3

Euston Tower

Hard-to-Handle Materials

3.1 Focus Areas

As shown in 2.2.5, the existing tower comprises primarily concrete, steel (rebar), brick, glass, and aluminium from the original 1960s construction. With the exception of aluminium and steel to the extent that it is well recycled, these are typically hard-to-handle material fractions in a way that promotes reuse/recycling and avoids downcycling.

It is acknowledged that solving the end of life routes for all materials simultaneously is a challenge beyond the influence of the proposed development. Accordingly, the focus areas are on those material fractions that are largest in quantity or have the highest embodied carbon.

These are referred to as the material hotspots.

Figure 3.2 maps the material fractions on a grid evaluating quantity along with embodied carbon. It is clear that most of the impact is due to concrete, aluminium, glass and steel. Progressing the reuse/recycling of these fractions, and avoiding downcycling, has been adopted as a focus area for the proposed development as it strives to be a circular economy pioneer.

While steel is the second most impactful material, it is mainly present in the building as reinforcement bar. Because of this, there is a limited opportunity to directly reuse the steel from the building, unless it is part of the reused concrete elements. The potential of reusing the rebar as part of the concrete floor slabs will be described in Section 3.2. Otherwise the best use of the existing rebar is to feed it back for recycling in steel production.

This Section goes into detail on how reuse/recycling of these material fractions is addressed, and describes the approaches taken to push current industry standard practice within these areas.

Figure 3.1 Images from existing building showing its current condition

Key Material Hotspots

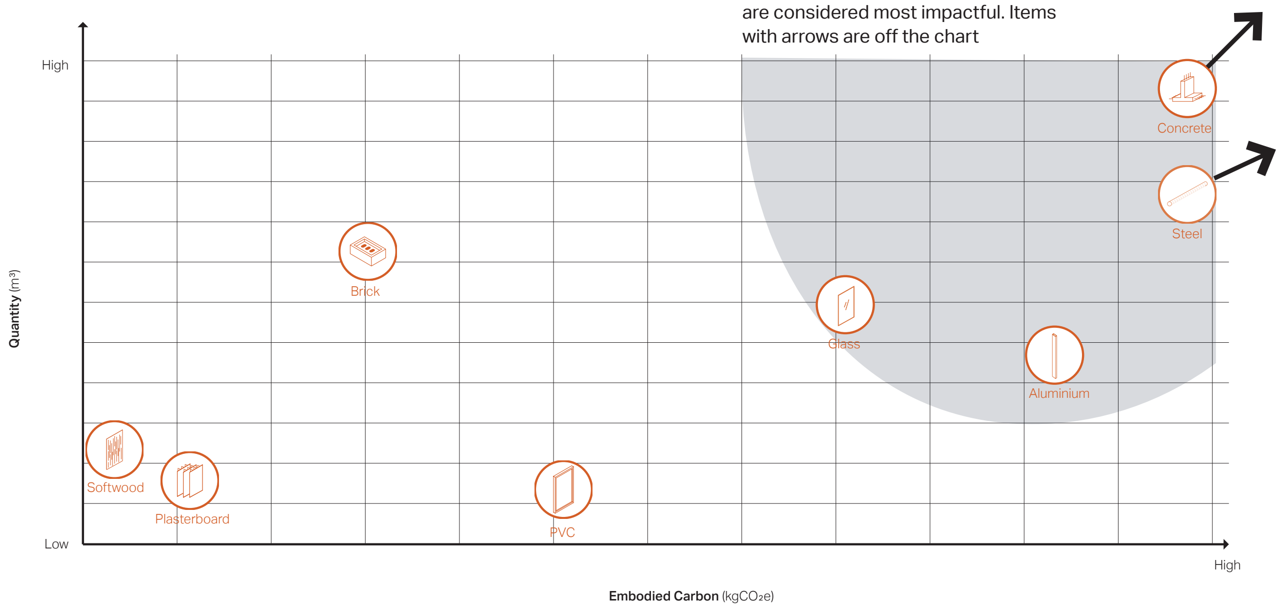


Figure 3.2 Diagram for identifying key material hotspots

Steel

Volume: 233 m^3
Weight: 1806 t
Embodied carbon: 3,640 tCO_2e

Component	Volume	Weight	Impact	Component	Volume	Weight	Impact
Columns rebar	81 m^3	625 t	1243 tCO_2	Glazing Support	2 m^3	17 t	46 tCO_2
Floorslab rebar	34 m^3	266 t	528 tCO_2	Balustrade	1 m^3	10 t	28 tCO_2
Beams rebar	26 m^3	206 t	409 tCO_2	Handrail	1 m^3	8 t	22 tCO_2
Ribbed slab rebar	55 m^3	409 t	855 tCO_2	Studwork Joists	1 m^3	5 t	15 tCO_2
Walls rebar*	27 m^3	210 t	417 tCO_2	Studwork Channel	0 m^3	2 t	5 tCO_2
Steel Deck	3 m^3	27 t	66 tCO_2	Staircase rebar	0 m^3	1 t	2 tCO_2

Concrete

Volume: 14,405 m^3
Weight: 34,237 t
Embodied carbon: 3,534 tCO_2e

Component	Volume	Weight	Impact	Component	Volume	Weight	Impact
Floors slab	5,064 m^3	12,153 t	1,252 tCO_2	Staircase	477 m^3	1,146 t	118 tCO_2
Columns	1,815 m^3	4,355 t	449 tCO_2	Roof deck	345 m^3	691 t	71 tCO_2
Beams	1,681 m^3	4,034 t	416 tCO_2	Blockwork	169 m^3	237 t	22 tCO_2
Walls*	2,810 m^3	6,744 t	695 tCO_2	Mortar	53 m^3	101 t	20 tCO_2
Ribbed slab	1,987 m^3	4,769 t	491 tCO_2	Paving slabs	3 m^3	7 t	1 tCO_2

Aluminium

Volume: 140 m^3
Weight: 305 t
Embodied carbon: 2,035 tCO_2e

Component	Volume	Weight	Impact	Component	Volume	Weight	Impact
Curtain Walling	36 m^3	90 t	603 tCO_2	Frames	4 m^3	11 t	75 tCO_2
Panels	33 m^3	87 t	580 tCO_2				
Second. Frame	52m^3	78 t	520 tCO_2				
Mullions	9 m^3	23 t	153 tCO_2				
Canopy	6 m^3	16 t	105 tCO_2				

Glass

Volume: 151 m^3
Weight: 378 t
Embodied carbon: 592 tCO_2e

Component	Volume	Weight	Impact	Component	Volume	Weight	Impact
Facade (Tower)	68 m^3	169 t	244 tCO_2	Doors (2nd)	0.9 m^3	2 t	4 tCO_2
Secondary Glazing	64 m^3	161 t	267 tCO_2	Blue Panels	0.4 m^3	1 t	2 tCO_2
Glass (Lower)	7 m^3	18 t	29 tCO_2	Glass Feature	0.2 m^3	0.5 t	0.8 tCO_2
Windows (lower)	9 m^3	22 t	37 tCO_2	Staircase	0.1 m^3	0.3 t	0.6 tCO_2
Atrium	2 m^3	4 t	7 tCO_2	Clear Panel	0.1 m^3	0.2 t	0.3 tCO_2

**Quantity differs from what is recorded in the Pre-demolition Audit as this document accounts for retention of the existing central core in the proposed development.*

Figure 3.3 Component quantities for the four main material fractions

3.2 Concrete

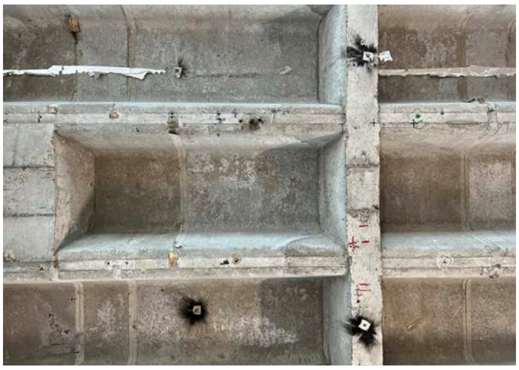
3.2.1 Elements and components

The existing Euston Tower is an in-situ concrete framed building. Generally the existing structural system is a reinforced concrete frame with a combination of ribbed and flat slabs for the decks. A ring beam runs around most of the perimeter. Lateral stability is provided by a central reinforced core, in combination with four satellite cores at the extremities of the floorplate.

Concrete the largest Key Demolition Product (KDP) identified, estimated to be approximately 34,237 tonnes equivalent to 3,534 tonnes of CO_2e. This is from a number of sources:

- Concrete floor slabs (16,922 tonnes)
- Walls (6,744 tonnes)
- Columns (4,355 tonnes)
- Beams (4,043 tonnes).

The structural concrete is generally in a good condition, however, since all the elements are in-situ, it makes it difficult to recover and reuse, and would typically be downcycled.



