
05 GRC Proposal

Material Qualities

GRC is essentially the same base material as recon stone and both are being cast in moulds. The main difference is the inclusion of glass fibres into the mix. The inclusion of glass fibres give the material a greater strength to weight ratio, producing a far lighter facade. This is advantageous, as it will allow for more flexibility during construction, and will pose less risk to the LUL station below.

These material qualities also allow for more versatile use and reduces the risk of cracking, particularly at the corners.

Although we initially proposed a Portland stone colour, we were encouraged to select a lighter colour by LBC. This was developed into the Recon sample shown on opposite.

A GRC material has been sourced to closely match the Recon sample viewed on site and broadly supported by LBC.

As seen when they are compared, the GRC has a surface quality, texture and variance of colour and speckle which will deliver a visual aesthetic in line with the recon stone.

Furthermore, the GRC is an inherently more colour controlled material and will retain its original colour longer than recon stone, whose discolouration would become apparent before the GRC.

The qualities of the GRC express the same dynamism and depth of a recon or natural stone solution, fulfilling the original aspirations of the design intent.



Recon material sample



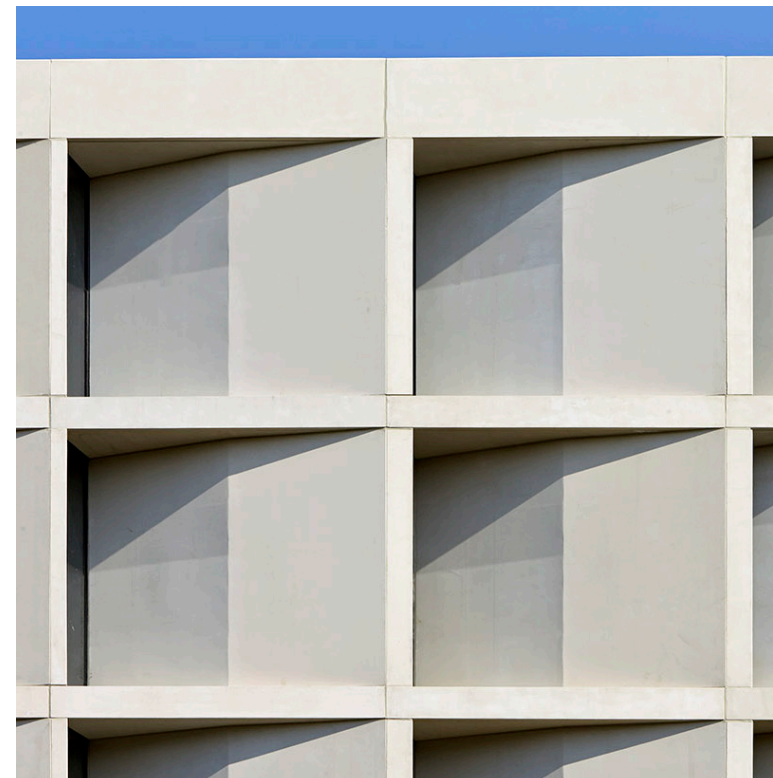
GRC material sample

Module Size

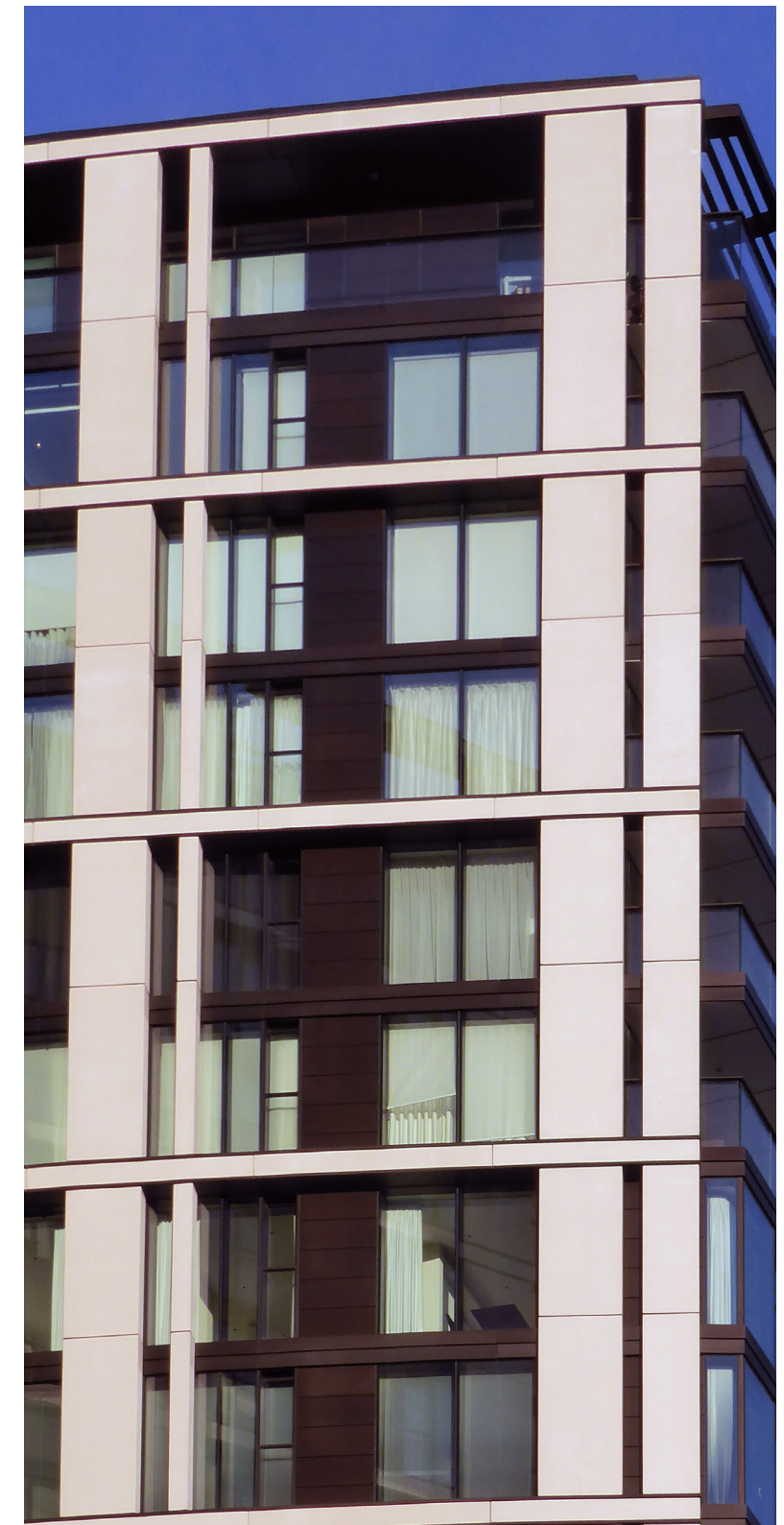
The design intent of the stone element has always had a vertical emphasis. As discussed with Camden LBC, excessive jointing inevitably detracts from this aesthetic.

