsaw.

2. Flooring
Added weather protection with its hardwearing resin enriched surface. Inbuilt moisture protection for cut sheets.

3. SIPS (Structural Insulated Panel Systems)
SIPS are a modern alternative to traditional timber framed construction and function as the structural element for walls, roofs, and suspended floors.

4. Furniture
Chipboard is used to create lightweight furniture such as tables, stools, benches, bookcases and shelvings.

End of life stage

1. Landfill
Chipboard is biodegradable so its waste will contribute to greenhouse gas production if allowed to rot in landfill sites.

2. Mulch
Chipboard can be used as mulch to prevent soil erosion and a composting agent to improve airflow and decomposition.

3. Energy Production
Chipboard waste is used along with wood pellets as Bio Fuel to heat water to form steam in Boilers.

4. Recycling
Chipboard, which is also know as particleboard can be recycled to make new particleboard.

Chipboard

Cool story - Seriously, how good is Chipboard?

Chipboard could literally be the best thing since sliced bread. Manufactured with wood processing waste, chipboard is light, affordable, and thanks to veneers and laminates, you can have your cheap furniture to look like those high-end ones which naturally you can't afford.[1] Chipboard, which promotes usage of wood residues is used in woodworking, construction and furniture, ensuring high economic feasibility while promising flexibility in usage.[2] It's truly the perfect wedding. Or is it? During the manufacture of chipboard, chips from wood waste are dried, which generates a significant amount of gas from driers. Chemicals such as synthetic resins containing formaldehyde used in board finishing has a less than pleasing impact on both the environment and your usual earth dweller's health.[3] But wait, there's more. Wood and timber waste, usually made up of chipboard due to their low cost and low durability, are not usually welcomed in household recycling bins, although you can still take an exciting family trip to the closest household waste recycling centre to dispose of them. Chipboard waste is also used as fuel in biomass energy production, although the combustion of harmful chemicals again releases toxic gases in the environment. It does seem that the story of chipboard is not so rosy after all, and indeed further research is required to enhance its ecological prowess so that it matches its economic efficiency and overall usability. So for now, if you do not wish to fall victim to formaldehyde poisoning, maybe it is time to lay off the IKEA products.

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Clay Brick

Raw Materials

Clay (Shale + Kaolin)
One of the most naturally abundant materials / Mined in open cut mines.

Additives
Manganese and Barium are used to produce different shades

Barium Carbonate
Improves resistance to the elements. Barite is generally mined.

Sand
Bonded to the brick for texture and colour. Usually mined through an open pit.

Water
Bonded to the brick for texture and colour

Manufacturing process

1. Preparation
A six step process, from gathering the soil to blending other materials and tempering the clay

2. Moulding
time efficient and economical. 2 types: plastic clay and dry clay machines

3. Drying
Bricks are dried for 3-10 days to remove moisture and avoid cracking while burning.

4. Firing
Bricks are fired in kilns up to a certain temperature. Bricks gain hardness and strength during this process

5. Packaging
Automated setting machines unnload and set bricks. They are transported to the job site and unloaded for construction.

Construction Process

Materials and Soaking
Brick and Mortar. Bricks should be soaked before use.

Scaffolding
Needs to be transported to site and erected.

Laying Brick
Particular set of rules to use when laying brick.

Curing Brickwork
Should be kept wet for 20 days after laying. This step is not always necessary.

End of life stage

Recycled or downcycled
Bricks can last for centuries and recycled. Downcycled to aggreegate or disposed of to landfills

Clay Bricks

Cool story: Cigarette butts in Bricks

Bricks are extremely durable and can be recycled but if the natural raw materials could be reduced, the embodied and transport energy of extracting these raw materials would also be lowered.

Researches from RMIT have developed a technique of making bricks with discarded cigarette butts. “Manufacturing fired clay bricks with as little as 1 percent cigarette butt content could completely offset annual worldwide cigarette production.” [5] and at the same time, produces a brick that is lighter and more efficient.

If bricks were to be used, the energy expended in the firing process could be cut by up to 58%. The finished brick is comparable with the structural properties of a normal brick, but is a lighter with greater insulation capabilities. Poisonous pollutants from the cigarette butts are trapped inside the bricks during the firing process.

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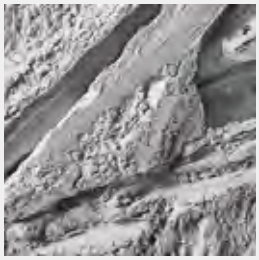
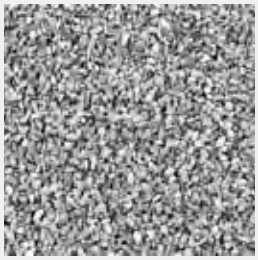
Concrete block

Raw Materials



Cement
Mixture of compounds / Calcium oxide (CaO), Silicon oxide (SiO2), Aluminum oxide(Al2O3), Iron oxide(Fe2O3), Water(H2O), Sulfate(SO3)



Gravel
Natural resource / Loose aggregation of rock fragments
Typically made of sandstone, limestone or basalt

Sand
Natural resource / Common component is Silicone Dioxide (Quartz)

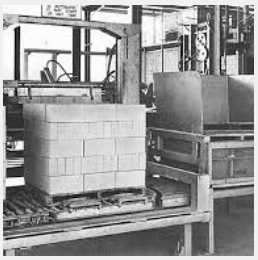
Water
Natural resource / Hydrogen and Oxygen H2O

Manufacturing process

1. Mixing
Ratio mixture of dry ingredients are blended together. As mall amount of tempered water is added and mixed.

2. Molding
Mixture is forced into molds and compressed. Dry mixture keeps shape once mold is removed.

3. Curing
Low pressure steam kiln, 66-74 °C, blocks soak for 12-18 hr. Slow release
High pressure steam kiln, 149-191 °C, 5-10 hours, rapid pressure release.



4. Cubing
Splitting and stacking of blocks.

Construction Process

Precast Units
Precast blocks are made off site and transported to site

They are then layed with a mortar and water mixture as desired.

This layering process is continued until desired height. Tie rods are used if walls are load bearing for additional structural support.

End of life stage

Re-use
Concrete blocks, if undamaged after disassembly can, be repurposed.

Crushed
Concrete blocks that weren't considerably removed, can be recycled as concrete aggregate

Land-fill
Most crushed concrete chokes landfill sites. This can be in various states after demolishion occurs. (See image)

Striving for holistic views: demolishing with building in mind and building with demolition in mind.

"One of the biggest obstacles to a circular economy is that we're not building things for multiple life cycles. We need to start designing buildings for disassembly."

- Eva Gladek, CEO
NGO Metabolic

Concrete block

Cool story

The investment of embodied energy used to create the concrete blocks is repaid by the longevity of the material. Concrete blocks are only recyclable if disassebled from a building during demonlishion, however this is a labour intensive and expensive process that most companies cannot afford. At the end of a building's life, the concrete blocks are commonly crushed to create concrete aggregate which can be recycled and reused.

Many companies are researching ways to utilise recycled materials in the concrete mixture to make it more sustainable. Some concrete block manufacturers replace the element of cement with waste products from power stations - such as ash - to create blocks known as AshCrete.

An alternative to concrete block construction is the physical use of plastic compressed to create a block form (see above image). A startup company, ByFusion, in New Zealand have developed a machine that turns scraps of plastic waste into bricks. The 100% modular technology can utilise all types of plastic to create blocks in the size of typical concrete cinder blocks.
Innovative building block alternatives are also being constructed out of fungi and mushroom root structure known as Mycelium, which is completely natural and biodegradeble.