Concrete

Volume: 14,405 m³
Weight: 34,237 t
Embodied carbon: 3,534 tCO₂e

	Volume	Weight	Impact		Volume	Weight	Impact
Floorslabs	5,064 m^3	12,153 t	1,252 tCO_2	Staircase	477 m^3	1,146 t	118 tCO_2
Columns	1,815 m^3	4,355 t	449 tCO_2	Roof deck	345 m^3	691 t	71 tCO_2
Beams	1,681 m^3	4,034 t	416 tCO_2	Blockwork	169 m^3	237 t	22 tCO_2
Walls*	2,810 m^3	6,744 t	695 tCO_2	Mortar	53 m^3	101 t	20 tCO_2
Ribbed slab	1,987 m^3	4,769 t	491 tCO_2	Paving slabs	3 m^3	7 t	1 tCO_2

**Quantity differs from what is recorded in the Pre-demolition Audit as this document accounts for retention of the existing central core in the proposed development.*

Figure 3.4 Component quantities for concrete

Key Concrete Component Hotspots

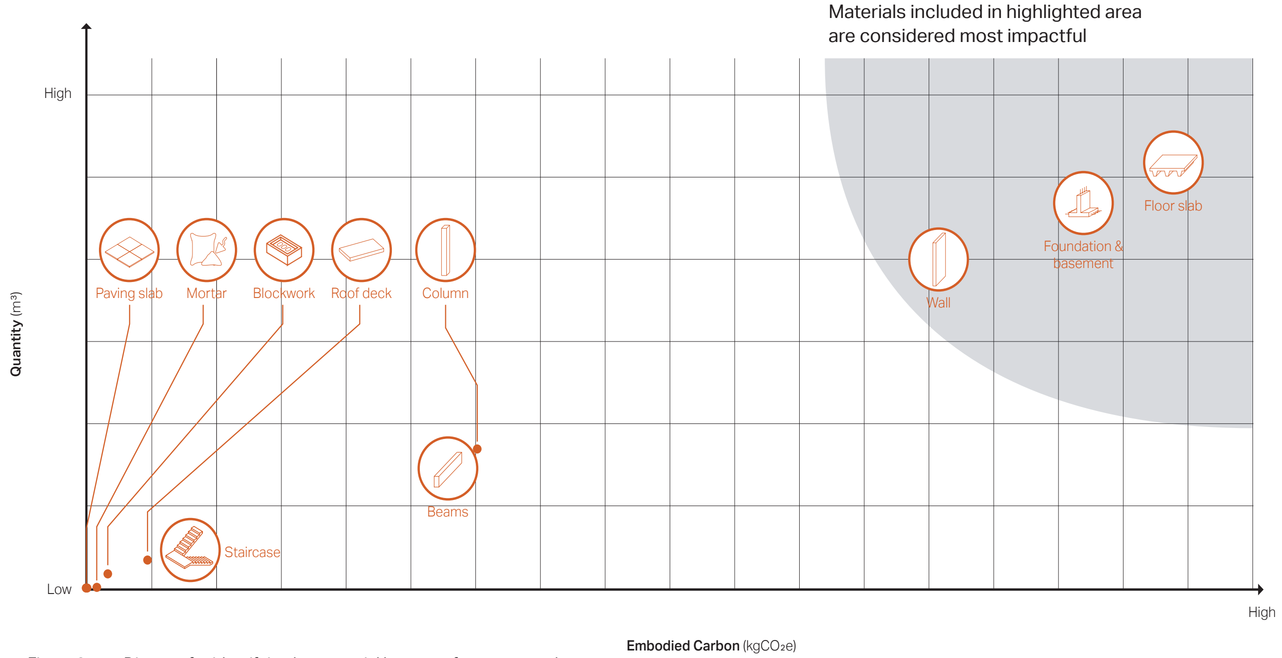


Figure 3.5 Diagram for identifying key material hotspots for concrete elements

Concrete Components on Site

Figure 3.6 Images of main concrete components in the tower (slabs, columns, cores)

3.2.2 Concrete processing

Figure 3.7 illustrates the potential end of life routes evaluated for the deconstructed concrete, each of which are elaborated upon below.

Standard practice
The standard practice for treating concrete waste is to downcycle it. This would entail crushing it for use as lower value product such as roadfill.

Best practice
An alternative is to use the rubble as a Recycled Concrete Aggregate (RCA) in new concrete. Recycled concrete aggregates can be used in:

- Bitumen bound materials
  RCA may be used in a variety of base course and binder course mixtures.
- Concrete
  RCA can be used to replace 20% of the coarse aggregate in concrete (up to grade 50 concrete)
- Pipe bedding
  Suitably graded recycled concrete aggregate is used in pipe bedding
- Hydraulically bound mixtures (HBM) for sub-base and base
  Used in construction of car parks, minor roads
- Unbound mixtures for sub-base
  Suitably graded recycled concrete aggregate is used as sub-base
- Capping
  Recycled concrete aggregate is suitable for capping applications.

Where it cannot be reused, it is the ambition in the proposed development to treat the existing concrete as RCA, as opposed to lower level products.

SmartCrusher
Considerations have been made as to possibilities of recycling the concrete instead of downcycling it. The SmartCrusher technologies have been considered.

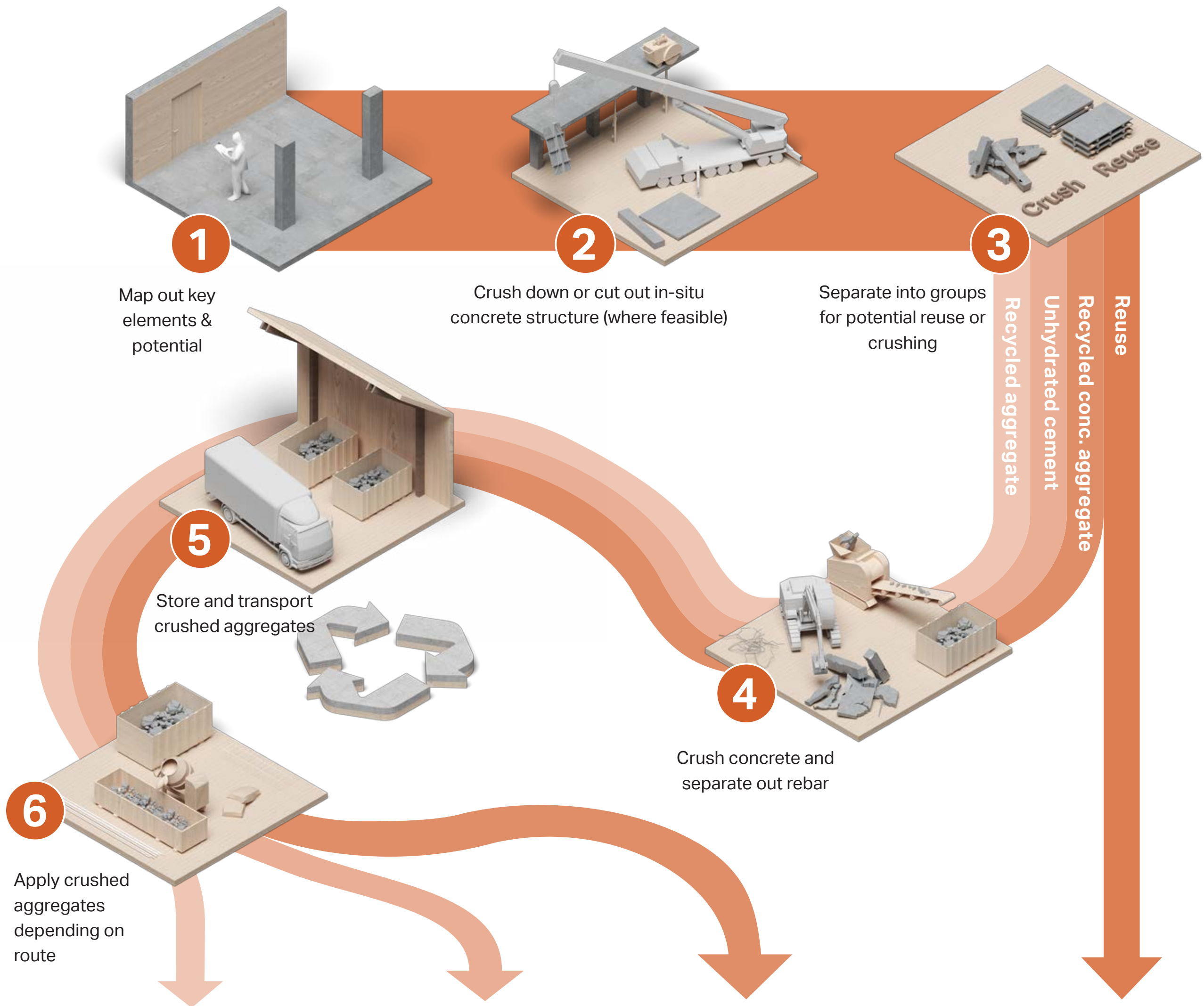
Unlike traditional methods, the SmartCrusher process allows for a more granular separation of the constituent parts of the concrete which enables reuse of the cement (the carbon-intensive portion of concrete making).

The team behind SmartCrusher have been engaged about potential for testing/applying their technology on the proposed development, however currently their efforts are focused in the Netherlands, before initiating future plans for licensing technologies internationally.

Structural reuse
Structural reuse of in-situ concrete elements is not typically conducted, and certainly not at the scale of Euston Tower.

It is the ambition for the proposed development to test the potential of cutting out the existing in-situ slabs for reuse elsewhere in a structural application. Refer to 3.2.3.

