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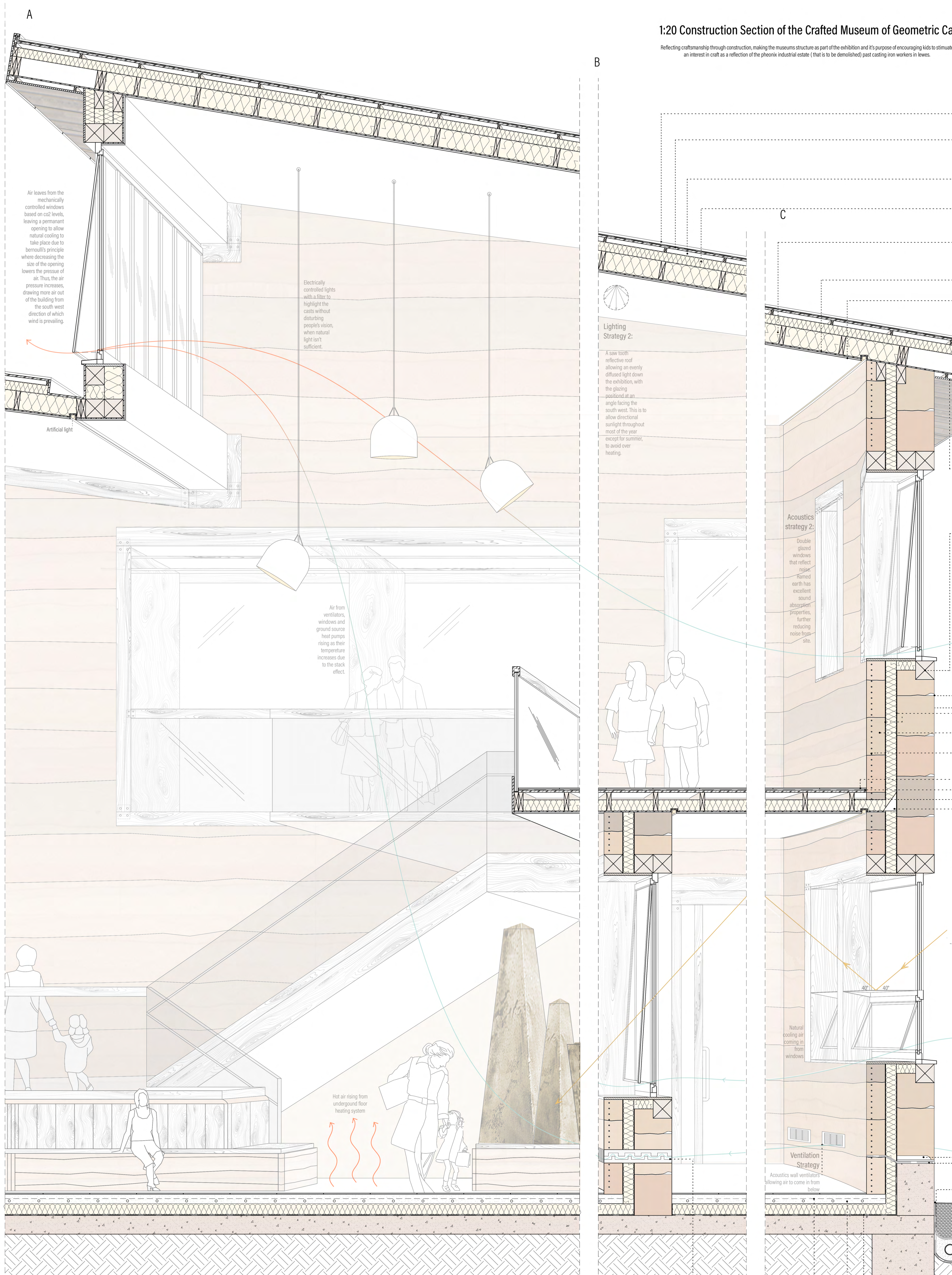
Task 2 AD672

1:20 Construction Section of the Crafted Museum of Geometric Casts

Reflecting craftsmanship through construction, making the museums structure as part of the exhibition and it's purpose of encouraging kids to stimuate an interest in craft as a reflection of the pheonix industrial estate (that is to be demolished) past casting iron workers in lewes.



Timber Cassette Roof Structure

For a self supporting roof that rests on the rammed earth walls

Standing seam zinc unweathered roof cladding 0.8mm thick.

Seperating layer (roofing felt), followed by 18mm thick Plywood for decking.

Ventilation cavity/ Timber Perlin thickness of 48x24m to support the roof decking.

Woodfibre insulation thickness of 120mm/ Timber perling to support the roof rafter thickness of 48x24m.