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Epoxy Resin

Bio-Based

Raw Materials

Lignin Base
Lignin is the bio-product that can be used as an alternative to petroleum products.[1]

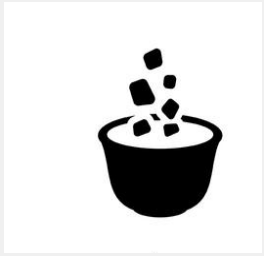
Polyol
Polyol comes insolvent family and alcohol substitution of methylene chains.[2]

Solvent and catalyst
Solvents is a substance that dissolves a solute. Catalyst is a chemical that increases the rate of reaction.[3]

Acid Anhydride and mixed-epoxy compound
The anhydride is an epoxy resin curing agent. It is useful for the laminating board and providing the finish.[4]

Manufacturing process

1. Mixing resin compounds
The Lignin is ground and transformed into powder then mixed to catalyst and the solvent to form a mixture.[5]



2,Adding Acid Anhydride
The Acid Anhydride is added to the mixture to esterification forming a median product.[6]

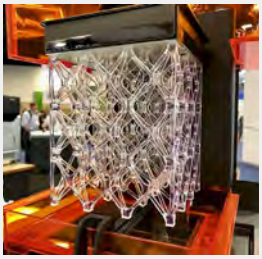
Adding Multi- Epoxy Compound
Mixing both Multi epoxy and the median product leading to epoxidation. The Epoxy is in a concentrate form.[5]

Adding Solvent
Mixing Bio-epoxy to the solvent and can form a coating and leads to a reaction and can pour it for good application.[5]

Construction Process

Adhesive and sealant
Bio-epoxy resin is used to stick surfaces of wood, tiles, sheets and for sealing gaps in construction.[7]

Floor, surfaces Finishes
Bio-epoxy resin is used to stick surfaces of wood, tiles,and for sealing gaps in construction.



3D Printing
Bio-epoxy resin can used to form transparent, translucent and opaque models in different colours.

Preserving Objects
It can preserve the biological,stone, metal and liquid in a solid form and protect it from spoiling or decaying

End of life stage

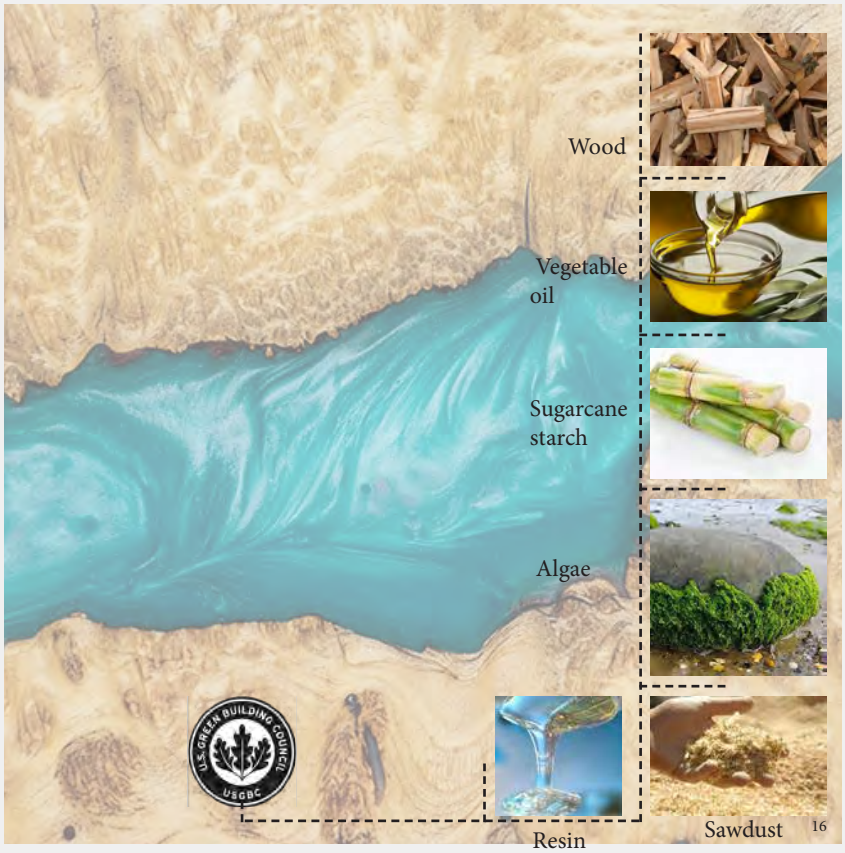
Fillers
The product can be Crushed and powdered to be used as filler to produce PET products

Landfill waste
The resin that cannot be separated from the other products used as coat or adhesive will be disposed as landfill.

Printing
The crushed clear Bio -based resins are also used for printing models.

Epoxy Resin

Bio-Based



Cool story

Bio-based Epoxy resin is made using plant product that is called lignin. Lignin creates half the carbon footprint of a petroleum product.[8] The bio-base can be made with sugarcane, sugarbeets, algae, corn, soybean, tree bark.[9] The use of such materials reduces the dependency on petroleum, further creating a green product. US LEED promotes the use of Recyclable and Bio-based materials. The use of bio-based resin in boats, electronics, and construction is high as it can reduce carbon footprint 45.4metric tonnes per annum. Bio-Epoxy has a great life cycle cost, consuming at least 77% of the Bio contents.[10] It has great benefits including Low VOC, BPA free, UV stable, Extremely hard product, 100% renewable source resin and is organic. A lot many manufacturing and construction companies are adopting it due to its lower environmental impact.[11]

Interesting!

Fiber Cement

Raw Materials

Limestone
Abundant Mineral / Mined in open cut mines using explosives.

Clay
Finely grained natural rock / soil. Appears in various colours, depending on soil content.

Gypsum Rock
Mined in large quarries / Found in both crystal and rock forms.

Silica Sand
Mined in Northern QLD / Quartz which has been broken down by water and wind.

Wood Pulp
Wood fibres reduced mechanically / chemically to pulp.

Manufacturing process

1. Heating
Raw materials (Limestone, Clay, Gypsum) are crushed and fed into a cement kiln.

2. Clinker
Elements come out of the kiln as ‘clinker’ in the form of small marbles, which are then finely crushed.

3. Mixing
Wood pulp, silica sand and cement is then mixed with water in large vats.

4. Setting + Hardening
Panels are dried, pressure is applied and cement hardens.

Construction Process

Precast Units
Precast boards can be nailed / drilled on site.

End of life stage

Reground
Can be reground and used as fill, though currently no programs to incorporate the recycled materials in production.

Fiber Cement

Cool story

Fiber Cement is a relatively new building material, and was developed in the 1980's. Due to the growing awareness of the danger of asbestos in the 1970s, broad research was done to find a replacement material, and so Fiber Cement was developed by James Hardie.

Only recently has research shown that Fiber Cement can in fact cause significant health issues. Due to the inclusion of crystalline silica in Fiber Cement, respirable particles are released when processing and installing the material (smaller than the eye can see) and remain airborne well after the dust has settled. Because of their minute size, inhaling such particles can lead to Silicosis, a process where particles are embedded deep into the lungs. Silicosis is incurable and can result in many types of diseases, as well disability and death.

Although crystalline silica makes up 10-30 percent of Fiber Cement, there are various ways to reduce the risk of Silicosis when working with the material:
- Wearing effective respiratory equipment
- Control the spread of dust particles through air movement control
- Keep silica dust wet before disposal, to prevent inhalation

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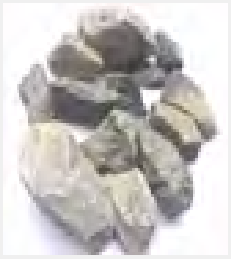
Glass (Soda-Lime Silicate)

Raw Materials

Silica sand
Silica (SiO2) is the primary constituent of sand.

Soda Ash
Makes the glass easier to melt.

Limestone
Adds durability to the glass.

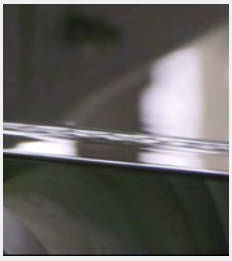


Dolomite
Working and weathering properties.

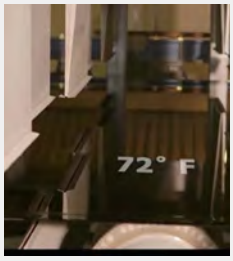
Manufacturing process

1. Mixing
Raw materials are mixed with cullet (recycled broken glass)

2. Melting and refining
Heated in a furnace at around 1600 C to form molten glass. Refining cools glass and helps remove air bubbles.