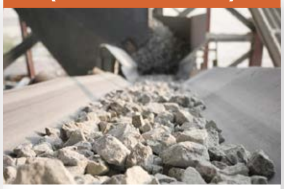
Potential End of Life Routes for Concrete



DOWNCYCLING

Roadfill

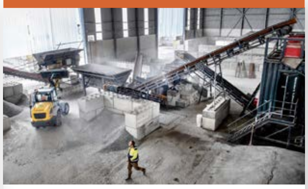
DOWNCYCLE (CLOSED LOOP)



Recycled concrete aggregate

Considered

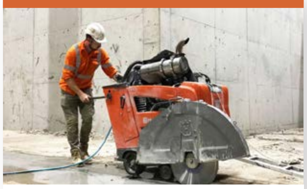
RECYCLE



SmartCrusher process allows for a more granular separation of the constituent parts of the concrete which enables reuse of the cement.

Not mature on UK market

UNIQUE REUSE



Cutting out and reusing in-situ concrete ribbed slabs

Current test and trials

Figure 3.7 Potential recovery routes for concrete

3.2.3 Roadmap to reuse

The existing floor plates comprise 10” (254mm) deep concrete ribs spanning onto beams or directly onto walls. The potential for cutting out, testing, and reusing the existing ribbed slabs in structural application is currently being evaluated.

Key to innovation at this scale is being able to break down the problem. A roadmap has been prepared of the initial steps required to test the feasibility of reuse back into the new structure. This is shown in Figure 3.10.

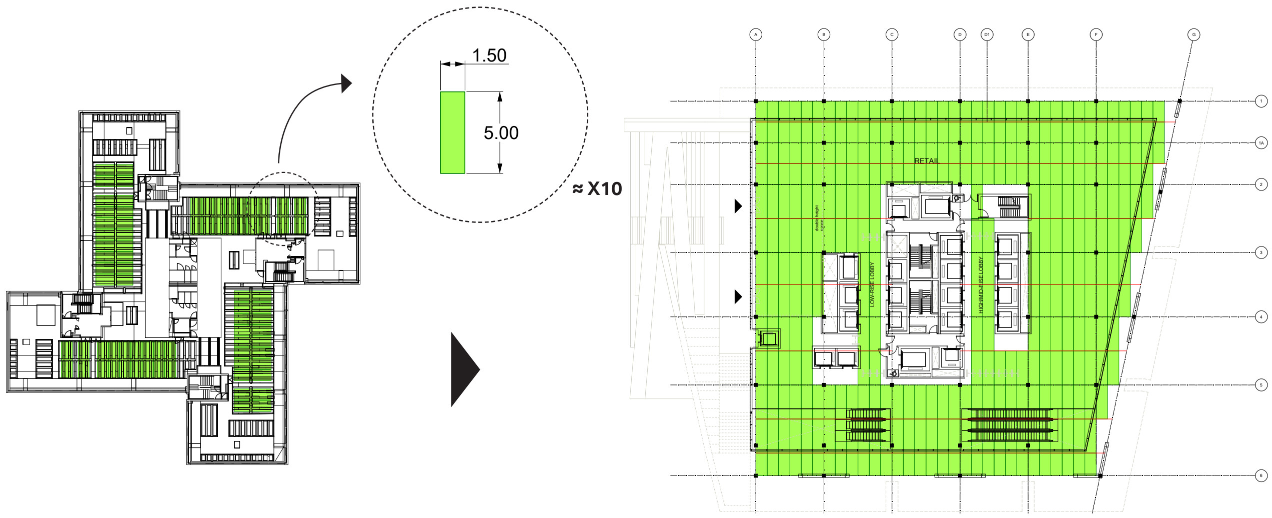
From the non-intrusive and intrusive studies of the existing structure, information is available on the conditions of the ribbed slabs. A desktop study has been carried out to identify the overall quantities and qualities. The sketch in Figure 3.9 illustrates that for each floor of the existing tower there are approximately 38 panels with dimensions of 5m x 1.5m. Approximately 355 of these panels would be required per floor, for the lower floors in the proposed development.

Additional in-situ testing on carbonation and rusting have been carried out to prepare the way for more detailed simulation and testing of the structural capability of the panels.

The methodology and logistics for cutting out a sample panel for testing with the University of Surrey has been developed. Cutting out of the test panel is about to be conducted at the time of writing.

Figure 3.8 Images of existing ribbed slabs

Potential Reuse of Concrete Slabs



Existing Plan

Ribbed Slab Panels (Available per floor)

Quantity:	38 panels
Area:	285 m²

Proposed plan

Ribbed Slab Panels (Required for one floor)

Quantity:	355 panels*
Area:	1,940 m²

*Note maximum span of 4.5m. Due to current grid, full length of each panel may not be fully utilised, waste to be considered.

Figure 3.9 Sketches quantifying potential structural reuse of concrete slab elements (sketch by Arup)

Roadmap for Reuse of Concrete Slabs

1 Prepare the Way

- On site audit and feasibility assessment
- Identify overall quantities and qualities
- In-situ testing (carbonation, rusting, etc.)
- Concept design and application areas

Gateway
Technical feasibility assessment

2 Simulation and Testing

- Develop testing methodology and drawings
- Brief key sign-offs (insurance, building control, leasing, etc.)
- Cut out test panels
  - **In progress (November 2023)**
- Transport
- Clean and prepare panels for testing
- Test panels are per testing regime

Gateway
Testing report and sign off

Future

3 Technical and Sign-offs

- Review overall quantities
- Technical design of panels (structure and fire)
- Finalise application areas (on site, LBC, BL, etc.)
- Cost and programme review

Gateway
BL review and engagement with key sign-offs (insurance, building control, leasing)

Figure 3.10 Roadmap for structural reuse of concrete slab elements

3.2.4 Testing and trials

The design team is intending to extract a test specimen of the existing structural ribbed slab for investigation and load testing.

A technical note was prepared by Arup to provide a location and considerations for the slab extraction, and a specification of the testing requirements. The following are included as expected outcomes of the trials.

- Dimensional survey of specimen to be extracted, including any deviations or modifications from as-built condition (i.e. damage, inclusion of embed channels etc.)
- Full cover meter survey of both top and bottom surfaces to assess reinforcement within slab and ribs, including longitudinal, transverse and shear reinforcement.
- Sawcut specimen of slab to provide 4.5 x 1.5m panel upon extraction (this may require larger section to be removed and trimmed to size)
- Extracted section to include min. 2 no. ribs
- Removal of section from building and delivered to testing site at University of Surrey.

The testing results will provide an indication of the technical feasibility of reusing the cut out panels in the new structure, or elsewhere in a structural application.

Once the initial technical studies are assessed, further studies will be carried out to assess the suitability with regards to fire requirements and compatibility with current structural design, as well as economic and programmatic implications of reusing the panels in the proposed development.

The testing and reuse of in-situ concrete is an innovation for Greater London, and has not been conducted previously at scale.

Diagram for Potential Reuse of Concrete Slabs

Sample Slab
Indicative location for panel removal
Panel Dimensions:
1.5m wide x 4.5m long
Approx weight = 2.5-3t

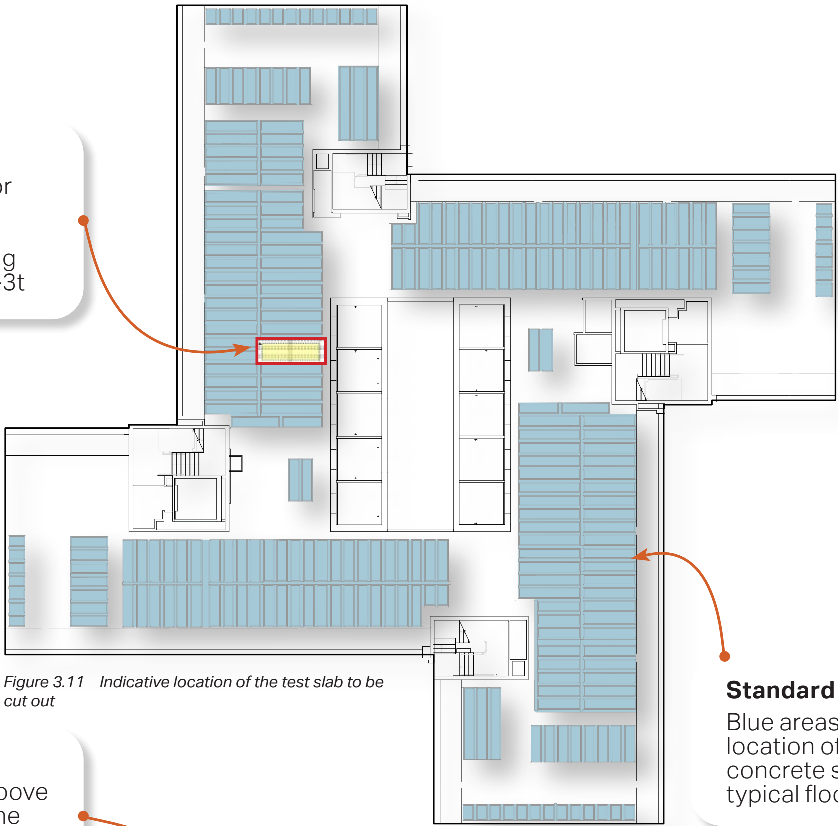
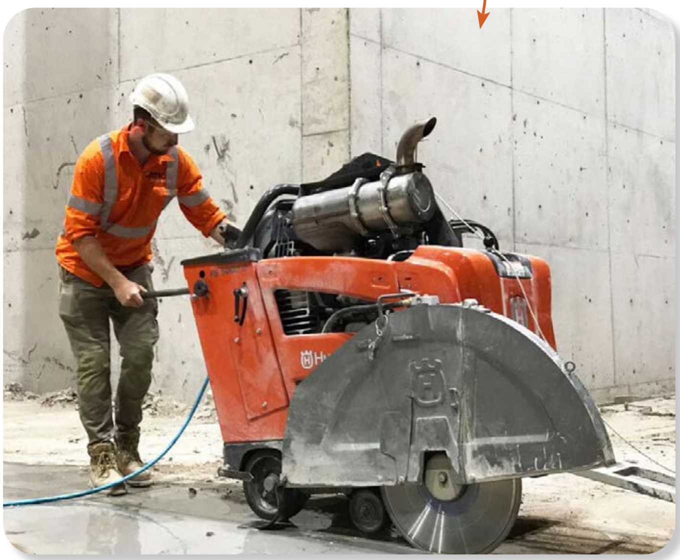