Timber Joists forming the roof rafter thickness of 50x20mm/Woodfibre insulation thickness of 200mm.

Plywood to support ceiling finish, 12m thick.

Plaster finish, 15mm thick.

Zinc continues to cover fascia.

Cavity and Perlin to support soffit.

Shou Sugi Ban (Japanese burnt larch wood) for soffit. 18mm thick.

Rammed Earth Wall Construction

Oak joist to support window frame. 200x200mm thick.

Trass layer to reduce the capillarity of rammed earth without effecting vapour permeability.

Rammed Earth load bearing wall, 400mm thick.

Plaster Clay 5mm thick to connect insulation board onto rammed earth wall.

Pre cast rammed earth interior wall reinforces with cement, 200mm thick.

Polypropylene geogrid to stop rammed earth from eroding.

These work horizontally and redirect the load down the sides of the windows/ any opening within the rammed earth wall. At points these are also placed vertically to balance the asthetic without redirecting the load. These are bolted onto a flitch plate to connect. They're left exposed to show how the building is also 'crafted' in it's construction.

Rammed horizontally at a 400mm width with a geogrid mesh on top. These pieces are then placed vertically with a 200mm thickness and stacked on top of each other to create a rammed earth interior finish. They're connected to insulation with plaster clay.

Timber First floor Construction

Polished concrete tiles floor finish, 12mm thickness

A paper thin seperating membrane folowed by Morter of 10mm thickness.

Where the seperating membrane is to allow the expansion of timber as one walks without effecting the tiles

Douglis fir frame joists with woodfibre board isulation and a ventilation cavity.

Steel Frame to support timber floor frame.

Lighting strategy 1

Horizontal specular reflectors attached to windows to allow direct sunlight coming to reflect at the same angle onto the specular reflective ceiling in the walkway and then back down into the exhibition space. Where the angle shown is of the spring autumn equinox, at around 40°.

The museum contains textured casts with the intention of grabing childrens attention, therefore, allowing direct natural sunlight would further enhance those textures and their intentions, where the dymanic appears of natural light would make the space more engaging.

Foundation and French Drainage System

Mineral Slurry sealant to bind rammed earth to DPM and Ferrock Foundation

Damp Proof Membrane

Geotextile membrane wrapped around pipe for protection from aggregates getting inside it.

Aggregates and a french drain system

The site is a natural landscape with a small risk of surface flood. Therefore, the french drain is to protect the foundation from any dampness from the soil or any small floods that may occur.

Flooring with Heating Pipes Construction

Ferrock, 550mm, followed by 200mm and a 500mm base.

Similar to concrete but absorbs co2 during its prodution, it excels in saltwater, and asthetically matches the rammed eath since part of it will be exposed.

DPC (Damp proof course) membrane

Screed 100mm/ underground heatpipes with a diameter of 16mm.

Levelling self smoothing screed poured around plastic heat pipes, clipped onto insulation to prevent the floating of pipes during the pouring.

Reinforcing mesh halfway through screed.

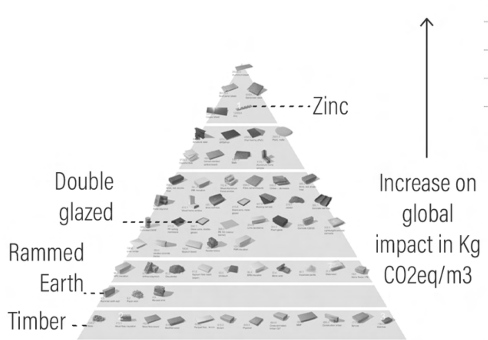
Heating Strategy:

Ground source heat pumps that use the low grade natural heat of the ground and passes it through a heat pump box that increases the temperature of a liquid that's then used to heat the flooring heating system embeded within the screed.

Acoustics strategy 1:

walkway forms a double skin facade forming an acoustic buffer zone paired with the acoustics ventilators as a noise reduction strategy due to a doors workshop emitting harsh noises near site.

Costruction Material Pyramid



Using an area of a 3000 by 10000mm wall and a windows to compare the Global Potential impact in an attempt to get the smallest number possible.

The folowing 3 senarios showed me that timber makes a much greater impact, specifically oak.