3. Tin/ float bath
Floats glass on melted tin to form glass of even thickness and to ensure planarity on both sides.



4. Annealing
Slowly cools glass to prevent distortion.

5. Cutting Cuts cooled
solidified glass to necessary size.

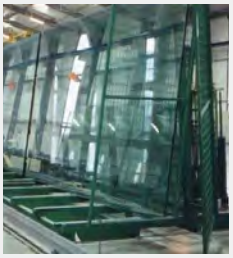
Construction Process

Processing and Edgeworking
Including further personalization including drilling of holes and notches, sand blasting, engraving etc.

Washing
Passes through a washing machine where it is carefully cleaned using brushes and special cleaning solvents to avoid impurities.

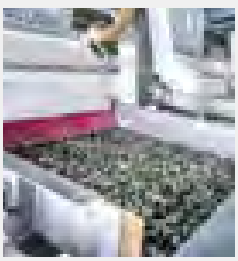
Tempering Furnace
The glass then passes to the tempering furnace where it is heated to 600°C.

Toughening
The glass is very rapidly cooled by air blowers to 300°C. This sudden drop in temperature fuses any external coatings to the glass and hence strengthens its mechanical and structural resistance.



Stacking and Transport
Glass sheets are lifted vertically using suction cups with a thin layer of interleafing lucite powder between each sheet for protection against scratches. These are then safely transported in special vans.

End of life stage



Crushing
Recycled glass is crushed and used as a raw material for production of new glass.

Glass (Soda-Lime Silicate)

Cool story

Glass is 100% recyclable and can be recycled endlessly without loss in quality or purity. In fact, recycled glass can replace upto 95% of raw materials required to make new glass. The industry term for this type furnace ready recycled glass is called "cullet".

Beer, liquor and wine bottles and glass jars from our houses can be disposed in glass recycling bins for recycling. Glass recycling benefits us in many ways - Recycled glass reduces emissions and consumption of raw materials, extends the life of plant equipment, such as furnaces, and saves energy.

But what about glass from construction waste?
These are slightly more tricky to recycle since they usually have different specifications and compositions. But here are some ways in which it can be recycled or repurposed.
1.Glass from old windows can be melted and manufactured to make fiberglass.
2.It can incorporated into glassphalt (a glass and asphalt blend), stirred into the reflective yellow and white paint used on roads or be used as backfilling for drainage.
3.Broken glass can be combined with concrete to create terrazzo flooring and countertops.
4.Old glass (and ceramics) can be used in landscape, floral and decorative applications.
5.Old windows can be reused as is or used for contructing greenhouses or cold frames.

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Granite

MATERIALS MATTER / MATERIAL OVERVIEW /
NURUL AINA NADZRI

Raw Materials

Quartz
Most Abundant Mineral.
Highly resistant to mechanical
and chemical weathering.
Dominant mineral
of mountaintops and the
main part of beach, river,
and desert sand.

Feldspar
Large group of
rock-forming silicate
minerals.
Found in sedimentary,
igneous, metamorphic rocks.

Mica
Minor amounts.
Known as Sheet Silicates:
Forms in distinct layers
The sheets and flakes of
Mica are flexible, fairly light
and soft.

Amphibole
Minor amounts.
Generally dark black or
brown.Heavy and
metaphormic rock.

Manufacturing process

1. Extraction:
Granite Quarry
Jet piercing machine or
diamond wire saws cuts
the section then
separated by explosives
or hydraulic splitters. The
granites are lifted by cranes
and transfered.

2. Block Cutting
Width of blades are
adjusted.
Water is sprayed to prevent
heat to dissipate and
minimize any sparks.

3. Grinding
Process to smoothen the
grainysurface of the granite
with Grinding machine
with diamond
abrasives. Water is used
to minimise heat
from friction.

4. Apply Epoxy and
Polishing
Epoxy Resin : Fills pits and
micro fissures. Preserved
its natural beauty and last
longer.
Polishing: Remove excess
resin and smoothen
the surface.

Constructing Process

Granite Pavers
Pavers are placed close to
each otheron compact sand
bed. Sand is spread to fill
up the joints.

Granite Tile Countertop
A layer of plywood backer
board are installed.
The tile base is protected
with waterproof membrane.
Thinset mortar is applied
before placing the granite
tiles.

Granite Floor Tiles
Mortar mix is applied on
clean subfloor.
Granite tile is placed on top
of the mortar mix and lightly
tap with a rubber mallet.
Grout is applied between
the tiles.

Granite Wall Cladding
Wet installation: plastered wall
ishacked by a chisel or
hammer to provide rough
surface before mortar
and tiles are placed.Dry
installation: mechanical ties
and anchors are use to
connect the tiles to the wall.

End of life stage

Sorting scraps
Granite scraps are sorted
by material type, colour and
size.

Cutting Granite
Granite scraps are cut into
variety of size and shape.

Cleaning
Granite scraps are placed
in a tumbler to strip off any
old finishes or coatings.

Finished product
The granite products are
examined to prevent any
crack or damage.

Granite

Cool story

Granite is an igneous rock formed from solidified molten rocks. Granite is made from feldspar, quartz and small amounts of amphiboles, mica and minerals.[1] Granite is light in colour with coarse grain size of different coloured minerals.

The largest producer of granite is located at the quarries on the North Eyre Peninsula and between the Eastern Mount Lofty Ranges to the South-East area in South Australia.[2] The cost of granite have decreased than the last decade because of the advancement in the granite processing technology such as better computer control system and diamond sawing.

In Queensland, the Bracalba Quarry is owned and operated by the Brisbane City Council approximately 70 kilometres of North Brisbane near the Moreton Bay Region. The quarry provides granite hard rock, greenstone hard rock and decomposed granite.[3][4]

Granite is non-renewable resources and may cause air and water pollution during extraction.[5] However, granite is highly recyclable, durable and reusable.[6]

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Laminated Bamboo Floor

MATERIALS MATTER/
MATERIAL OVERVIEW/
VIRAJ MHATRE

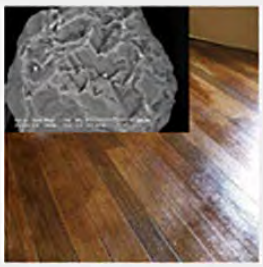
Raw Materials

Bamboo

Bamboo can be harvested every 3-6 year compared to timber which takes 10-50 years

Urea-formaldehyde (UF)

It is produced from Urea & Formaldehyde. Approx. 20 million metric tons of UF are produced annually.



Aluminium Oxide

Aluminium Oxide is extracted from ground aluminum ore bauxite by combining bauxite with lime and caustic soda in high-pressure containers.

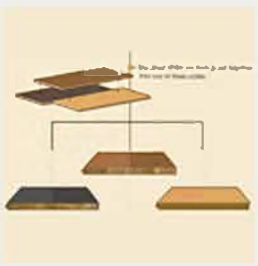
Manufacturing process

1. Harvesting & Milling

The outer green hull is removed and stalk is cut lengthwise into strips which are then milled flat.

2. Boiling & Carbonization

Boiling removes sugars & starches friom the strips to avoid expansion & contraction. Carbonization can be done to change color.



3. Manufacturing

Horizontal planks- Made by gluing wider surfaces. Vertical Planks- Made by gluing narrow edges. Strand Woven- Bamboo fiber remnants are intricately woven and compressed together.

4. Finishing

Planks are milled with a tongue & groove installation system for a flat surface and a snug fit. A clear coating like aluminium oxide is applied for more protection against wear and damage.

Construction process

1. Cleaning

The floor on which the planks are to be installed is cleaned to avoid bumps on the floor.

2. Install underlayment

The foam underlayment deadens sound and helps the floor feel more resilient and durable.

3. Preparing Adhesive

Adhesive is selected as per the material of the floor.

4. Gluing

Gluing the laminated planks to the concrete, underlayment or subfloor.

End of life stage

Recycling

The planks can be reused at a manufacturing plant after careful removal of adhesives and coatings using solvents.