Figure 3.11 Indicative location of the test slab to be cut out

Standard Floorplate
Blue areas show the location of the ribbed concrete slabs on a typical floorplate

Removal
Slabs are cut from above and removed by crane to be transported for testing and future reuse



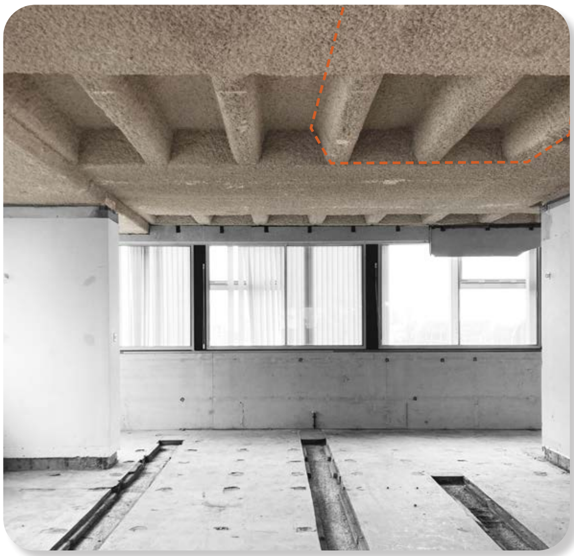


Figure 3.12 Reference photo for cutting of in-situ concrete elements

Figure 3.13 Reference photo for example slab location

3.3 Glass

3.3.1 Elements and components

The facade is the original 1970s construction, and relatively recently, has been upgraded with the addition of reflective solar film for internal glare control and secondary glazing for acoustic and thermal comfort.

The main system comprises single glazed vision glazing and a red back-painted (though recently it is suspected that this is ceramic frit) and toughened glass spandrel panel. The transparent panel has a solar coating film post-applied on the inner side. The spandrel panel has had a security film applied to it approximately ten years ago following spontaneous breakages from NiS inclusions. None of the glass is laminated. There is an additional secondary glazing system which consists of aluminium framing with horizontal sliding vents on standalone steel framed support system.

Notwithstanding their age and condition, the glass panels in the facade system and secondary glazing are difficult to reuse, repair or refurbish due to their specific coatings, applied films and treatments. Nonetheless, remanufacture of glass products utilising reclaimed glass materials have a significant benefit to future glass manufacture, in the form of avoided carbon emissions and virgin material use.

A detailed survey was carried out by Arup to provide more details on these glass types and quantities, as shown in Figure 3.16. It is clear that the majority of the glass is:

- External vision glazing (310 tonnes)
- Secondary glazing (108 tonnes)
- Spandrel glazing (99 tonnes).

These elements were identified as being the best candidates for glass recycling trials. Refer to 3.3.3.

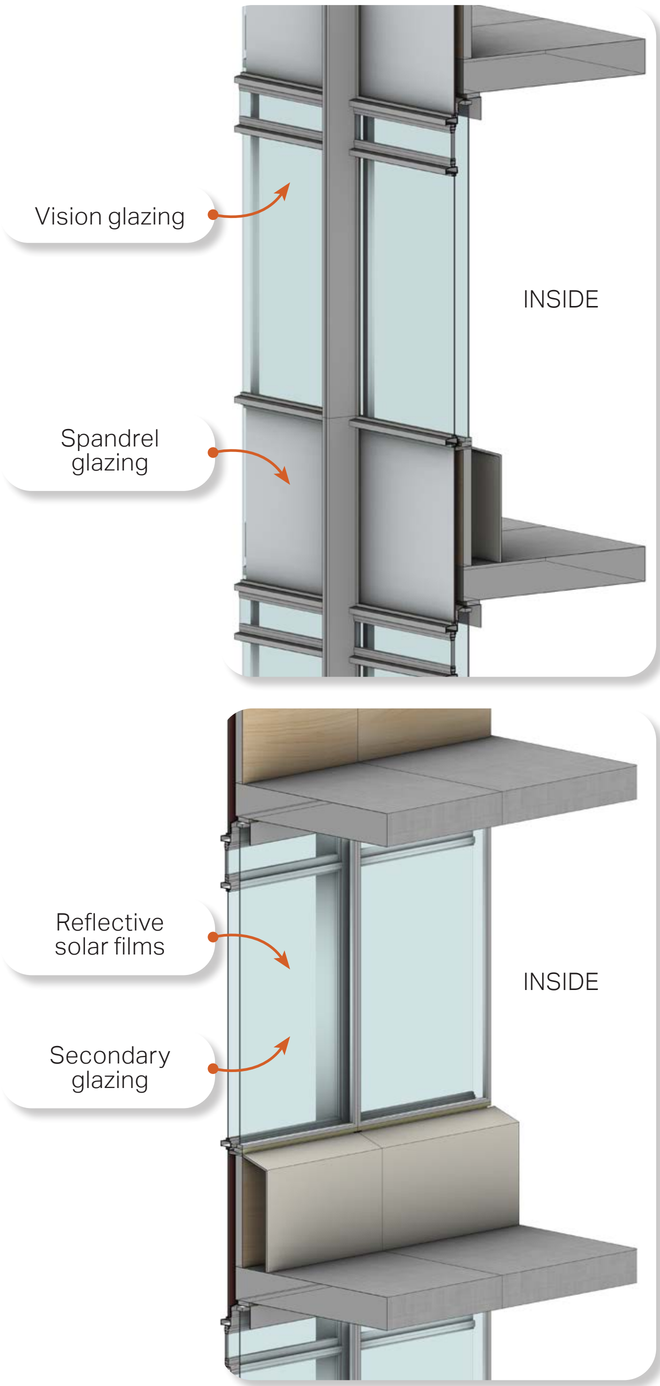


Figure 3.14 Facade build up with different glazing types indicated

Key Glass Component Hotspots

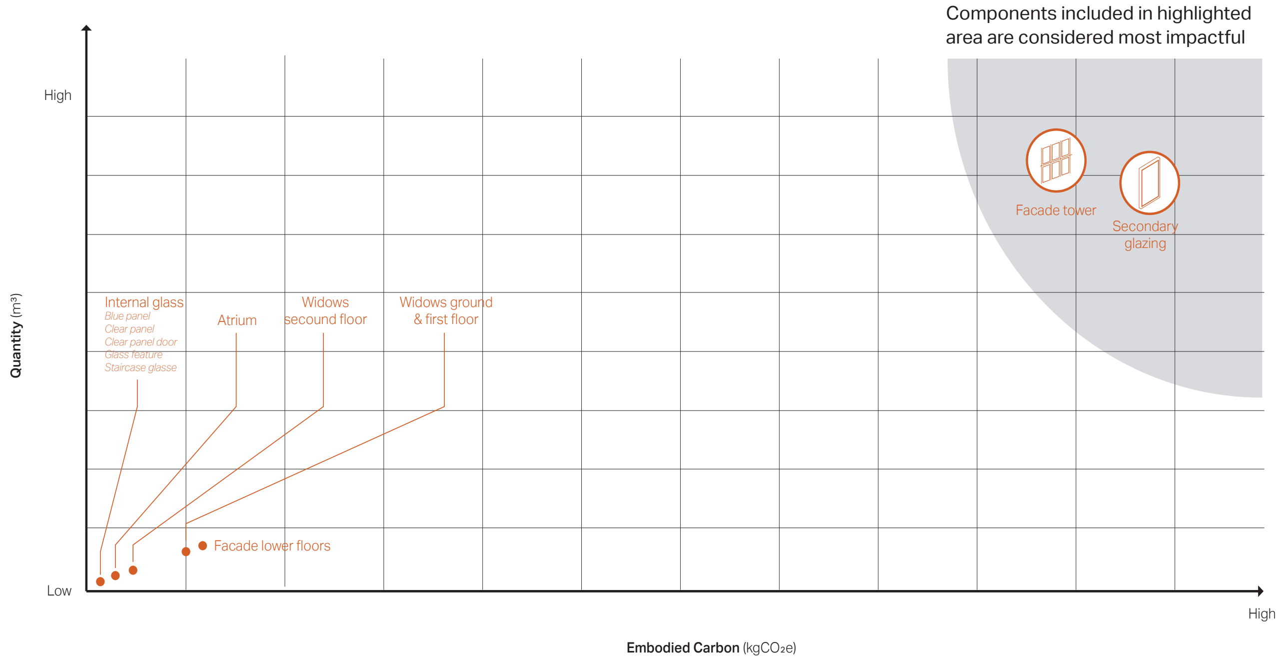


Figure 3.15 Diagram for identifying key material hotspots for glass

Detailed Glass Library

	Glazing type and description	Number of Floors	Area per Floor (m²) [1]	Total area (m²)	Total Mass (tonnes)
GL-01	External vision glazing (full height) Monolithic, 12 mm thickness (assumed toughened with solar film)	31*	220	6,915	207
GL-01A	External vision glazing (ventilation sections tall) Monolithic, 12 mm thickness (assumed toughened with solar film)	31	80	2,482	74
GL-01B	External vision glazing (ventilation section short) Monolithic, 12 mm thickness (assumed toughened with solar film)	31	30	920	28
GL-02	Secondary Glazing Monolithic, 6 mm thickness (assumed toughened with solar film)	31	232	7,184	108
GL-03	Spandrel Glazing Monolithic, 6mm thickness (assumed ceramic frit)	31**	207	6,612	99
GL-04	Rolled patterned glass (plant room) Monolithic, 6mm thickness (assumed Stippolyte)	0.5	116	58	0.87

[1] Dimension averaged from internal façade dimensions
** Additional half height storey for plant room*
*** Additional double height storey for plant room*

Figure 3.16 Detailed survey providing information on glass types and quantities

3.3.2 Glass processing

Figure 3.17 illustrates the potential end of life routes evaluated for the deconstructed glass, each of which are elaborated upon below.