Where a natural or recon stone facade is restricted by practical and technical limitations in achieving the design intent of the piers, GRC has a larger module size, which is capable of spanning the floor to floor height of the building in a single smooth panel. In selecting this material, the quantity of joints can be minimised, leaving a single joint in line with the finished floor level to allow for deflection.

As it can meet a single storey height, it also eliminates the wastage of material which would occur in the recon stone solution as it would be cut down to suit the heights.



Examples of large format GRC modules



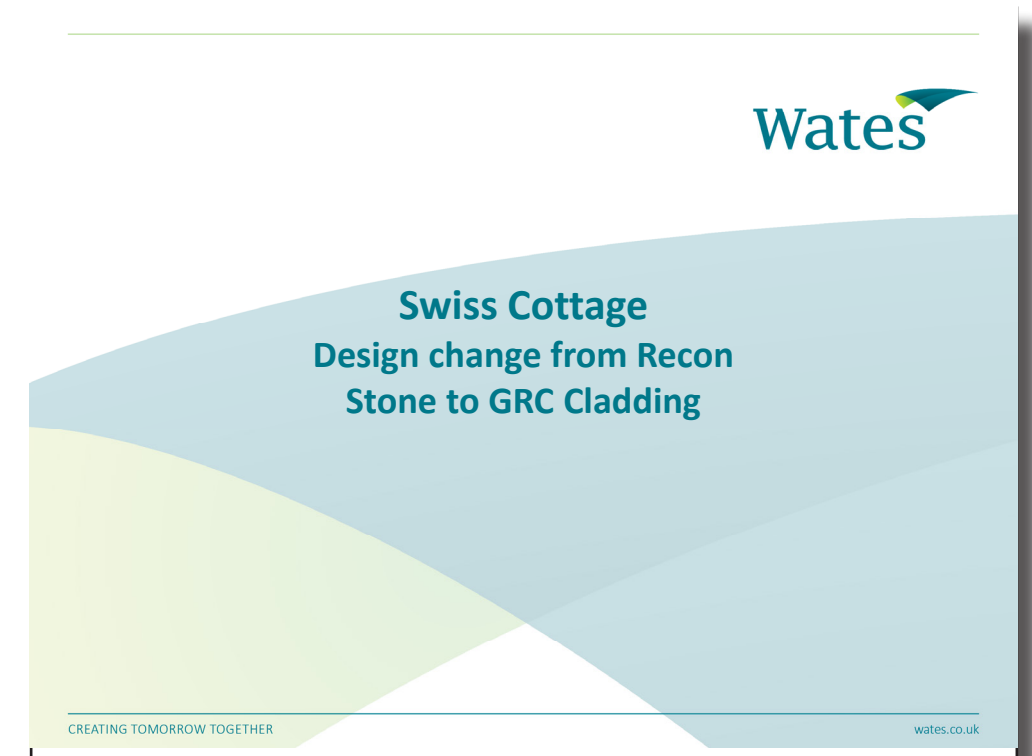
06 Construction Factors

Construction Factors

Beyond the design considerations, the contractor (Wates) have compared the Recon Stone and GRC proposals based on issues around manufacture and installation.

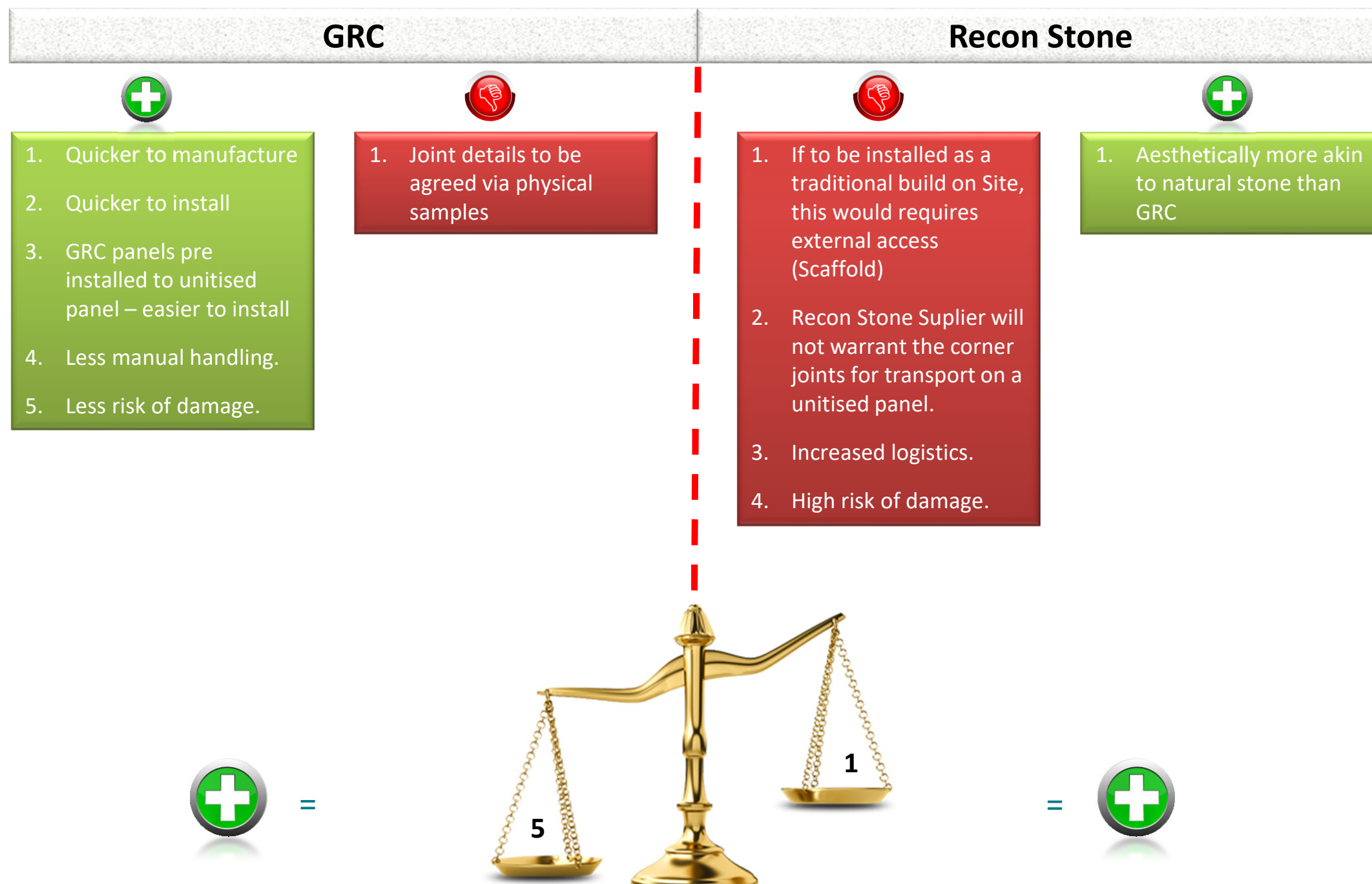
Pages from their report are provided here and relate to;