Bamboo

The prototype 'Boo Cottage' (left and top) in Bangalow NSW, created by Barefoot Design, involved the harvesting of over 200 bamboo poles for the modular structural panels, flooring and furniture panels. Images: Jaye Irving, Barefoot Design.

Cool Story:

Bamboo is used in Australia for 'green' building products because of its fast-growing time and its ability to absorb carbon. Bamboo can be used for flooring, decking, panelling, scaffolding and also to make veneers, cabinetry, interior cladding and curtain walls among several other uses. The images above show a house made almost entirely out of Bamboo, including the furnilure.

Nici Long who is an Architectural designer at Cave Urban designs bamboo structures, including shelters and temporary pavilions for special events like the Annual Woodford Folk Festival in Queensland, says "Bamboo is incredibly easy to work with so a whole community can get involved with a project," she says. "It's lightweight, with low embodied energy and it's biodegradable."

Not so Cool:

Bamboo products in Australia are almost entirely imported from Asia due to low labour, production and manufacturing costs, but things could change.

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Laminex(HPDL)

Raw Materials

Decorative paper
Provides the pattern, woodgrain, or solid color for a sheet of laminate.[1]

Overlay paper
Provides surface strength and scratch-resistance properties for the laminate.[1]

Brown paper
Makes up the “core” of the laminate.[1]

Melamine resin
A clear transparent resin for treating the decorative paper.[1]

Phenolic resin
Made from phenol and is the basic material used for making plastic.[1]

Manufacturing process

Soaking Paper
The brown paper that is going to form the bottom side or base of the laminate is soaked in a bath tub that is filled with phenolic resin.[1]

Drying the papers
in this stage,saturated papers get to dry for being inflexible and breakable.[1]

Cutting
The rolls of stiff paper cut to essential sizes by cutting machine.[1]

High-pressure pressing & bonding
The papers or sheets are stacked upon each other and pressed together by hydraulic presses.[1]

Sanding the non-decorative side
In the final step of the process, the bottom side (non-decorative side) is uniformly sanded by a sanding machine.[1]

Construction Process

Benchtops

Final laminate and substrate product is made into joinery such as bench tops and furniture.

Cabinetry

Laminate coats the front of cabinetry as well as the internal carcass of joinery.

Panels

Laminate panels can also be used as decorative features on walls.

End of life stage

Re-Using
60% of product is serviceable for reuse over 40 more years.[2]

Recycling
Home mill, fabrication and installation scrap is reworked into new product.[2]

Disposal
It assumes 30% is recycled. Incineration is rare in Australia so none is modelled.[2]

Laminex(HPDL)

Cool story

To reach the desired GBCA Green Star rating, The Laminex Group have carried out several initiatives on its product and manufacturing techniques. For instance, the Laminex Group fabricates MDF from wood chips and fibre sourced from plantations and sawmills endorsed by Australian Forestry Standard (AFS) Sustainable Forest Management Certification and Chain of Custody and Programme for the Endorsement of Forest Certification Schemes (PEFC) certification, ensuring that the main raw material for the products is legally sourced and sustainably harvested. Quality inspections are applied to wood fibre to ensure consistency before MUF resins and adhesives are added and the boards are pressed, dried and cut to size. Almost two thirds of entire process energy are generated by burning otherwise unusable waste wood fibre, greatly reducing the demand on fossil fuels such as coal, oil and natural gas. Moreover, The Laminex Group appreciates benefits from low emissions and are therefore continually tries to reduce carbon emissions footprint across their supply chain by deploying latest technologies in industry.

Would have been good to talk about recycling issues

Marble Tiles

Raw Materials

Origin of marble
Marble is a raw and natural material from earth . Marble is made from a combination of sand, soda lime and silica.[1]

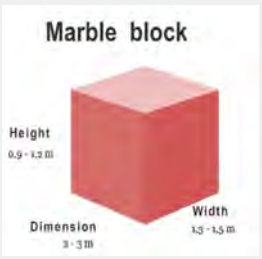
Sand
The main component of the sand is SiO2, silicon dioxide but Sand is classified as a heterogeneous.[1]

Soda Lime & Silica
Soda lime is the chemically calcium hydroxide and sodium/ potassium hydroxide.[1] Silica is a white or colorless crystalline a sedimentary rock confident of siliceous minerals. [1]

The from of marble
Marble is a metamorphic rock, they are from when limestone is exposed to high temperatures and pressures.[1]

Manufacturing process

Marble Quarry
Marble is mined from the open marble quarry or a underground quarry. [2]



Extracting Marble
Marble is extracted in block form and commonly cut into vertical direction. Different quarries have different cutting methods. [2]

Cutting
Marble is cut using multiwire cutters or block cutters. Multiwire cutters will produce slabs and block cutters will produce strips. The cut product is then processed by the mitre saw or cutter in order to create tiles. [2]

Strengthening and polishing
Once the product is cut from the machine, the Marble product will be sent to be strengthened and polishing to produce finish. [2]

Construction Process

Prepare the substrate
Substrate is smoothed, and if required, anti-fracture membrane or waterproofing is applied.[3]

Prepare the mortar
Starting mortar at the corners mortar is applied to surface, creating grooves in the mortar and apply the marble plate. Mortar dries quickly so smalls area are done at a time. [3]

Lay the marble tiles
Grout spacers help to lay tiles evenly spaced. [3]

Seal and grout the marble
Once all the marble tiles have been applied, they are grouted and cleaned. Silicone is used wear sealing is required. [3]

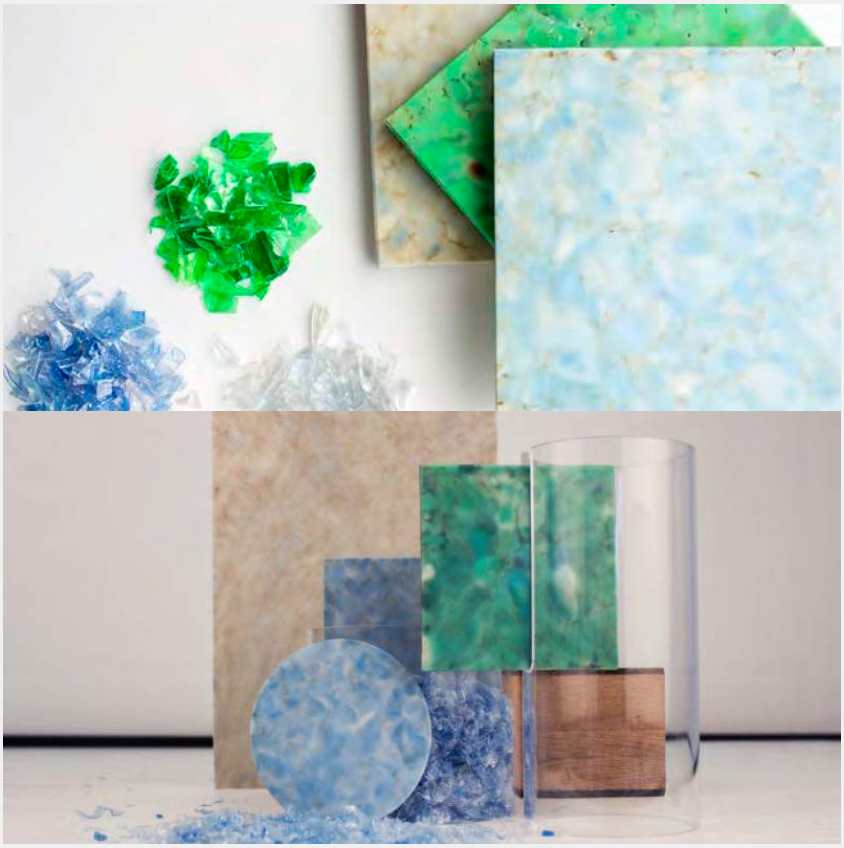
End of life stage

Landscaping
Marble could be recycled into Garden Aggregates that use in the landscaping. [4]

Concrete mixture
Marble could be recycled in concrete mixture which could product other product such as terrazzo table. [4]

Walkways
Marble could be recycled into other concrete mixture which is a terrazzo side walkway in your backyard. [4]