Reuse
For glass to be reused it needs to be collected on specialist steel A-frame stillages, handled and stored carefully. The majority of the facade glass is unfit for reuse. There are some internal glass partition walls that could have potential for reuse, this is addressed in Section 4.4.

Upcycled products
It is intended to use some of the glass cullet for upcycled products. For more information see Section 4.3 of this document.

Downcycling
Since the facade glass is unfit for direct reuse, the standard practice would be to downcycle the glass. The glass recycling industry has developed grades of glass cullet:

- Class C
  Which is contaminated and not suitable for re-melting back into glass. Contamination can include ceramic frit, putty, lead beading, and space bars. This will be used as aggregate or road paint.
- Class B
  This is called "mixed cullet" and may have some contamination such as laminated glass, which is suitable for glass wool insulation or container glass.

Recycle
It is the ambition to get higher value out of the facade glass than what is standard practice. There is an industry demand for high quality cullet, but almost no post-consumer recovery is undertaken. Class A cullet is required to facilitate this:

- Class A
  Clean clear glass cullet with no contamination which can be used back in the floating by re-melting. This is currently mostly from pre-consumer glass. Demand for this outstrips supply.

Based on the material quantity estimations of the glass materials at the existing Euston Tower, there is a potential to remanufacture up to 376 tonnes of glass back into the glass float line for use within new flat glass products, avoiding more than 218 tCO_2e, and avoiding 452 tonnes of virgin material. The additional carbon implication associated with transport from a regional material dismantler is approximately 13 tCO_2e resulting in a net avoidance of 205[1] tCO_2e.

Every tonne of cullet saves up to 310kWh of energy at the glass furnace

116,666 kWh

of energy at the glass furnace

Every tonne of cullet saves 1.2 tonnes of virgin raw materials

452 tonnes

of virgin material saved

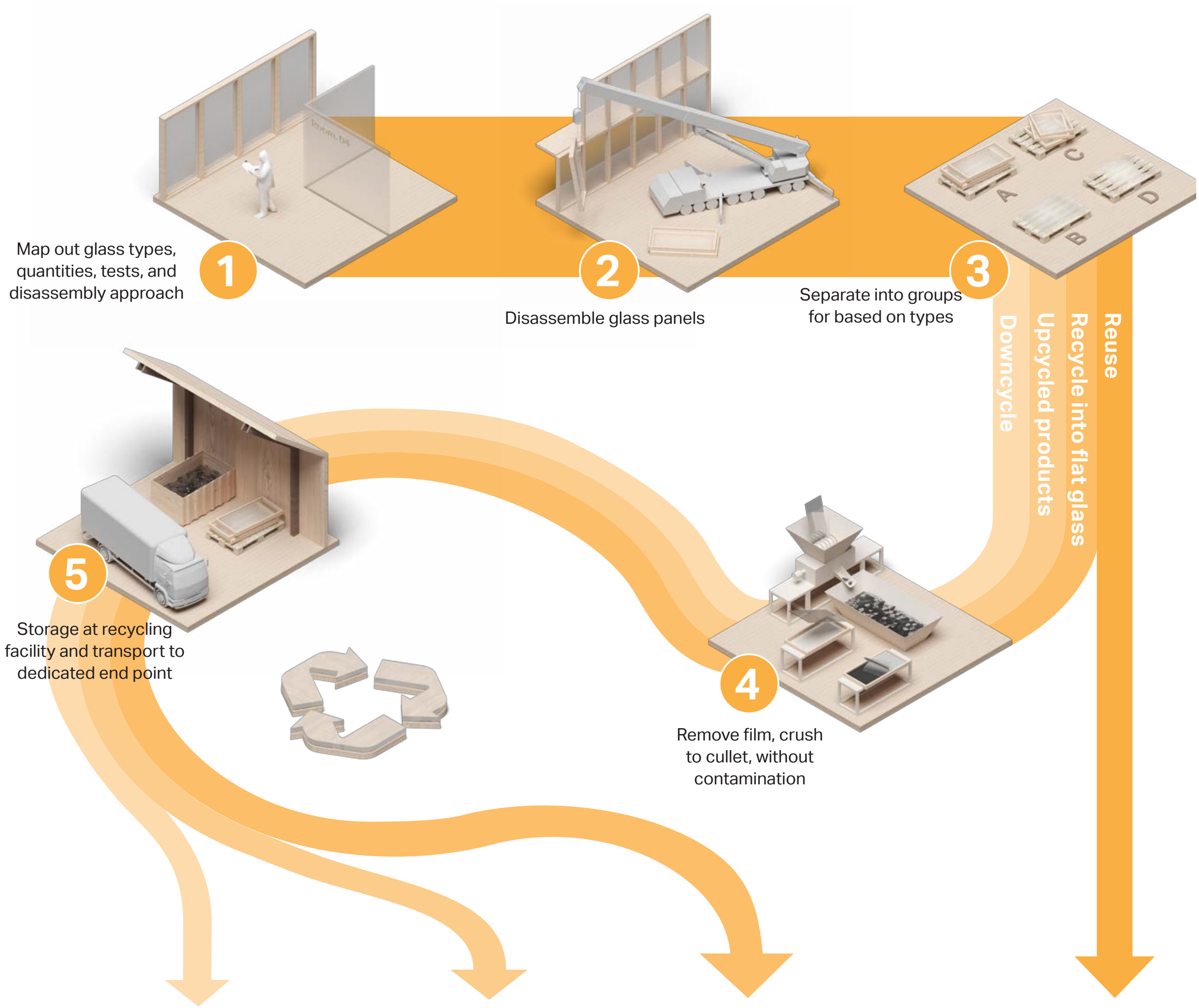
Every tonne of cullet saves up to 580 $kgCO_2e$ in future glass manufacture

205 tCO_2e

avoided in manufacture

[1] This excludes the 86 tonnes of ceramic fritted glass, which would be recycled for other applications. For this study, we have approximated a carbon saving of 1/3 of the closed loop recycling process which equates to an estimated saving of a further 17 tCO_2e

Potential End of Life Routes for Glass



DOWNCYCLING

Class C cullet – which is contaminated and not suitable for re-melting back into glass. This will be used as aggregate and road paint.

Class B – this is called "mixed cullet" and may have some contamination which is suitable for glass wool insulation and container glass.

UPCYCLED PRODUCTS

Low to no contamination of glass cullet for glass tile or terrazzo

Upcycle (Section 4)

RECYCLING

Class A – clean clear glass cullet with no contamination which can be used back in the floating by re-melting.

Current test and trials

REUSE

Only smaller items have potential for direct reuse

Upcycle (Section 4)

Figure 3.17 Potential end of life routes for glass

3.3.3 Roadmap to recycling

The most suitable reclamation process of glass is dependent on the quality and quantity of the materials, site trials, market demand, and reuse marketplaces in addition to any added time and cost associated with reuse, re-manufacturing or recycling. A lot of these procedures currently rely heavily on manual labour, and it is therefore imperative that this is discussed early with contractors to understand the most efficient way of handling these materials.

Arup has been involved in the project to identify, quantify, and test the potential for enabling and certifying the recovery process of the flat glass materials from the existing tower.

Figure 3.18 presents a roadmap for recovering the existing facade glass and unfolds the first steps that have been completed. A detailed survey was carried out by Arup to provide more detailed audit of the glass types and quantities. A glass disassembly and recycling feasibility report was prepared with the detailed overview of the existing glass types, and estimated the reclamation potential thereof.

Figure 3.19 shows the quantities of the constituent glass types along with the opportunities for recovery evaluated feasible for the specific type.

This report furthermore includes a methodology and description of logistics for dismantling the glass panels for testing and trials.