- General construction
- Design
- Warranty
- Transport
- Wastage



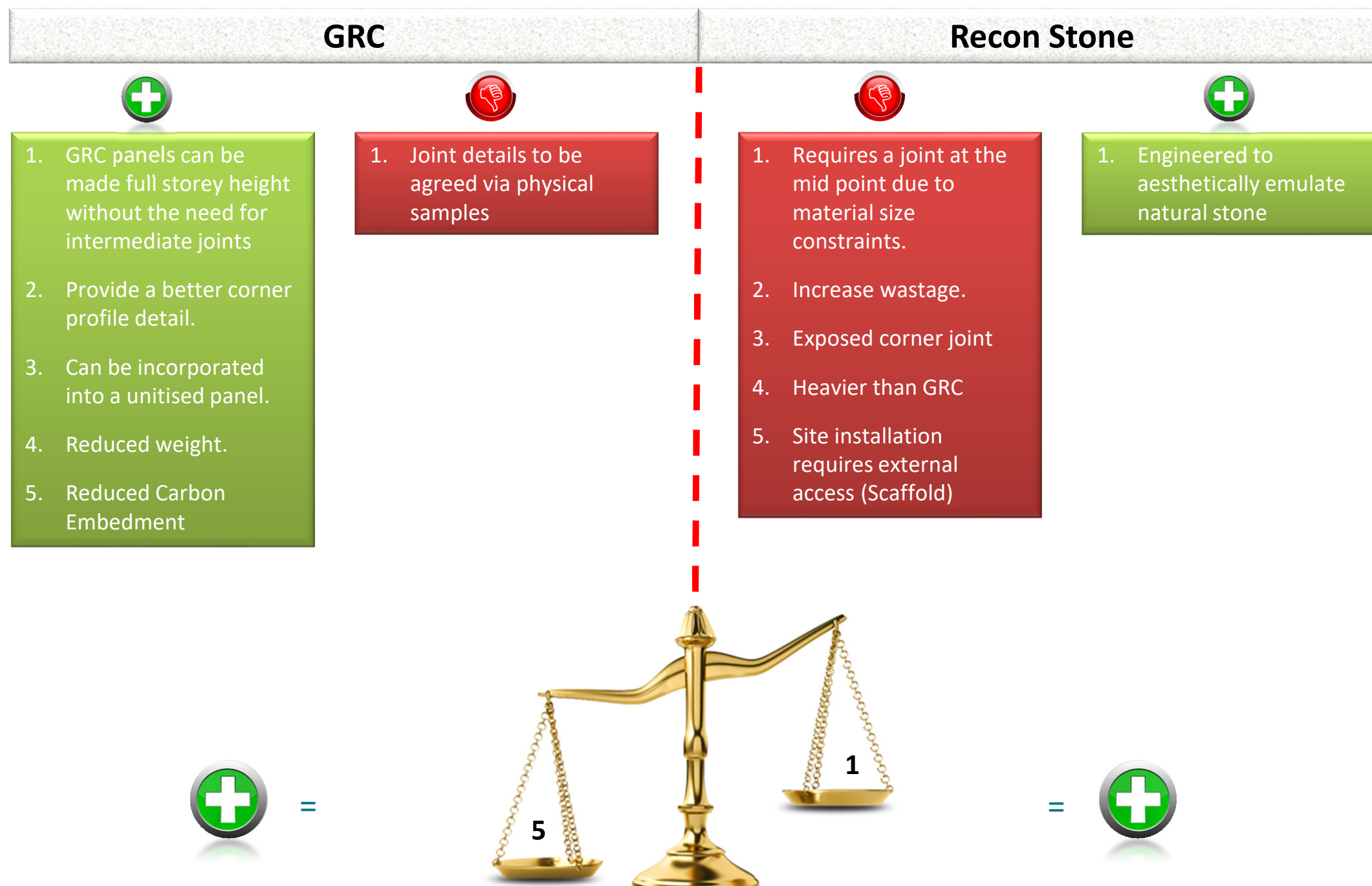
Wates pros and cons report

Construction – GRC v Recon

Wates

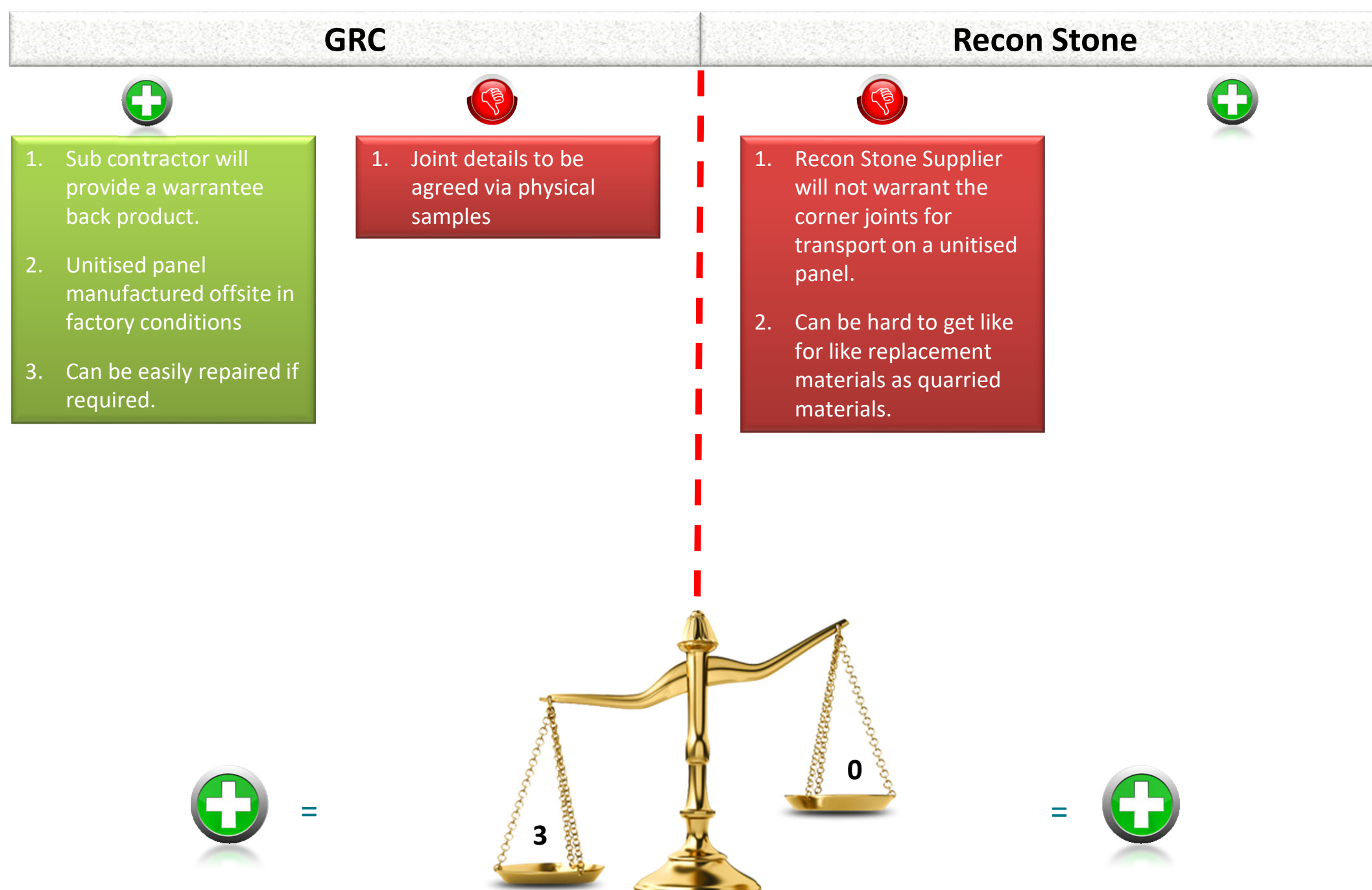
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Design – GRC v Recon