Marble Tiles



Cool story

Marble is the natural material can been used for different finishing products such as floor and wall tiles, slabs for benches and furniture.[5] However, the extraction of the marble had been considering unsustainable and harmful to the environment due to the naturally exhaustive manufacturing processes and non-renewable reosurces.[6] Marble is, however, a highly recyclable and reusable product, as well as durable. It can be recycled in several different products such as concrete mixture, landscaping pebbles, aggregate fill, and walkway paving.[7] There is also now an opportunity to replace the use of marble tiles by using the plastic bottles to create a tile that looks like mimics the look of marble.[8] Created from 100% recycled PET plastic waste, this alternative product can be used on wall applications just like normal marble tiles; this could be the future alternative for marble products.[9]

Plasterboard

Raw Materials

Gypsum Rock
Naturally occurring hydrated calcium sulfate, a by-product of evaporated lakes and seawater.[1]

Fibre
Typically paper or fibre glass, the fibre works to bond the plaster.[2]

Admixture
- Plastersisers
- Foaming agents
- Additives[3]

Paper
Cross-fibred paper encases the plastermix, providing strength to final product. The product can be made from 100% recycled paper.[4]

Manufacturing process

Crushing & Heating
Natural gypsum is "calcinated" with a furnace heated at over 300'C, removing 75% of water, and is then grounded creating plasters.[2]

Mixing
Plaster is mixed with water fibres, plastersisers, foaming agent , and additives (various additives will change the properties of the board, eg. moisture or fire resistance).[2]

Board Line & Kiln
Wet plaster mixture is pored onto a conveyor with paper, sandwiching the wet mix. The wet boards are cut before entering the gas heated kiln for drying.[2]

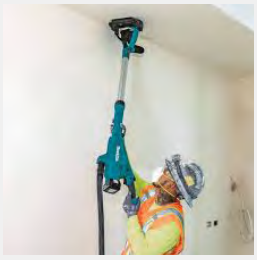
Bundle, Stack & Distribute
The final product is bundled and stacked before distribution via trucks or shipping containers.

Construction Process

Shipment to site from distribution centres/ suppliers.[5]

Installation
Plasterboard sheets are fixed to structural elements with adhesive and/or screw or nail fixings. Installation may also require steel plate of tophat fixings.[5]

Jointing
There a multiple jointing techniques, most commonly 3 layers of wet jointing compound, or 2 layers of jointing tape (cross fibre tape) are applied.[5]



Drying & Sanding
Minimum 24hr required for drying (sometimes a heater may be used to speed the drying process. Once dry, the jointing compound is sanded smooth.[5]

End of life stage

Landfill Waste
Due to the nature of deconstruction, plasterboard is contaminated by mix-loads of construction waste and is difficult to recover. Plasterboard makes up 4-8% of construction waste in Australia.[6]

Take-Back Scheme
Many plasterboard manufacturers offer take-back schemes to recycle plasterboard. This must be arranged with the builder/ contractor in order for the plasterboard to be recovered from site.[6]

Recycling
Plasterboard has to be clean (no vinyl adhesive ect) in order to be recycled. The paper and plaster components are separated before being reprocessed into new plasterboard.[6]

Plasterboard

Cool story

Plasterboard is a highly recyclable material. In order to be recycled into new plasterboard, the plasterboard must be recovered from site, uncontaminated. That means the plasterboard cannot have vinyl adhesives or be mixed with other construction waste, making it difficult to separate from other materials. The paper and plaster components are separated to be reprocessed. Because plasterboard is essentially reformed gypsum, the existing plaster can be crushed and wet down to be reformed once again.[6]

Other recycling initiatives in Australia, such as ReGyp[7] and & Waste Initiatives[8], are able to recycle plasterboard to be used for agricultural use, aqua-cultural use, and for civil works.

Plasterboard is relatively a lower impact product to manufacture than many construction materials due to its ability to introduce recycled materials, and lower heating temperatures required during the manufacturing process. The main problem is plasterboard makes up a 4-8% of construction and demolition (C&D) waste in Australia, and up to 15% in the US. The lack of recycling may be due to the lack of knowledge for take-back schemes, and the reduced efficiency of separating materials during demolition. Recycling needs to be organised between the manufacturer and the builder or contractor. This step is often missed, so plasterboard is added to mixed C&D waste, ending up in landfill.[6]

Plywood

Raw Materials & Resource Extraction

Timber
Harvested from Birch, Cedar, Pine, Spruce from controlled forests

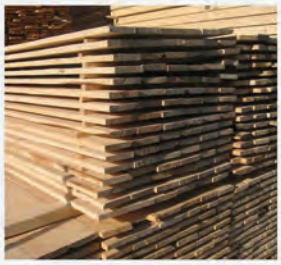
Seedling Greenhouse Operations
Controlled environment which requires fertilizer, electrical energy to run nursery pumps and keep seedlings cool for planting.

Forest Management - thinnings
Selective removal of trees to reduce competition to thus improve growth rate and maintain health of remaining trees.

Harvesting, Logging and Transportation
Involves felling, skidding and loading, which requires considerable power and fuel so as to run harvest equipment.

Manufacturing Process

1. Bucking & Debarking
Mechanical removal of bark from the logs to then cut them to proper length so as to create peeler blocks. Co-products include bark and wood waste.



2. Block Conditioning
Blocks are conditioned with steam so as to ease peeling, reduce veneer breakage to ensure smoothness and high quality of veneer.

3. Veneer Processing
Log are peeled through a veneer lathe to create uniformly thin sheets. Dryers remove the moisture content from green veneer through energy intensive process.

4. Hot Pressing & Sawing
Veneers are coated with phenol-formaldehyde resin, subjected to cool pressing for flattening and stacked into panels for hot-pressing. Panels are trimmed and sanded for use.

Construction Process

1. Cutting & Marking Plates
Cut plates of plywood to required size. Plates are then marked as per desired use and layout. Plywood is used in roofing, flooring and wall plates.

2. Installing Structure
The support structure installed can be wall studs, timber floor joists or roof shingles. These support elements are cut, lifted to position and fixed by toenailing.

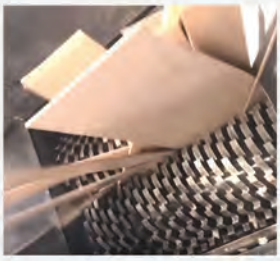
3. Framing Openings
In walls, it is required to locate openings in the layout, which are then fitted with required trimmer studs and cripple studs to frame openings prior to fixing plywood.

4. Finishing
Plywood is finished with satin polyurethane for walls and hard finish oil polyurethane for flooring. Install prehung interior doors and trim moldings.

End of life stage

1. Disassemble & Collection
Walls are disassembled and stacked. Nails are not removed as mills or mulch sites usually run timber waste through magnets to remove metals prior to processing.

2. Division & Classification
Waste timber is classified into Class A (untreated high quality timber) and Class B (untreated and unstained engineered wood products) prior to processing.



3. Shredding
A shredder and a mill shred and turn the wood waste into compost or mulches, which has diverse applications.

4. Re-use
Compost - Mulches used for soil imprevement, control erosion and used as animal bedding - As fuel used to create biomass to reduce carbon emission

Plywood

Cool story - Recyclable Plywood you say?

Plywood, a recyclable material? How true is that? We know that urea formaldehyde and phenolic resins, potentially carcinogenic materials known to cause respiratory tract irritation, organ damage or foetal malformation, are used as adhesives in plywood manufacture, which certainly challenges the very notion of recyclable plywood.[4] How can we re-use plywood waste if it poses such risks? A study conducted by The University of Beijing addressed that very issue surprisingly by utilising one of the most unloved product of modern civilisation, the much dreaded, yet so useful, plastic bag.[5] Indeed these thin, hard to degrade anti-ecological fiends, composed of polyethylene, polypropylene and polystyrene, were melted, and their high plasticity, low thermal conductivity[6] and good chemical stability provided an efficient adhesive which meets China's national standard while keeping the problematic formaldehyde emission to nearly zero. This new adhesive was used to manufacture an alternative poplar plywood via different hot-pressing temperatures and hot pressing times, to produce a plywood free of formaldehyde emission, which certainly kills two birds with one stone or to keep PETA happy, feed two birds with one scone, promoting the recycling and re-use of plastic waste while providing a greener alternative and environmentally friendly wood-based panel[7], with excellent water resistance and dimensional stability. Higher product specifications also broaden the application fields in construction and manufacturing, promoting economic and social benefits[8] while reducing environmental pollution. That's what I call recyclable plywood!