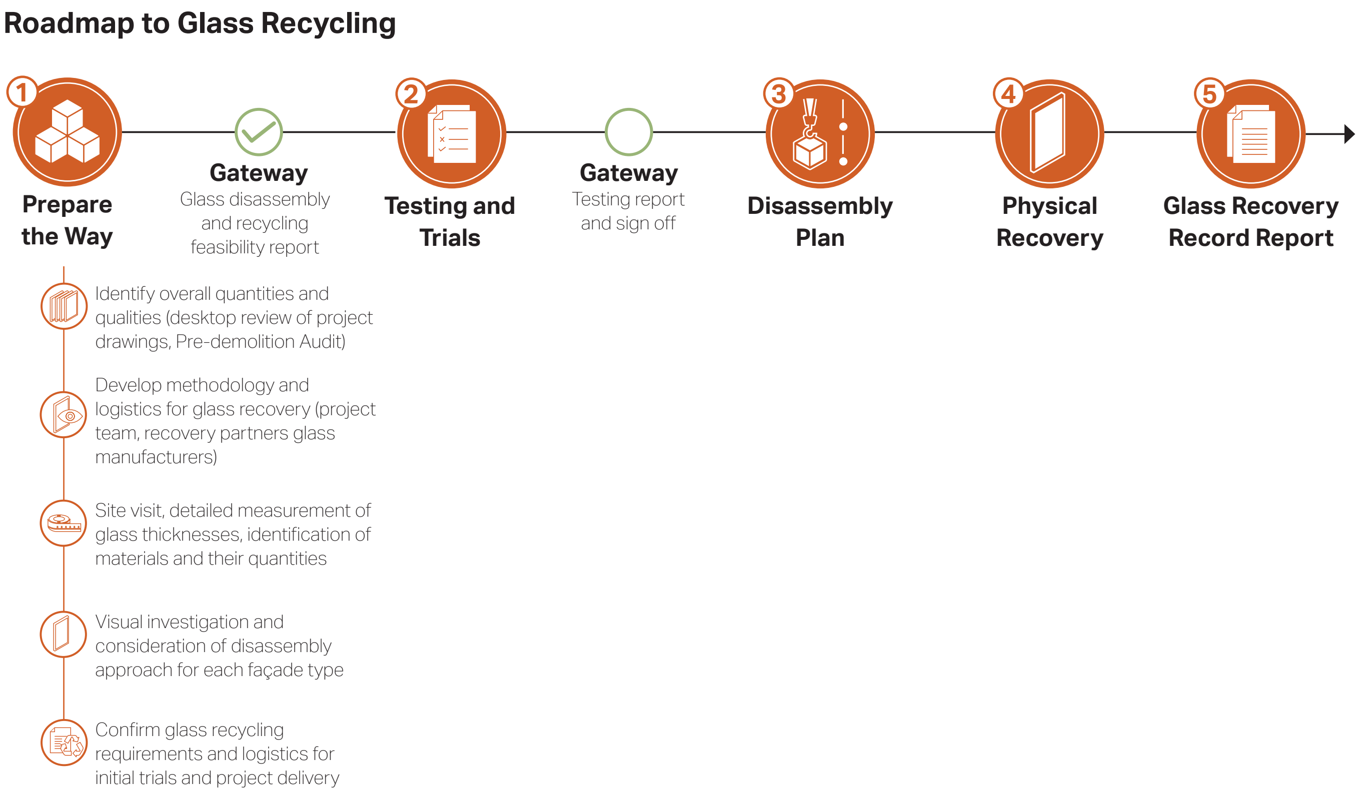


Figure 3.18 Initial steps unfolded in roadmap to glass recycling which have already been completed

Quantities and Opportunities for Specific Glass Types

	Glazing Type and Description	No. Glass Panes per Floor	90% Total Area (m²) [1]	Total Glass Mass (tonnes)	Opportunity
GL-01	External vision glazing (full height) Monolithic, 12 mm thickness (assumed toughened with solar film)	100	6,223	187	Trials for film removal required. Glass prepared for closed loop remanufacturing
GL-01A	External vision glazing (ventilation sections tall) Monolithic, 12 mm thickness (assumed toughened with solar film)	50	2,234	67	Trials for film removal required. Glass prepared for closed loop remanufacturing
GL-01B	External vision glazing (ventilation section short) Monolithic, 12 mm thickness (assumed toughened with solar film)	50	828	25	Trials for film removal required. Glass prepared for closed loop remanufacturing
GL-02	Secondary Glazing Monolithic, 6 mm thickness (assumed toughened with solar film)	150	6,466	97	Trials for film removal required. Glass prepared for closed loop remanufacturing
GL-03	Spandrel Glazing Monolithic, 6mm thickness (assumed ceramic frit)	150	5,951	89	Recycling only [2]
GL-04	Rolled glass (plant room floors only) Monolithic, 6mm thickness (assumed Stippolyte)	75	52	1	Suitable for closed loop remanufacture likely to rolled glass
	Closed loop recycling opportunity Subtotal		15,804	376	
	Total		21,755	466	

[1] Total area reduced by 10% to account for framing and yield and rounded to the next whole number
[2] Ceramic frit prevents closed loop remanufacturing routes, the material can be recycled for other lower grade glass products

Figure 3.19 Material quantities and opportunities for the various glass types

3.3.4 Testing and trials

From the candidates for the glass recycling trials, three panels each have been carefully extracted and dismantled for testing. Figure 3.21 illustrates the disassembly process of the three glass panel types: vision glazing, secondary glazing, and spandrel glass.

At the time of this document, the panels for trial have been removed and transported to the recovery partner, separated, and crushed to cullet.

The cullet is to be sent to a glass manufacturer for laboratory testing to identify the make up of the cullet and its suitability for re-manufacture. Throughout the process, the material will be kept separate for analysis of each glass type and for the avoidance of contamination. The results of this testing will identify the suitability of the different glass type as for use in new flat glass manufacturing.

The results of the testing and recycling trials will be published to share learnings with the wider industry.

Roadmap to Glass Recycling

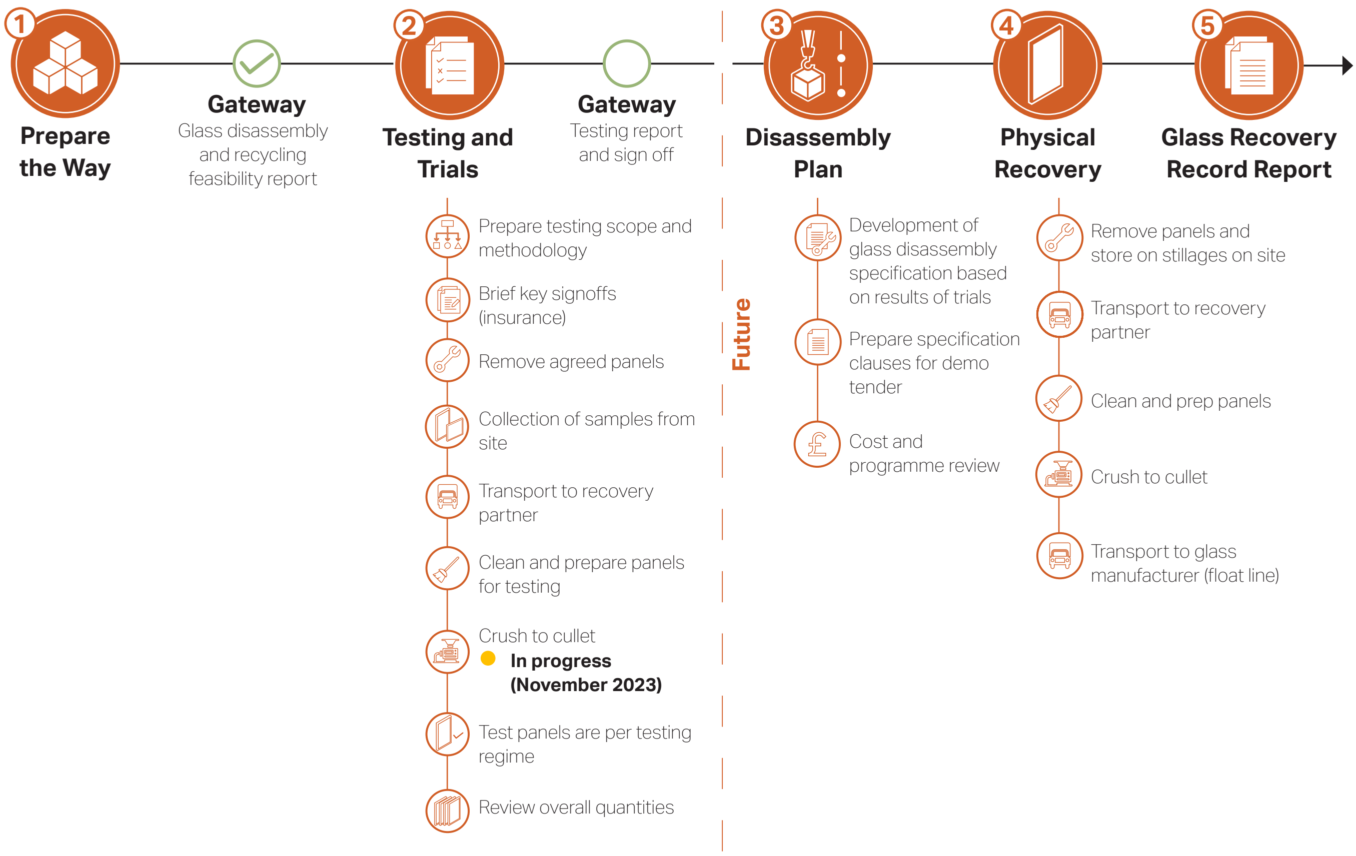


Figure 3.20 Current and remaining steps unfolded in roadmap for glass recycling

Secondary Glazing

Removal of secondary glazing
Remove glass with its aluminium frame out of sliding tracks to inside of building, remove aluminium frame, store glass on stillages, and transport for crushing