Wates

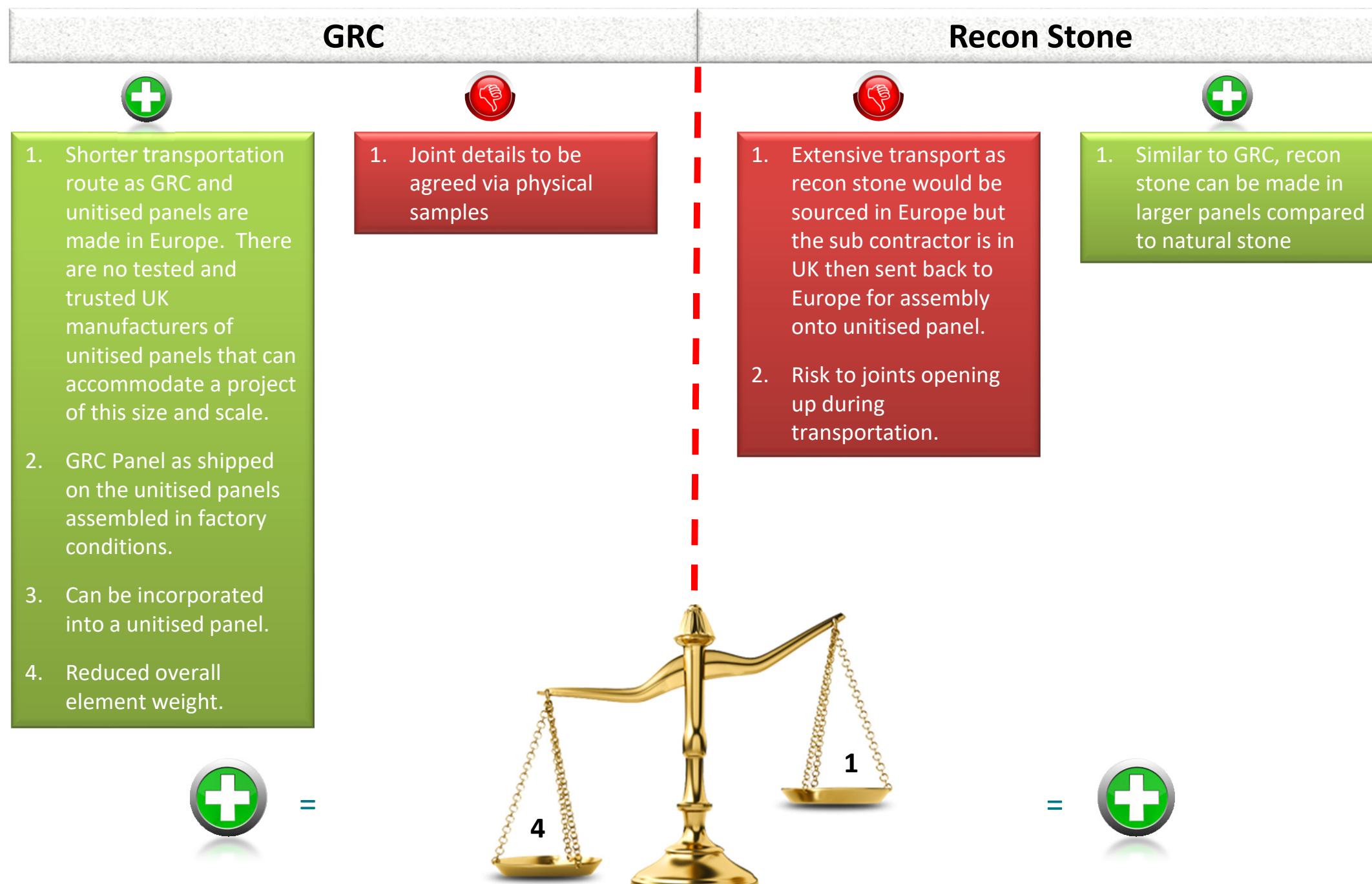
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Warrantee – Recon v GRC



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Transport – GRC v Recon

Wates

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07 Sustainability

Sustainability

In the pursuit of reducing the embodied carbon of the built environment, the development team, with assistance from contractor Wates and their supply chain, have undertaken a sustainability assessment of facade options. This considers the life cycle of the facade, taking into account production, transport, assembly, use and disposal of materials.