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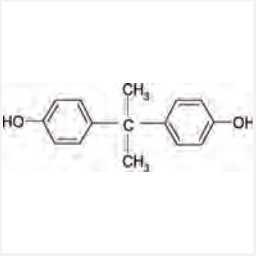
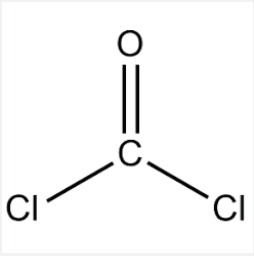
Polycarbonate

Raw Materials



Bisphenol A
Bisphenol A is produced by the condensation of phenol with propanone.[1]



Phosgene
Carbonyl chloride is produced from carbon monoxide and chlorine.[1]

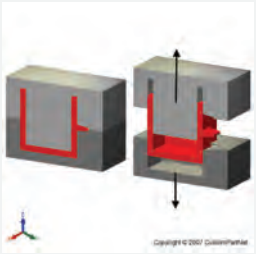
PC Pllets
Polycarbonates are manufactured by condensation polymerization of bisphenol A (BPA) and phosgene (COCl2).[1]

Manufacturing Process

1. Pre-drying
To remove moisure, polycarbonate should be pre-dried using hot air circulating oven at a temperature at 125 °C.[2]

2. Melting
Polycarbonate become liquid at their melting point at 155 degrees Celsius. Various additives may be added to form certain properties.[2]

3. Extrusion / Molding
Under pressure, the melt is forced into a die or mold. It can be repeated several times until the desired shape is obtained.[2]



4. Cooling
For polycarbonate grades with a high distortion temperature, water cooling or forced cooling air may be used.[2]

Construction Process

1. Shipment
PC sheet has a good impact resistance, which is really useful during shipping and installation processes of any project.

2. Cut / Cold Bend
Polycarbonate is a thermoplastic. It can be cut and formed into different shapes and structures on site.

3. Bonding
Aluminium rivets and bonding solvents are commonly used during the installation of polycarbonate sheets.[2]

4. Finishing
Operations such as sanding, solvent polishing and screen printng are applied to give the polycarbonate sheets a good appearance.[2]

End of Life Stage

1. Mechanical
Mechanical recycling of polycarbonate is to sort, shred and wash and then turn into a granulate ready for manufacturers to use again.[3]

2. Chemical
Chemical recycling of polycabonate is to react with phenol to produce monomers which are purified for further polymerization.[4]

Polycarbonate

Since 1970s, polycarbonate has been used in construction field for more than 50 years. Compare with glass, it characterizes a better impact resistance, thermal and electrical insulations. Its low weight and flexibity make it easier during transportation and installation. With relatively low production cost and high recyclability, the polycarbonate has become an ideal material for bringing daylight into buildings. Polycarbonate sheet in distinct forms (flat, solid, corrugated) has different characteristics and advantages, applied as overhead glazing, greenhouse glazing, translucent facades...[5]Various appearances, textures and colors provide architect with plenty of choices.

Although most polycarbonate can be 100% recycled mechanically or chemically, polycarbonate is still potentially harmful to the environment if it is not fully recycled or used responsibly. The polycabonate is made from petroleum so it cannot be degraded in landfills. Harmful chemicals such as bisphenol A are released into the land and ocean, which will cause a great damage to the nature and creatures.[6]

Therefore, to improve the environmental performance of polycarbonate, researchers have been looking for a way that would replace bisphenol A in polycarbonate. A team of chemists have tested a way to produce polycarbonate from the reactions between limonene and carbon dioxide.[7] Limonene could replace bisphenol A in polycarbonate, providing an organic and sustainable alternative to the future production. Another group of researchers from IBM has announced a new recycling process that turns used polycarbonate into safe plastics. A more heat and chemically resistant plastic was produced by adding a fluoride reactant, a base (similar to baking powder) and heat to the discarded polycarbonate.[8] Its strength prevents the decomposition process that led to the leaching of BPA. The result could provide a more environmental-friendly method of recycling polycarbonate.

There is no doubt that polycarbonate has many outstanding characteristics to suit the needs of modern construction industry. It plays a key role in constructing sustainable architectures. However, we should always keep its potential threat in mind, developing a more environmental-friendly alternative of production and recycling while improving the recycling efficiency, to make it more sustanable material for constructing the future.

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PVC

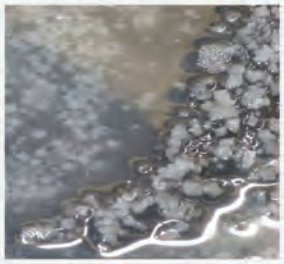
Polyvinyl Chloride

MATERIALS MATTER / CHIPBOARD / LINDSAY TAYLOR

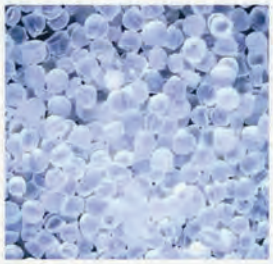
Raw Materials & Resource Extraction

Petroleum Naphtha
A hydrocarbon liquid stream derived from the refining of crude oil which is then used towards the production of gasoline and plastics.

Ethylene (C_2H_4)
Produced by the thermalcracking of petroleum naphtha via an energy-intensive process.



Chlorine (Cl)
Extracted from sea salt via a process called Chlor-alkali electrolysis.



= VCM (vinyl chloride monomer)
A colourless compound which is the precursor to the polymer Polyvinyl Chloride (PVC).

Manufacturing Process

1. Reaction
Polymerising VCM combining monomer molecules to form polymers in a slurry.

2. Recovery
Unconverted VCM is removed from the PVC slurry.

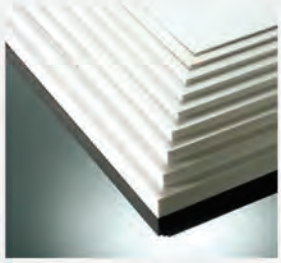
3. Drying
PVC particles are seperated from the slurry by passing through a certrifuge and water is steamed out. To leave PVC resin.

4. Packaging & Dispatch
The final product of manufacture is PVC resin, a fine white powder which are then packed and stored in warehouses.

Construction Process

1. PVC Products
PVC resin is heated and shaped into a final form that is used in a large number of products.

2. Pipe
Factory made and delivered to site for use in drainage, sewer conncections and electrical conduit.



3. PVC Sheet
Precast and craned onto site for a range of uses including cladding and roofing membranes as well as wall coverings.

4. Flooring
PVC flooring or Vinyl flooring provides a durable, easy to instal and easily recyclable flooring solution with a range of aesthetic effects and thickness.

End of life stage

1. Waste
Typically landfill but also in the plumbing industry, the pipe is disconnected and left in the ground in it's original place.

2. Incineration
Reduces the PVC waste in landfill. Incineration produces toxic gases such as hydrogen chloride which requires incinerators to be equipped with pollution control equipment.

3. Grinding
PVC waste which satisfies quality standards is cut and cleaned. Grinding waste PVC into small granules allows for the plastic to be used again.

4. Feedstock Recycling
Chemical processes heat the PVC breaking down the plastics into monomers and other basic elements used as virgin material alternatives in production of new polymers.

Cool story - How durable is PVC?