Rammed Earth Structure

show result in pyramid ↑	reset calculation	type project name	m^2	

	material	group	impact / m3	volume [m3]	area [m2]	thickness [mm]	result
1	Zinc	metal	12209.4 kg CO2eq/m3	0.0024 m3	m2	mm	29.3 kg $CO_{2\ eq}$
2	Wood frame window	komponenter	474.1 kg CO2eq/m3	0.00 m3	0.009594 m2	82 mm	0.4 kg $CO_{2\ eq}$
3	Glass pane, double-glazed	komponenter	266.1 kg CO2eq/m3	0.09 m3	2.275 m2	40 mm	24.2 kg $CO_{2\ eq}$
4	Rammed earth wall	mineralsk	9.3 kg CO2eq/m3	1.80 m3	3 m2	600 mm	16.7 kg $CO_{2\ eq}$
5	Wood fibre insulation	biobaseret	-173.1 kg CO2eq/m3	0.36 m3	3 m2	120 mm	-62.3 kg $CO_{2\ eq}$
							8.3 kg $CO_{2\ eq}$

Using the current structural material pallette, it appears that zinc, rammed earth and double glazing are the reason for an increase in the global potential impact.
However, zinc has the lowest global impact from the roof cladding materials availabe along with double glazing. Meaning that changing rammed earth would create the most impact on reducing the GPI. Even though rammed earth has the advantage of being a local material which could deal with the event of flooding occuring in lewes through safely eroding and being reconstructred in place.

CLT (Cross Laminated timber) Structure with Oak Cladding

show result in pyramid ↑	reset calculation	type project name	m^2	

	material	group	impact / m3	volume [m3]	area [m2]	thickness [mm]	result
1	Zinc	metal	12209.4 kg CO2eq/m3	0.00 m3	3 m2	0.8 mm	29.3 kg $CO_{2\ eq}$/m3
2	Glass pane, double-glazed	komponenter	266.1 kg CO2eq/m3	0.09 m3	2.275 m2	40 mm	24.2 kg $CO_{2\ eq}$
3	Wood frame window	komponenter	474.1 kg CO2eq/m3	0.00 m3	0.009594 m2	82 mm	0.4 kg $CO_{2\ eq}$
4	Wood fibre insulation	biobaseret	-173.1 kg CO2eq/m3	0.36 m3	3 m2	120 mm	-62.3 kg $CO_{2\ eq}$/m3
5	Cross-laminated-timber CLT	trae	-664.0 kg CO2eq/m3	0.90 m3	3 m2	300 mm	-597.6 kg $CO_{2\ eq}$
6	Oak tree	trae	-1063.0 kg CO2eq/m3	0.04 m3	3 m2	15 mm	-47.8 kg $CO_{2\ eq}$
							-653.8 kg $CO_{2\ eq}$/m3

The structural materials with lower global impact than rammed earth are timbers. I began with clt, which requires cladding as its a softwood, and thus I choose oak, which I noticed had a significantly low global impact.

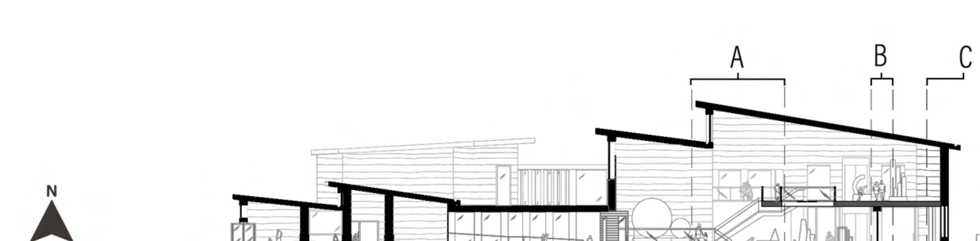
Oak Structure

show result in pyramid ↑	reset calculation	type project name	m^2	

	material	group	impact / m3	volume [m3]	area [m2]	thickness [mm]	result
1	Zinc	metal	12209.4 kg CO2eq/m3	0.00 m3	3 m2	0.8 mm	29.3 kg $CO_{2\ eq}$/m3
2	Wood fibre insulation	biobaseret	-173.1 kg CO2eq/m3	0.36 m3	3 m2	120 mm	-62.3 kg $CO_{2\ eq}$/m3
3	Oak tree	trae	-1063.0 kg CO2eq/m3	0.94 m3	3 m2	315 mm	-1,004.5 kg $CO_{2\ eq}$
4	Wood frame window	komponenter	474.1 kg CO2eq/m3	0.00 m3	0.009594 m2	82 mm	0.4 kg $CO_{2\ eq}$
5	Glass pane, double-glazed	komponenter	266.1 kg CO2eq/m3	0.09 m3	2.275 m2	40 mm	24.2 kg $CO_{2\ eq}$
							-1,012.9 kg $CO_{2\ eq}$/m3

Replacing CIT with a full oak structure resulted in the lowest potential global impact. However, oak is expensive due to it taking a long time to grow and isn't available in great amounts. Therefore, having a mix of CLT and oak might be a better option.

This resulted in the use of oak joists as part of my structure as I needed joists for supporting window, door and roof structures. Therefore, I could use oak to reduce the current gloabl impact of my structure without using large quantities of oak.



Section Cuts