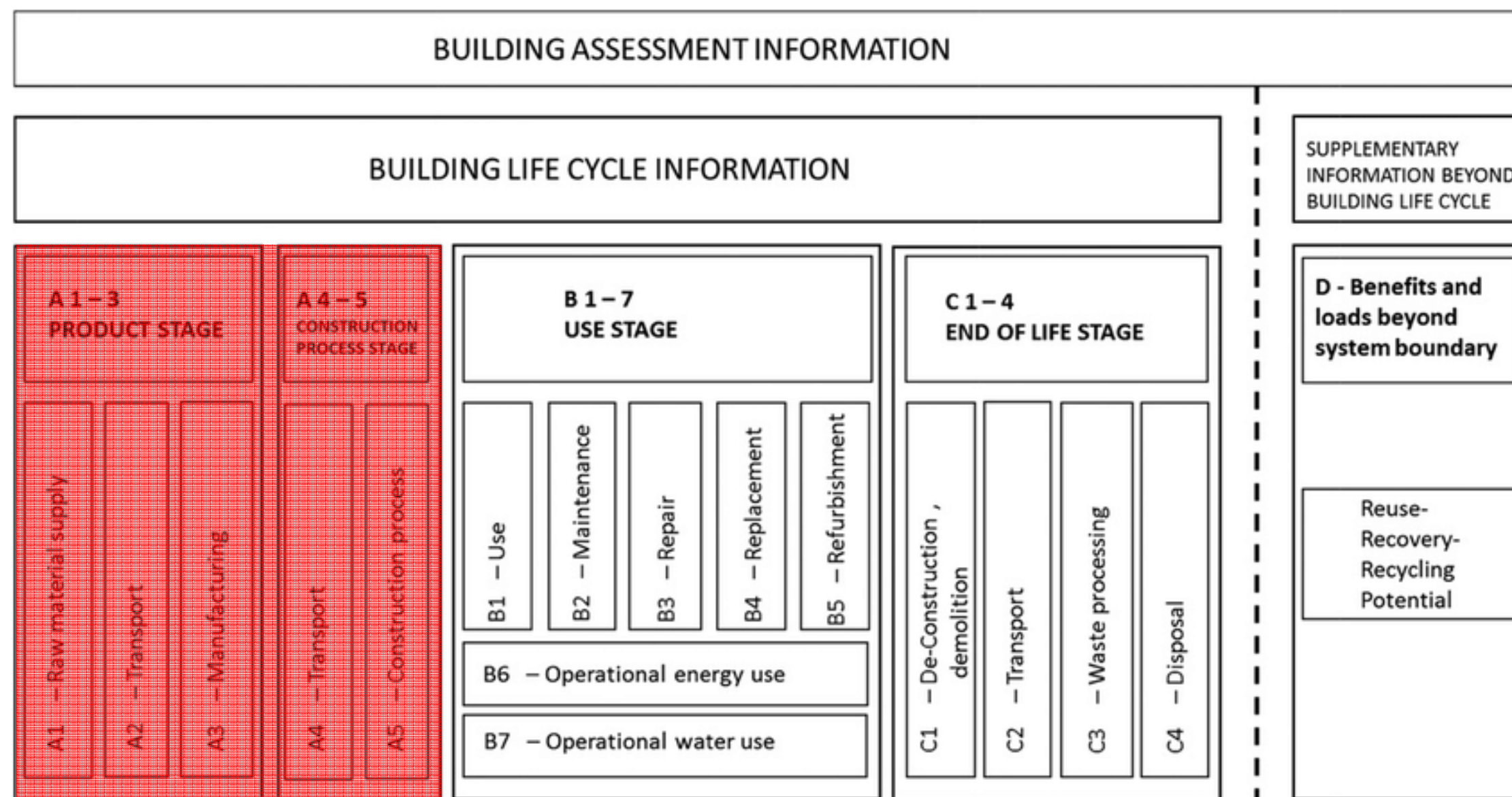
Key points from this research are:

- Overall, a GRC facade is expected to produce 31% less carbon than a Recon design
- Transport and raw material supply of reconstituted stone is significantly more carbon intense than GRC.
- Both materials have little embodied energy at usage stage, with a small and equal amount of operational water use allocated to each.
- At end of life stage, both GRC and Recon can be crushed and used as aggregate in GRC or concrete mix.

From this information, we consider GRC to have a far lower quantity of embodied carbon. In line with Camden Local Plan Policy CC1, this material is the best option to minimise the effects of climate change.

This report is reproduced on the following pages;

Building Life Cycle Information



Building Life Cycle Information



	Recon Stone	GRC	Project Measure 18330 m2	
A1 to A3 = Production Stage	64 CO2/ Kg/m2	34 CO2/ Kg/m2		A1 to A3 = Production Stage
A1 = Raw Material Supply	60 CO2/ Kg/m2	34 CO2/ Kg/m2	490.6 Mg	See attached sheets.
A2 = Transport	4.1 CO2/ Kg/m2	0.26 CO2/ Kg/m2	70.9 Mg	Recon & GRC Considered (See back up)
A3 = Manufacturing	0 CO2/ Kg/m2	0 CO2/ Kg/m2	0.0 Mg	Included in A1
A4 to A5 = Construction Stage	8 CO2/ Kg/m2	8 CO2/ Kg/m2		A4 to A5 = Construction Stage
A4 = Transport	0 CO2/ Kg/m2	0 CO2/ Kg/m2	0.0 Mg	Included on A2
A5 = Construction Process	8 CO2/ Kg/m2	8 CO2/ Kg/m2	0.0 Mg	Pre mounted on elements in production
B1 to B7 = Usage Stage	0 CO2/ Kg/m2	0 CO2/ Kg/m2		B1 to B7 = Usage Stage
B1 = Use	0 CO2/ Kg/m2	0 CO2/ Kg/m2	0.0 Mg	No running Costs
B2 = Maintenance	0 CO2/ Kg/m2	0 CO2/ Kg/m2	0.0 Mg	No maintenance (see B7)
B3 = Repair	0 CO2/ Kg/m2	0 CO2/ Kg/m2	0.0 Mg	Should not need repair / servicing
B4 = Replacement	0 CO2/ Kg/m2	0 CO2/ Kg/m2	0.0 Mg	Not required
B5 = Refurbishment	0 CO2/ Kg/m2	0 CO2/ Kg/m2	0.0 Mg	None
B6 = Operational Energy Use	0 CO2/ Kg/m2	0 CO2/ Kg/m2	0.0 Mg	None
B7 = Operational Water Use	0.300 CO2/ Kg/m2	0.300 CO2/ Kg/m2	0.0 Mg	Cleaning as part of the façade (1 Clean)
C1 to C4 = End of Life	9 CO2/ Kg/m2	9 CO2/ Kg/m2		C1 to C4 = End of Life
C1 = Deconstruction , Demolition	4 CO2/ Kg/m2	4 CO2/ Kg/m2	0.0 Mg	50% that of construction
C2 = Transport (from Site)	3 CO2/ Kg/m2	3 CO2/ Kg/m2	0.0 Mg	Based in UK facility
C3 = Waste Processing	1 CO2/ Kg/m2	1 CO2/ Kg/m2	0.0 Mg	Both can be crushed
C4 = Disposal	0.75 CO2/ Kg/m2	0.75 CO2/ Kg/m2	0.0 Mg	Aggregate Crush / Recycled
	1806.9 Mg	1245.5 Mg	561.4 Mg	
	82 CO2/ Kg/m2	51 CO2/ Kg/m2	31 CO2/ Kg/m2	