Really durable. Indeed, PVC is celebrated in the construction industry for its unparalleled longevity, especially when hidden underground away from solar radiation, whereby its durability extends to over 100 years.[9] This means that those PVC piping may outlive the building, along with most of its occupants. Even so, this number is, for now, purely speculative, as PVC has been around for only 60 odd years.[10] For all we know, those pipes may still be lurking for years to come, like that ex that never really disappears. The good thing is that, PVC is nowhere as toxic as that ex of yours, as it is considered to be a safe material in the construction industry, while also being the most tested plastic.[11] While PVC manufacturing is in fact highly hazardous due to the release of dioxin, a toxic carcinogenic compound. However, while PVC production has increased by nearly 300%, dioxin release has been in sharp decline over the last three decades due to innovative manufacturing practices. Based on a study undertaken by the Commonwealth Scientific and Industrial Research Organisation, it has been observed that PVC has as much effect on the environment as any other comparable alternatives in construction application, while ensuring lower costs and requiring low maintenance. Furthermore, a research undertaken by Plastics Industry Pipes Association of Australia (PIPA), states that very little PVC waste end up in landfills due to their high durability, with most waste made up of offcut and surplus pieces, which ironically impedes recycling due to the low scale of waste product.[12] Those PVC waste can be recycled 6 to 7 times, which means they may have an overall lifetime of 600 years[13], which means that your old PVC pipe under your sink may be used in some form by a descendant of yours, over 6 generations down the line.[14]

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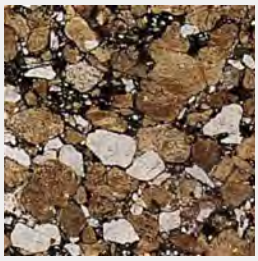
Sandstone

Raw Materials

Sand
Abundant Mineral / Mined in beach.

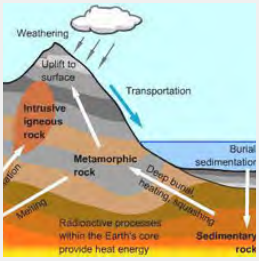


Clast
Abundant Mineral / Framework grains of sedmientation of sandstone, mined in open cut mine.

Siliceous cement
Abundant Mineral / Forms after deposition of grains, extracted from groundwater

Matrix- iron oxide
Abundant Mineral / Fine grains, extracted from low layer of sea bed

Manufacturing process



1.Sedimentation
A layer of layers of sand accumulates from air or water and sedimented by pressure.

2.Drill
Excavation of sandstone by drill

3.Transportation to processing factory
Craned and deliveried to factory for cutting

4.Preliminary shaping
Cutting stones into blocks

5.Second cutting
Cutting stones into customised shapes by craftman

6.Packaging
Packaged and stored for delivery

Construction Process

1.Customised stone
Transported and craned onto site

End of life stage

1. Crushing
Crushing loose material for rode base

Sandstone

Cool story

Sandstone as sedimentary rock is an excellent ecofriendly building resource undoubtedly. The huge consumption of sandstone reveals that various advantages offered by sandstone are beneficial for buildings. Sandstone is porous and it can filter out pollutants from running water. In the manufacturing process of sandstone, additional chemical are not required so pollution to the environment is eliminated. Thus, sandstone has relative low carbon footprint omparing with other stones. Moreover, sandstone is naturaly formed and it can be recycled easily. The development of extraction technology enhances the sustainbility of sandstone. Recycled snadstone are used in quarry reclamation, fill materials for new construction, landscapeing, cladding and etc.. Undoubtly, the long lifespan of sandstone facilitates the design of many historical buildings and landscaping.

Notwithstanding the benefits gained from sandstone, the vast consumption give rise to the landfill problem. Therefore, solutions for increasing the sustainability of sandstone are being explored. Apart from the reusing the sandstone in construction site, sandstone is investigated for the replacement of materials for manufacturing cement concrete. The possiblity of utilizing sandstone is maximized. Futhermore, reducing the embodied energy of sandstone is examined alternatively by adopting renewable energy for electricity generation in the stone porduction process. Hence, the carbon footprint is reduced efficiently.

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Spotted Gum

Raw Materials

Spotted Gum
Abundantly grown on the east cost of Australia / Generally sawn or veneered. [1]

Boron Salt
Used for hardwood treatment against Lyctus beetles. [2]

typ01 - Heartwood
Inner-layer of the trunk / dark brown to dark red-brown colour. [3]

typ02 - Sapwood
Outer-layer of the trunk / white to distinctively pale colour. [4]

Manufacturing process

1. Milling / Recovery
Logs are cut to specific lengths and sawn into boards.

Lasers in the multisaw are used for recovery. [5]

2. Grading
Boards are graded and unusable defects are marked with crayon.

Docking saw recognises and cuts marked areas. [6]

3. Treating / Seasoning
Boron salts used to treat wood.

Airdried for 3 months and kiln dried over 2 weeks for optimum moisture levels. [7]

4. Dry Milling
Boards are straightened before milling process.

Moulder profiles planes the board and are sorted into grades. [8]

Construction Process

Milled Boards
Taken on-site either as either solid or laminated timber. [9]

Fitted
Fit together with a tongue and groove joint. [10]

Finished
Smoothed surface from sanding and staining. [11]

End of Life Stage

Recycled
Spotted gum in landfill can be recycled for other structural components. [12]

Re-sawn
Sawn again and re-used as timber cladding and decking. [13]

Re-milled
Spotted gum can be re-milled and used again to make furniture.[14]

Spotted Gum

Cool story

Spotted gum is native to Australia and is one of the most durable and versatile hardwoods variously used for flooring, cladding, landscaping, structure and furniture. With this proud Australian spirit, more than 45,000 linear metres of Kennedy's recycled Spotted Gum and Grey Ironbark, recovered from the Howard Smith Naval Complex, constructs Brisbane Suncorp Stadium's external cladding. [15] The recycled timber was left uncoated, achieving a natural and weathered grey appearance. The heritage of these 100-year-old timbers embraces a common past of their own, united with the popular sporting venue. [16]

Spotted gum can also be harvested for 'pulpwood' products such as woodchips, paper, activated carbon and charcoal. [17] Spotted gum has a Class 1 life expectancy (40 years) above-ground and class 2 in-ground (15-25 years). It is one of the most widely recycled timbers in Australia. [18] With increasing popularity, there have been 'Spotted Gum Plantations,' where they are sustainably grown and maintained for future uses. Spotted gum is a lower risk plantation tree resulting from its drought and fire tolerances. [19]

According to renew.org, reusable timber dumped in landfill was reduced through expensive tip charges.[20] Almost a third of the 505,000 tonnes of timber waste in 2013-2014 was diverted from landfill and nearly half of the material was re-used. [21] A lot of this was recycled for low-grade uses such a packaging and mulch. [22]

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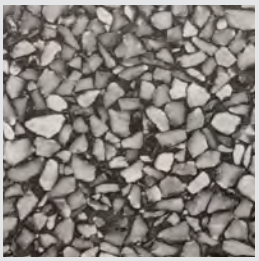
Terrazzo

Raw Materials

Portland Cement
Common/Versatile material. Low cost - Widespread availability of raw materials (Limestone, Clay & Sand). Aggregates paired with cement binder or epoxy. [1]



Durable Aggregates [2]
Abundant minerals - Coarse grained materials such as River Pebbles, Granite, & Glass give the tile strength and texture. [2]

Natural Marble Chips
Abundant mineral - Often not foliated / White (or coloured) limestone. Metamorphic rock extraction via Mining or quarrying using tools. [3]

Pigment
Abundant mineral/ Simple production/Low-cost. Heat Resistant - Often Mineral Iron Oxide (Dry insoluble substance). Colours tiles. Optional/Customizable. [4]

Manufacturing process

1. Batching Process
Weigh materials/ Conveyor belt moves raw materials. Mix - create separate layers (Face/base). Auto-water batching system. Raw materials poured into moulds. [5]

2. Pressing Process
Hydraulic press - Both layers (Face & Base) combined with applied pressure & ramming. Convey tiles - placed on flat racks/ stacked/ moved to curing & honing station. [6]

3. Curing & Honing Process
Convey tiles - Curing Machine (heated). Enters water blasting Honing machine. Grinding wheels Polish/Remove top layer. Range of finishing coats. [7]