Crush to cullet
Culletised separately, to be sent to glass manufacturer

Vision Glazing

Removal of vision glazing
Hold glass with sucker unit and remove glass to inside of building, store glass on stillages, and transport for crushing

Crush to cullet
Culletised separately, to be sent to glass manufacturer

Spandrel Glazing

Removal of spandrel glazing
Hold glass with sucker unit and remove glass to outside of building, store glass on stillages, and transport for crushing

Crush to cullet
Culletised separately, to be sent to glass manufacturer

Figure 3.21 Photos of the three types of glass panels being extracted, dismantled and crushed for testing and trials

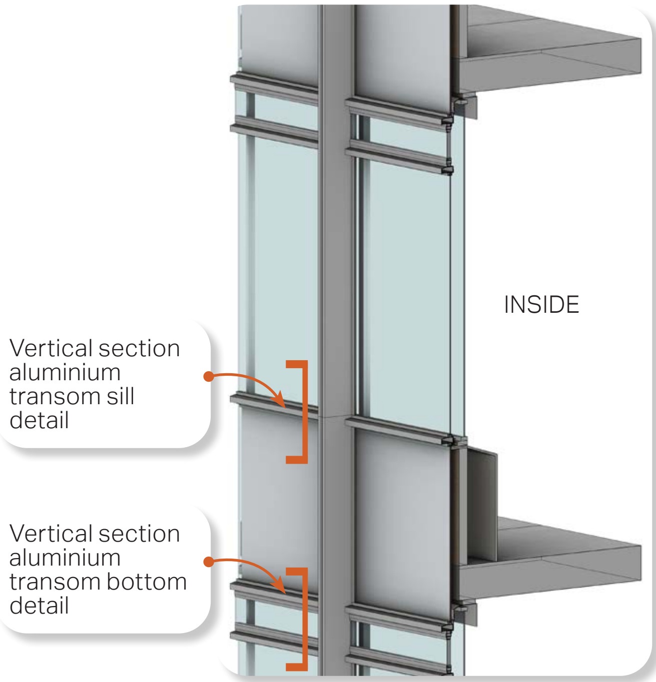
3.4 Aluminium

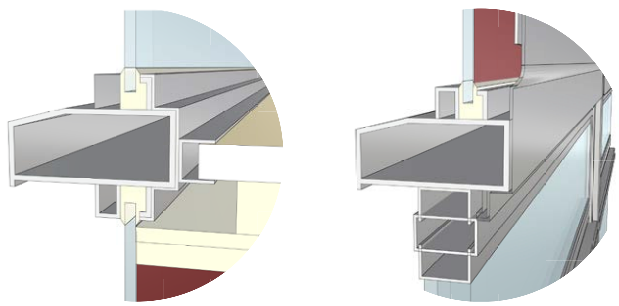
The main facade system is an anodised aluminium stick system with the structural mullions on the outside of the building emphasising the verticality.

The mullions and transoms in the facade system make up the largest quantity of aluminium in the existing building. A vertical section of the aluminium transoms can be seen in Figure 3.22.

Additional aluminium is located in the podium wind canopy. This may be the most suitable aluminium for reuse/ upcycling.

There is an estimated total of 305 tonnes of aluminium, equivalent to 2,035 tCO_2e from the deconstruction, as shown in Figure 3.23.





Vertical section aluminium transom sill detail

Vertical section aluminium transom bottom detail

Figure 3.22 Details of aluminium components in the facade

Aluminium Components Quantities

Aluminium

Volume: 140 m³
Weight: 305 t
Embodied carbon: 2,035 tCO_2e

	Volume	Weight	Impact
Curtain Walling	36 m^3	90 t	603 tCO_2
Second. Frame	52m^3	78 t	520 tCO_2
Mullions	9 m^3	23 t	153 tCO_2
Canopy	6 m^3	16 t	105 tCO_2
Frames	4 m^3	11 t	75 tCO_2

Figure 3.23 Aluminium component quantities

Key Aluminium Component Hotspots

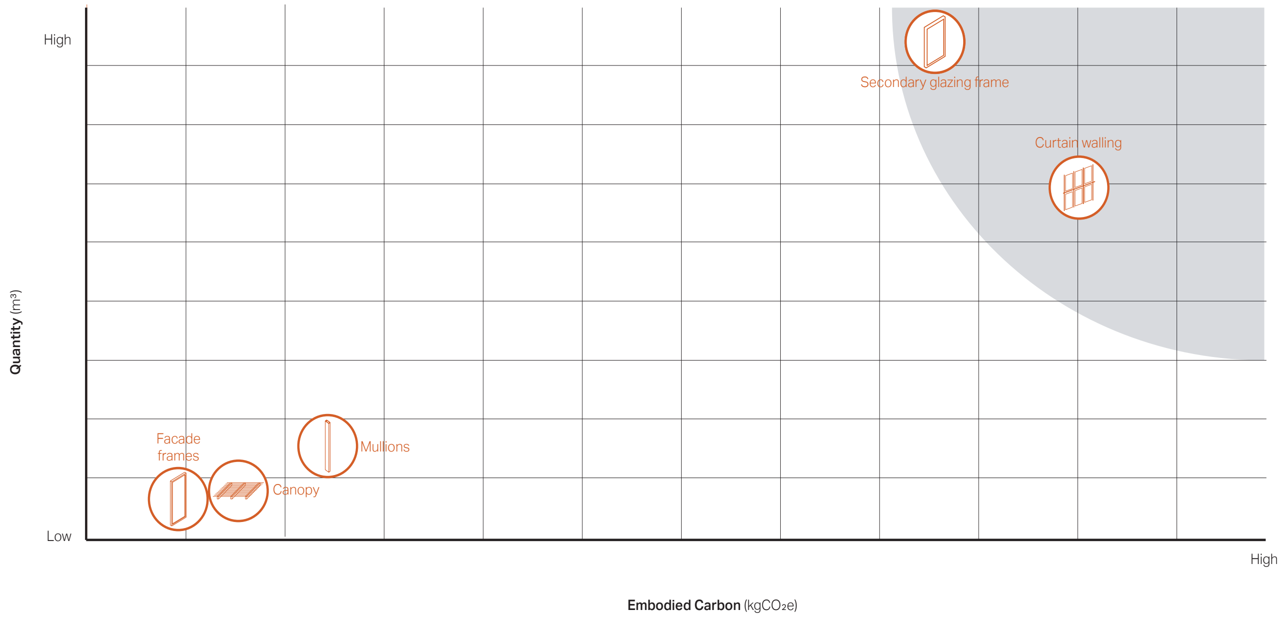


Figure 3.24 Diagram for identifying key material hotspots for aluminium

Figure 3.25 Images of aluminium components in the building. Wind canopy (left), facade mullion (middle) secondary frame (right)

3.4.1 Aluminium processing

Figure 3.26 illustrates the potential end of life routes evaluated for the deconstructed aluminium, each of which are elaborated upon below.

Standard practice
Aluminium is usually treated in a similar manner to steel, in that it will be sent to a scrap merchant, where it will be sorted, sheared (cutting large pieces), shredded, graded, and baled.

Aluminium has high recycling rates, which can be between 92% and 98% for architectural aluminium, and there is a highly established aluminium recycling market.

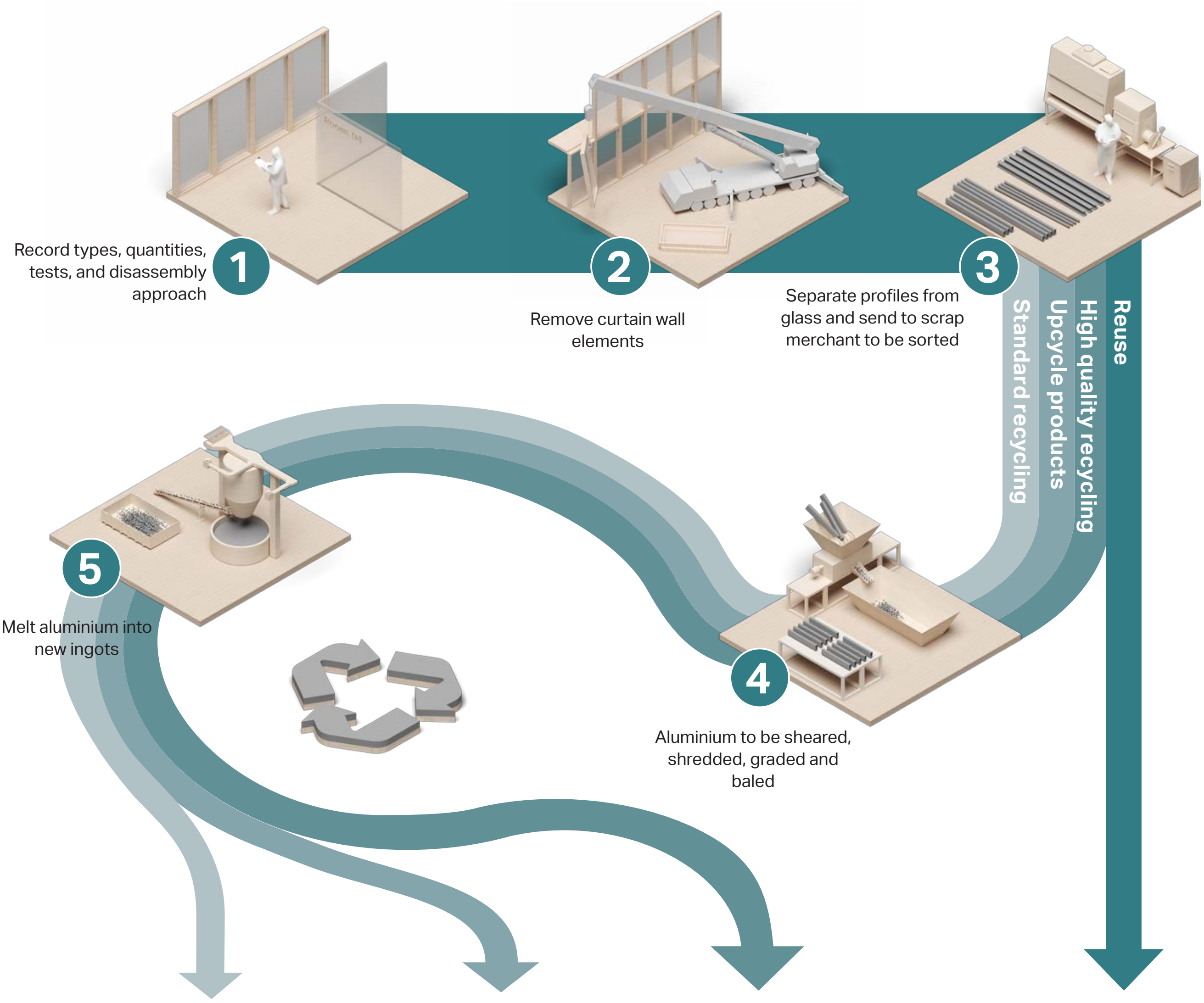
The aluminium will typically be recycled back into new aluminium. However, there is no guarantee what type or grade of aluminium that will be produced from the scrap.