Carbon Reduction	561.4 Mg 31.1%	Saving from Recon Stone to GRC
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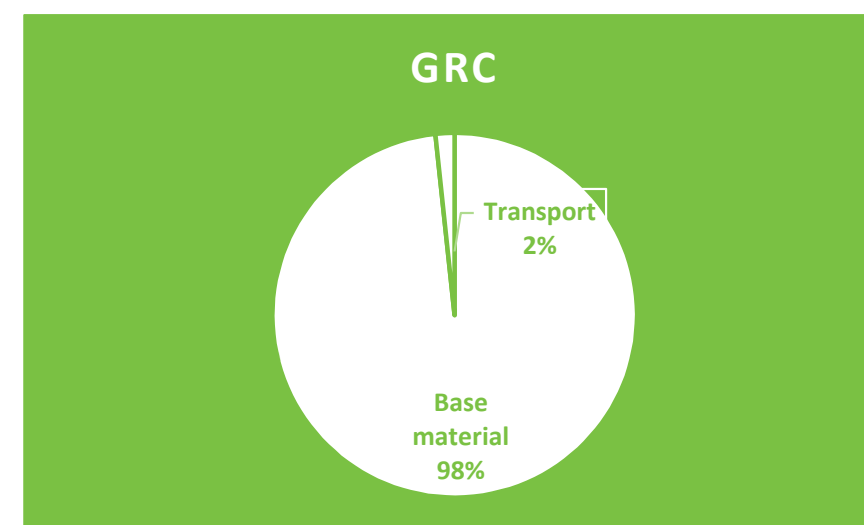
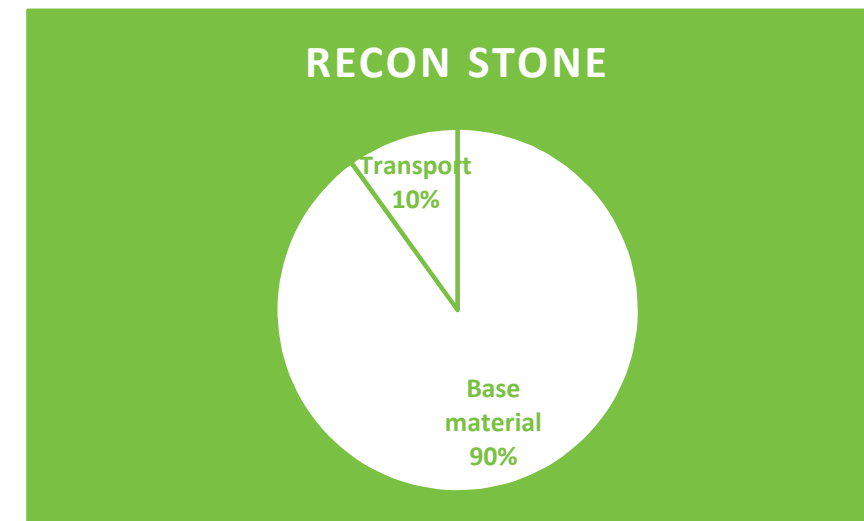
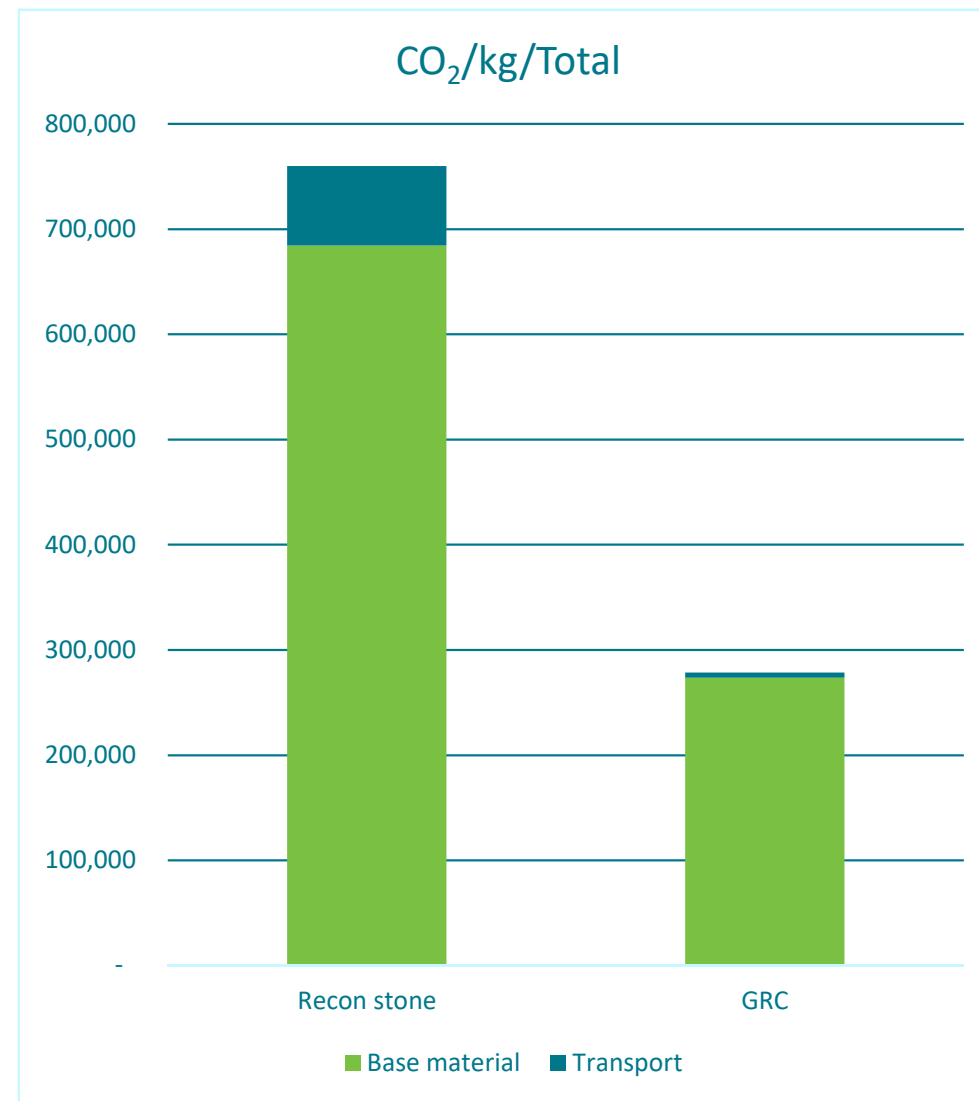
GRCA International Paper 2008:

In the current research, GRC recycling was examined. GRC was crushed after accelerated aging tests. Crushed granulated and fine GRC material was added into GRC and concretes mix. Typical physical properties of the GRC and concretes were measured and summarised. As a result of this examination, it was found that crushed GRC can be used in GRC and concrete mix, replacing fine aggregate or cement.