4. Distribution Process
Tiles Stacked/ Bundled/ Straightened. (Conveyor belt) Machine folds box around tiles & zip-ties. Stored/ Distributed to construction sites & clients. [8]

Construction Process

Pre-cast Tiles
Prefabricated mould. Made off-site. Important to prepare/measure floor. Apply thin-set and lay tile with spacers on corners. Allow to set. Grout floor. [9]

Pre-cast Units
Prefabricated mould/cut/ polish - Made off-site. Laid by team. Moved with construction trolleys (size). Types: counter tops, stair treads, wall panels etc. [10]

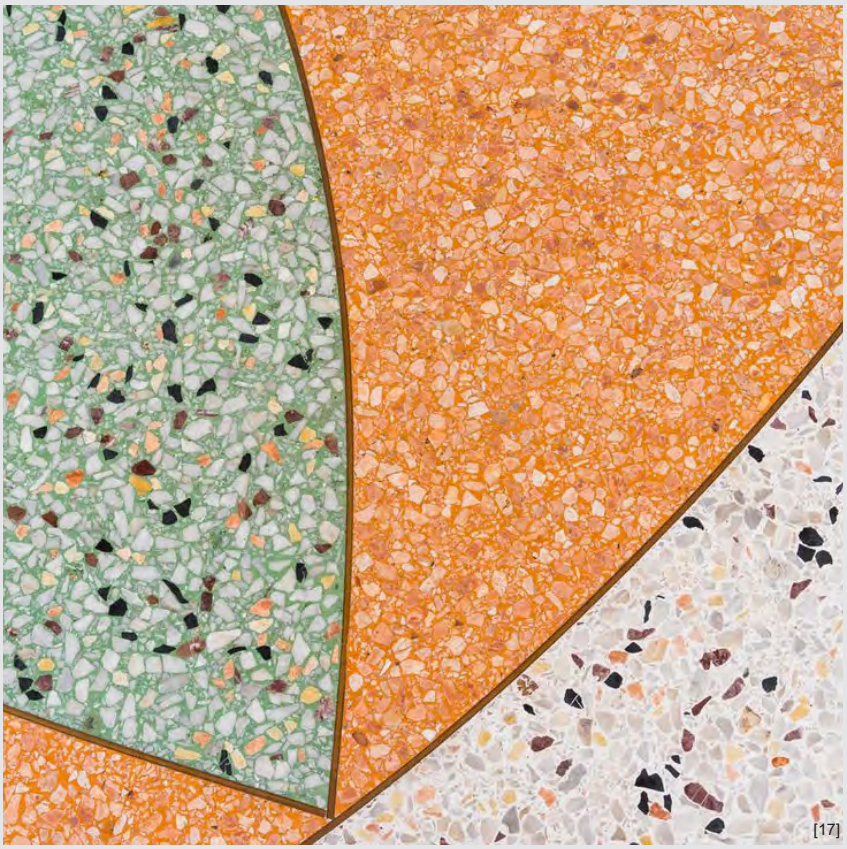
In-situ
Poured on-site. High level of Customization. Floor prep generally before pour. Process uses portable machinery on site. Ideal for commercial flooring. [11]

End of Life Stage

1. Restoration/Repair
Terrazzo can last for generations. If general wear/tear - cheaper to restore & repair, instead of covering or replacing [12].

2. Landfill & Crushing
Ideally dispose of correctly - Landfill. Recyclable - crushing up & re-using as aggregate in concrete/ or material for road base [13].

Terrazzo


[17]

Cool story

Terrazzo is a tough, sustainable material based on a centuries old design; with minimal maintenance it has a lifespan of 75 years and will generally outlast the building. [14] Terrazzo is comprised of approximately 30% cement/epoxy and 70% aggregates, which can be up to 98% recycled material. [15] From the beginning, terrazzo was developed to reuse scrap construction materials and minimise waste, and its high recyclability means it has a small impact on landfill and a low embodied energy. [16]

Terrazzo is showing resurgence; what once was considered a 'retro' look is now contemporary, as future generations rediscover new ways to use and make the material. [17] Limited only by the imagination, experimentation has arisen from advancements in technology and eco-friendly approaches. Such experimentation involves substituting traditional terrazzo aggregates for materials like plastic, glass bottles, and glass mirrors. [18] Examples show a wide variety of different compositions and appearances for terrazzo all sharing the need for recyclability. Architectural debris, including brick, concrete and metal waste forms what is called 'Urban Terrazzo'. [19] Similarly, methods of incorporating natural recycled substances like nuts, wood, shells and seeds (refer GiomoflexNaturo) or even using porcelain plumbing fixtures like sinks and toilets are being applied. [20]

'Lost' terrazzo is often re-discovered beneath carpet installed in earlier renovations. Due to its high durability and long lifespan restoring and repairing (filling holes, re-honing, sealing & polishing) is usually cheaper and more aesthetic than recovering or removing. [21] At the end of its long life, terrazzo is crushed, sieved and re-purposed, by removing desired aggregates to incorporate in new terrazzo or even cement/roads.[22]

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Treated Pine

Raw Materials

Soft woods
Plantation Pine
Hoop Pine
Radiata Pine

Chromated Copper Arsenate
Created as a fungicide and termiticide,
CCA is the more common timber treatment

Alkaline Copper Quarternery
Waterborne form of timber treatment
Considered safer than CCA

Manufacturing process

Timber Mill
Timber is milled to size once harvested from mono crop

Vacuum/pressure impregnation
Sealing the timber in a high pressure vessel.
VPI processes are used to apply (CCA) and (ACQ) amoung other preservatives.

Construction Process

Timber Framing
Pine is used as framing fixed with nails and framing anchors

End of life stage

Landflll
CCA or Blue Pine framing cannot be recycled, reused, burned or used for mulch because it can be harmful to the environment and is extremely toxic.

Treated Pine

Not So Cool story

Currently treated timbers are considered unfit for reuse as they are impregnated with toxic chemicals. It is recommended that treated timber is disposed of in landfill as cutting or burning the timber releases toxic chemicals into the air. The economic nature (cheap) and fragility of pine usually means that it is difficult to dismantle and is cheap to replace.

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Vinyl Flooring

Raw Materials

Polyvinyl chloride resins
A synthetic resin made from the polymerization of vinyl chloride.

White pigment
Coloring agents

Calcium carbonate
An abundant mineral used asan inert filler

Plasticizer & Stabilizer
- Makes vinyl soft and flexible
- Prevents degradation associated with impacts of heat and UV

Manufacturing process

1. Mix the ingredients
combine the liquid and powder ingredients

2. Sheet is formed
- solidifies the liquid foam
- felt paper backing
- floors design will be printed directly on this foam

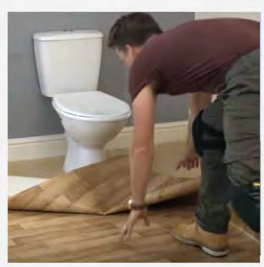
3. Sheet is cooled
- dry the ink
- coat the top layer
- create texture

4. Packaging
30 meters per roll

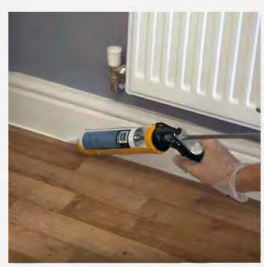
Construction Process

1. Preparation
make sure the surface is free from any protruding objects

2. Measuring
measure and record the length and the width of the room



3. Laying
- unroll and leave for 24 hours



4. Finishing Touches
- seal the joint with a silicon sealant
- fit a trim between the edge of the floor and the wall

End of life stage

1. Landfill
disposal in municipal landfill

1. Return for recycling

Vinyl Flooring

Cool story

PVC is relatively easy to recycle - if it can be recovered in sufficient quantities and quality. The best quality is when plastics are well sorted by type. Manufacturers already have high levels of recycling within their businesses, feeding their own material back into their own production process. For example, Armstrongflooring that started reclaiming and recycling flooring tiles in 2007 in Australia and in 2009 in North America. Through 2013, Armstrong has recycled over 10 million poundsof post consumer VCT flooring tiles into Vinyl Composition Tiles.

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