Best practice
It is an ambition to ensure that the aluminium scrap from the existing building is being fed back into the production of extrusions for building use (or similar high quality aluminium alloys that avoid degradation of the product).

The project team has engaged in dialogue with Alutrade to discuss potential route for the aluminium scrap. Alutrade is an aluminium recycler in the UK that ensures post-consumer scrap is sorted to separate out contamination that allows for the high-quality alloys needed for facade extrusions. Alutrade works as part of Hydro's supply chain, to deliver scrap that is used for the production of Hydro CIRCAL recycled aluminium billets.

Reuse/upcycling
The wind canopy at podium level is the aluminium component in the best condition and with potential for reuse/upcycling. Potential for doing so is explored in Section 4.6.

Potential End of Life Routes for Aluminium



STANDARD PRACTICE RECYCLING	UPCYCLING	BEST PRACTICE RECYCLING	REUSE
Aluminium will typically be recycled back into new aluminium, but with no guarantee of the alloy quality	 Upcycling ideas for recovering and transforming canopy	 Aluminium recycling back into extrusions for architectural use	No items identified as suited for direct reuse
	Upcycle (Section 4)	*Engaging in dialogue*	

Figure 3.26 Potential end of life routes for aluminium

3.5 Sharing Our Learnings

The focused efforts described in this Section will be proceeded as far as technically, practically, and economically possible. Subject to considerations on project risks, cost, and programme.

It is acknowledged that the aims in this Section are ambitious. But it is indeed this level of ambition that is needed for the construction industry to accelerate its transition to a circular economy.

One of the barriers to this transition is siloed knowledge.

Accordingly, throughout the process, the learnings regarding technical feasibility, logistics and, challenges met will be documented and shared. The aim is to push industry standard practice for how these large, high-impact, material fractions are treated, and provide transparency around the process.

If the full recovery is not successful on the proposed development, at the very least it should be a step towards making it easier to achieve and implement on the next.

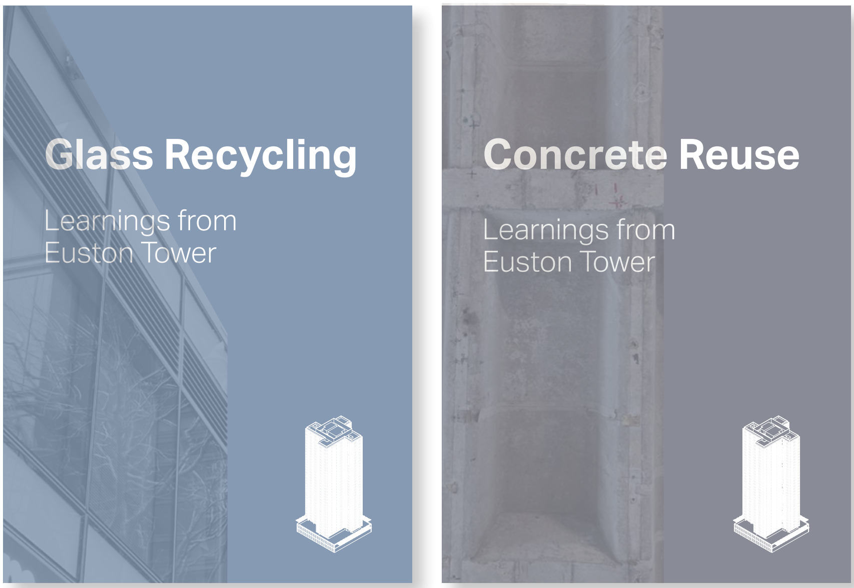


Figure 3.27 The learnings regarding technical feasibility, logistics, and challenges met will be documented and shared

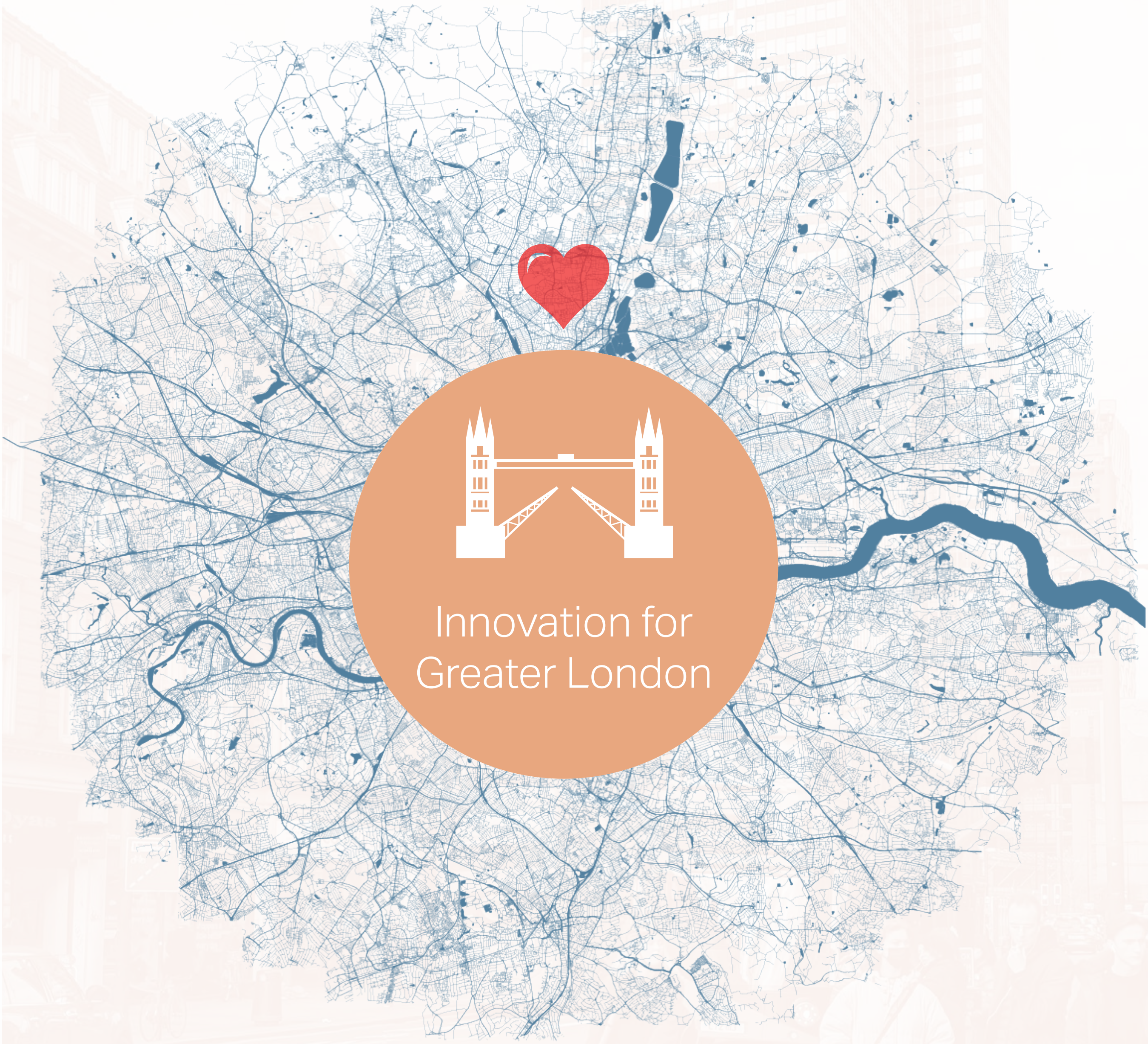


Figure 3.28 Lessons from the proposed development can help the industry to accelerate its transition to a circular economy