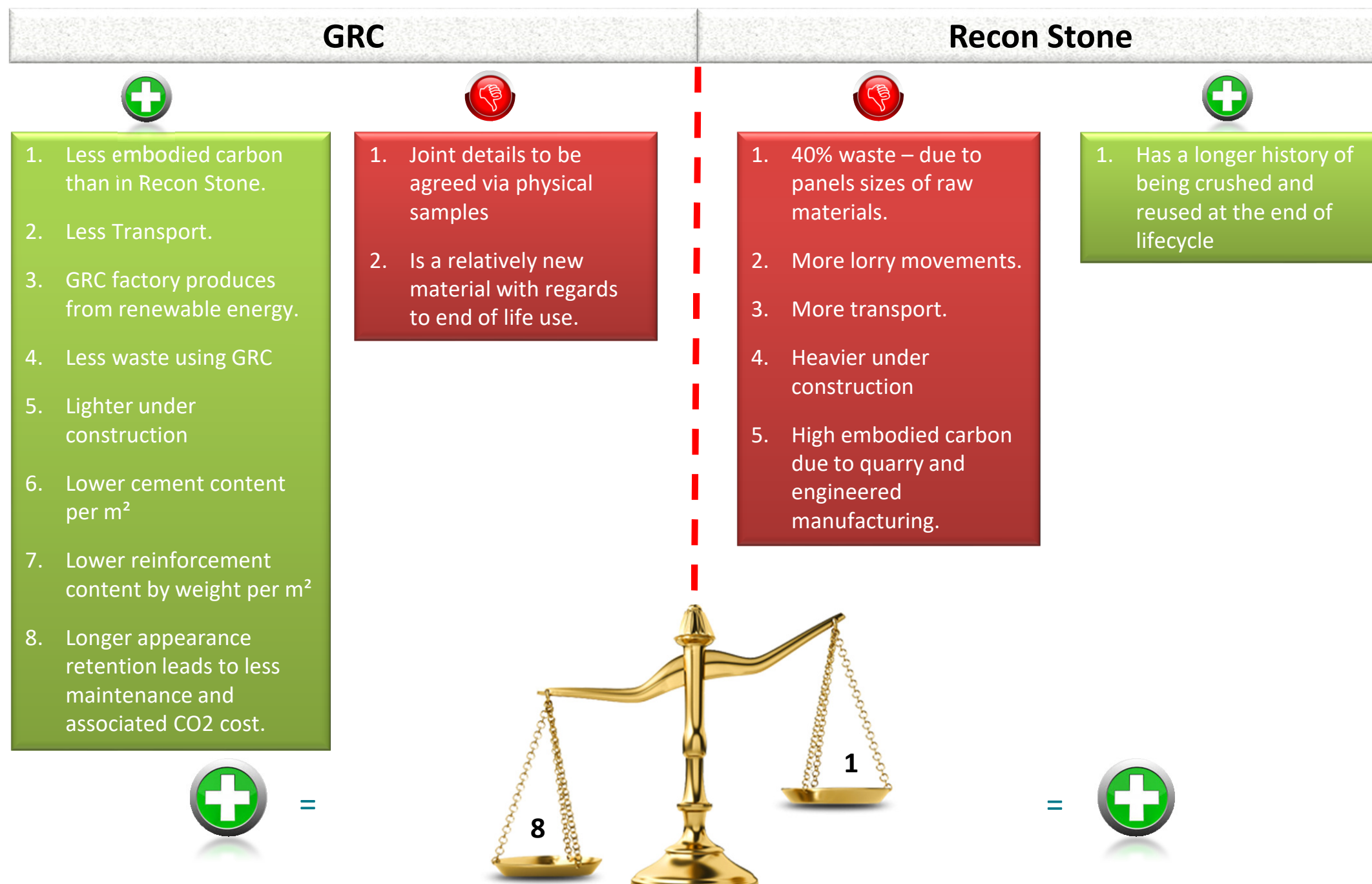
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Embodied Carbon Values in Materials & Transport



Carbon Embedment – GRC v Recon

Wates



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08 Precedent Buildings

Lillie Square Phase 2

Location: London Borough of Hammersmith & Fulham

Client: Capco & KFI

Architect: EPR Architects

Adjacent to Earl's Court and West Brompton train station, Lillie Square is a primarily residential mixed use scheme of 808 apartments.

GRC was selected for this phase of the project as it would allow the facade to be manufactured as part of a unitised system. This improves quality as it allows for up close inspection prior to installation, as well as programme and safety benefits.

The move to GRC allowed the design to make the most of larger panel sizes and have formed corners. This adds to the monolithic appearance of the building.



Tapestry Building, Kings Cross

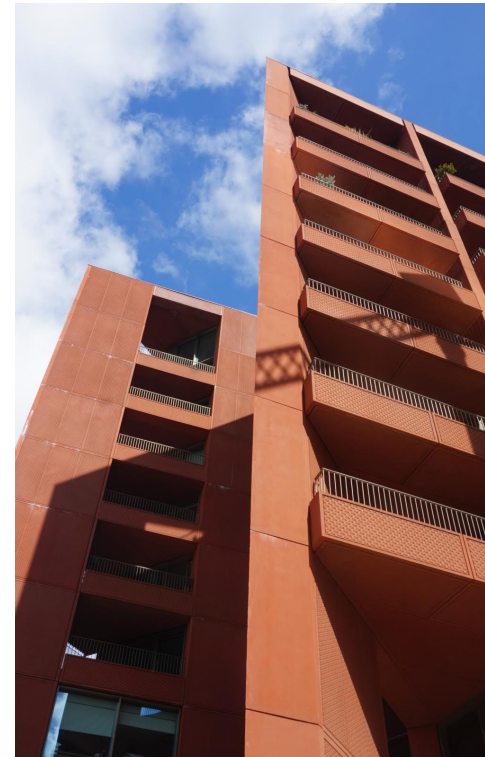
Location: London Borough of Camden

Client: Argent

Architect: Niall McLaughlin Architects

Winner of a 2018 regional award, Tapestry is a mixed use development adjacent to the kings cross gasholder.

In this case GRC is applied in a rich terracotta colour, with a contemporary ornamentation cast into the face. This level of decoration would in the past have been carved at great expense by stonemasons - tapestry kings cross demonstrates how GRC can be utilised to create a dynamic and engaging facade in a modern material.



Lewisham Gateway Phase 1

Location: London Borough of Lewisham

Client: Muse

Architect: PRP Architects

Part of the Lewisham Gateway development site, this first phase of the development is a primarily residential 22 storey building, providing 195 apartments.

Despite the height of the building, the lightweight nature of the material allowed for installation by mast climber, speeding up construction and avoiding the need for a tower crane.



University of Greenwich

Location: London Borough of Greenwich

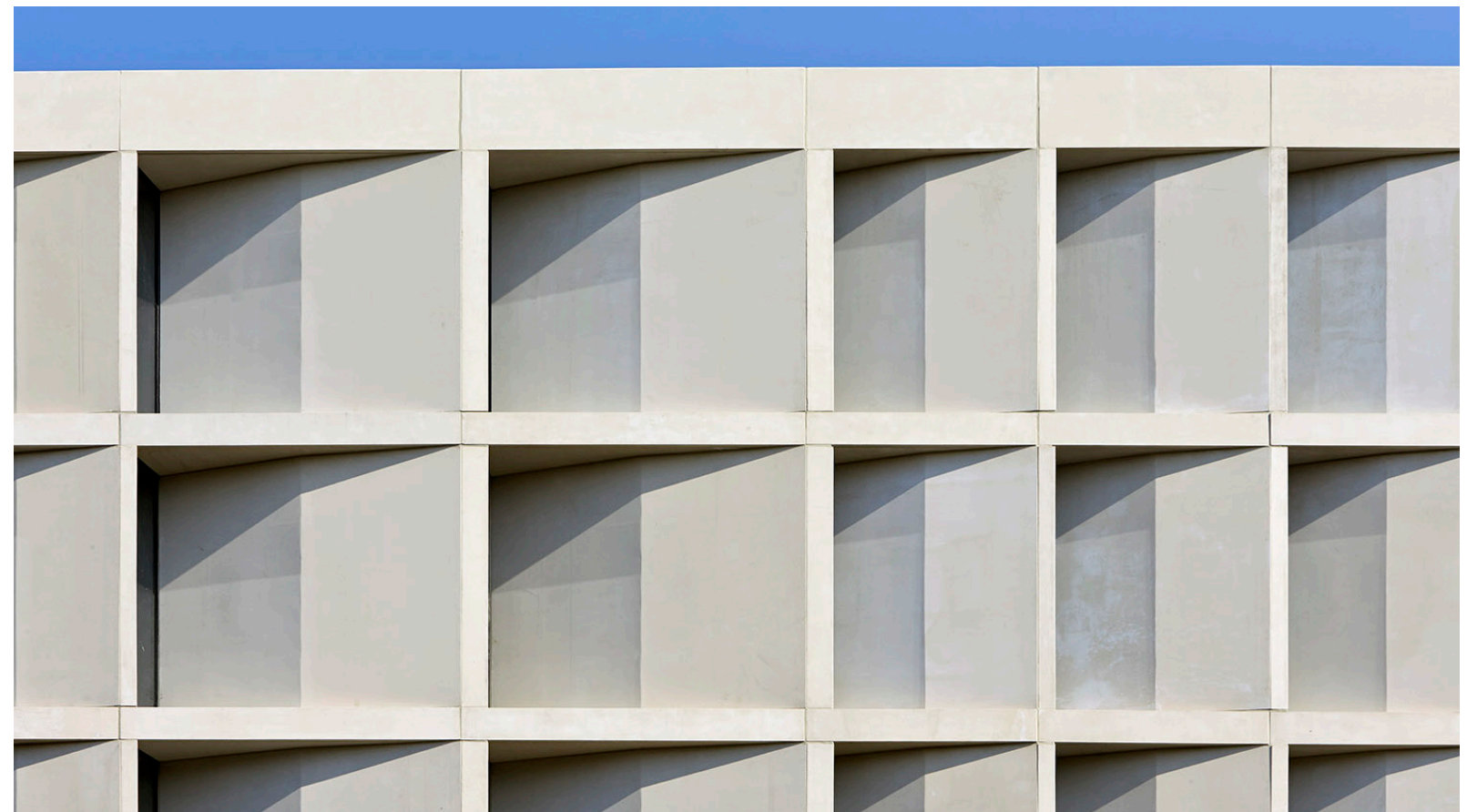
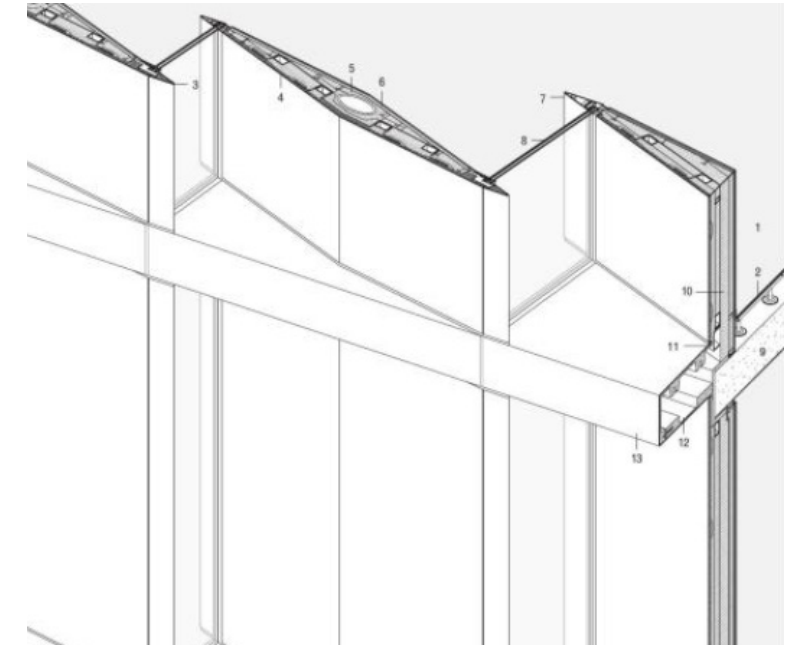
Client: University of Greenwich

Architect: Heneghan Peng

The Sterling Prize Nominated Architecture building for the University of Greenwich takes a similar monolithic approach to its facade.

The facade is made of a mix of materials - While Jura Limestone clads the main facade to Stockwell Street, the north facade redirects the aspect of the building away from the train line using a series of diamond profile fins. GRC was selected to keep these elements as thin as possible. Through extensive development, this material is near indistinguishable from adjacent portions of limestone and precast concrete.

This demonstrates how GRC, with appropriate development of colour and texture, can achieve a high quality aesthetic.



09 Conclusion

Conclusion**Design**

The GRC material is able to be produced in the largest size, whilst also delivering the desired jointing and sharp corners of the options considered. This will deliver the monolithic and solid frame of the design intent. The GRC provides a good visual match to the recon stone with variance and interest across the surface.

Sustainability

When viewed against the recon stone, the GRC proposals will provide less wastage, reduces transportation and has reduced embodied carbon overall when compared to recon stone.

Construction

The GRC proposals can be delivered without compromising the constraints of the site, especially around the LUL assets. The contractor has also noted that it is also safer and quicker to install than recon stone.

The considerations in this report have shown that a GRC facade is best placed to satisfy the variety of aspects reviewed.

- It can satisfy the design intent of the original planning design in terms of visual appearance and;
- The material can be designed, manufactured and installed without compromising the structural and logistical constraints of the site.
- A GRC facade optimises the sustainability benefits when compared to others.
- There have been other successful buildings delivered with GRC facades.

Based on these considerations, the development team believe that a GRC facade represents the best proposal for the project.

