

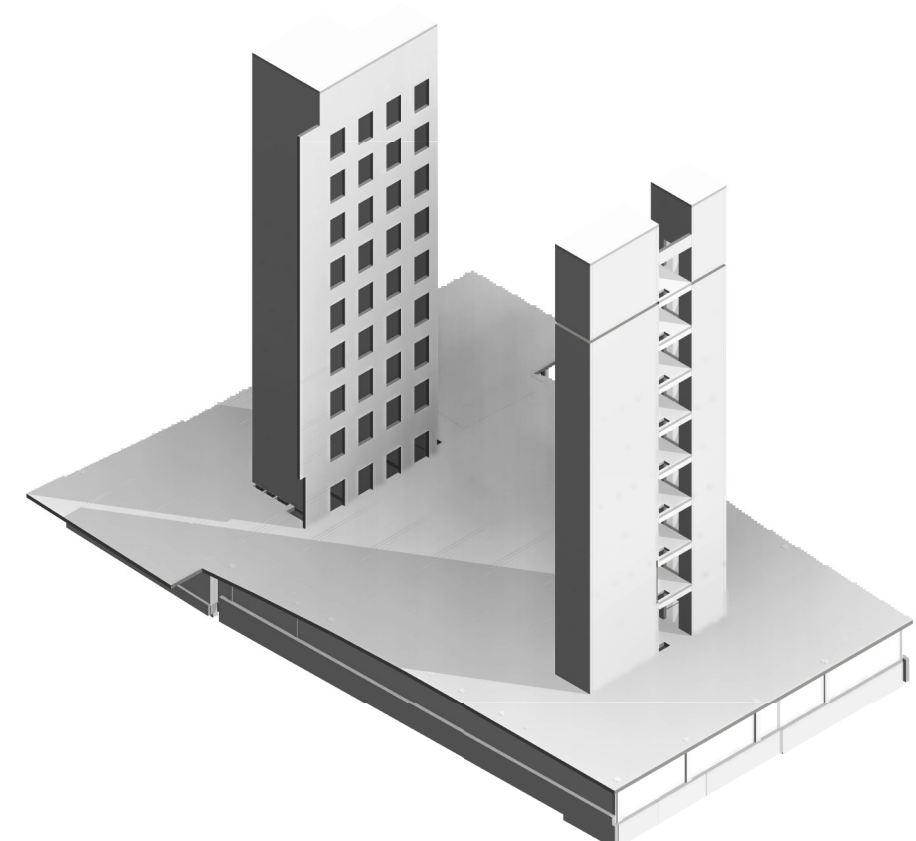
**Overall**

**Overall Analysis**

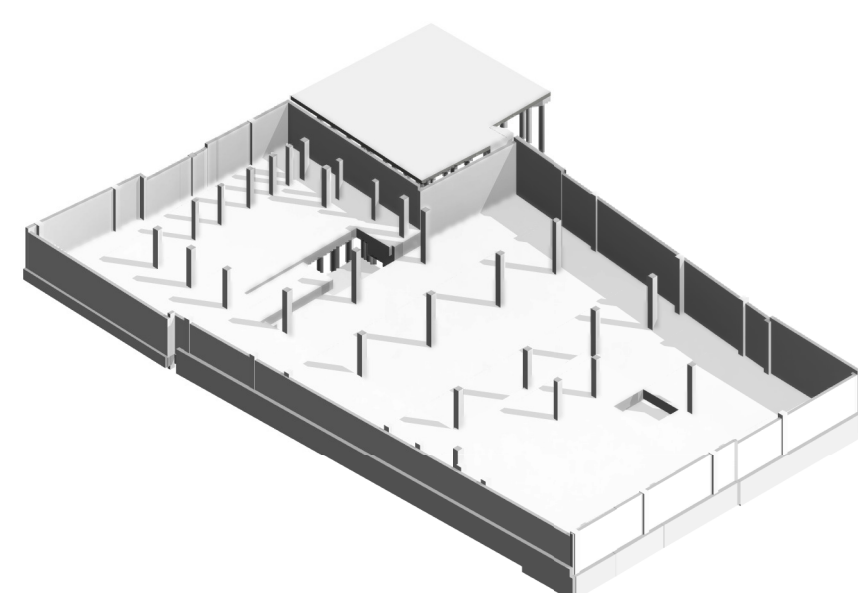
Total embodied CO <sub>2</sub> e	2,095,910 kgCO <sub>2</sub> e
Total GIA*	12,680 m <sup>2</sup>
Embodied CO <sub>2</sub> e Rate	165 kgCO <sub>2</sub> e/m <sup>2</sup>
LETI 2030 target	193 kgCO <sub>2</sub> e/m <sup>2</sup>

**Proposed Structure Analysis**

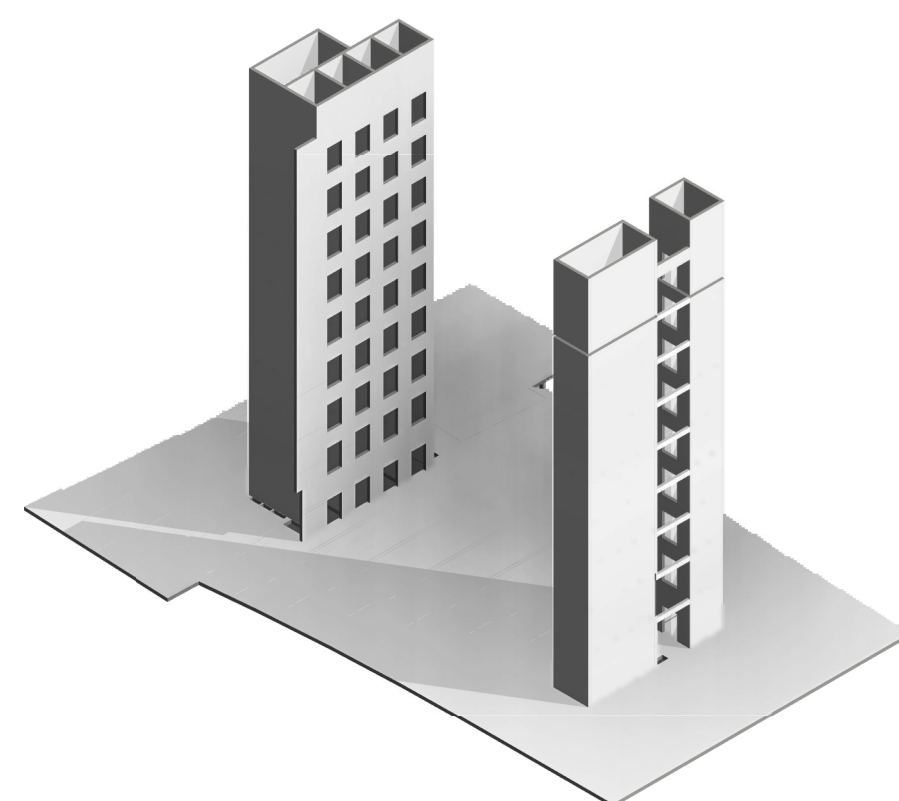
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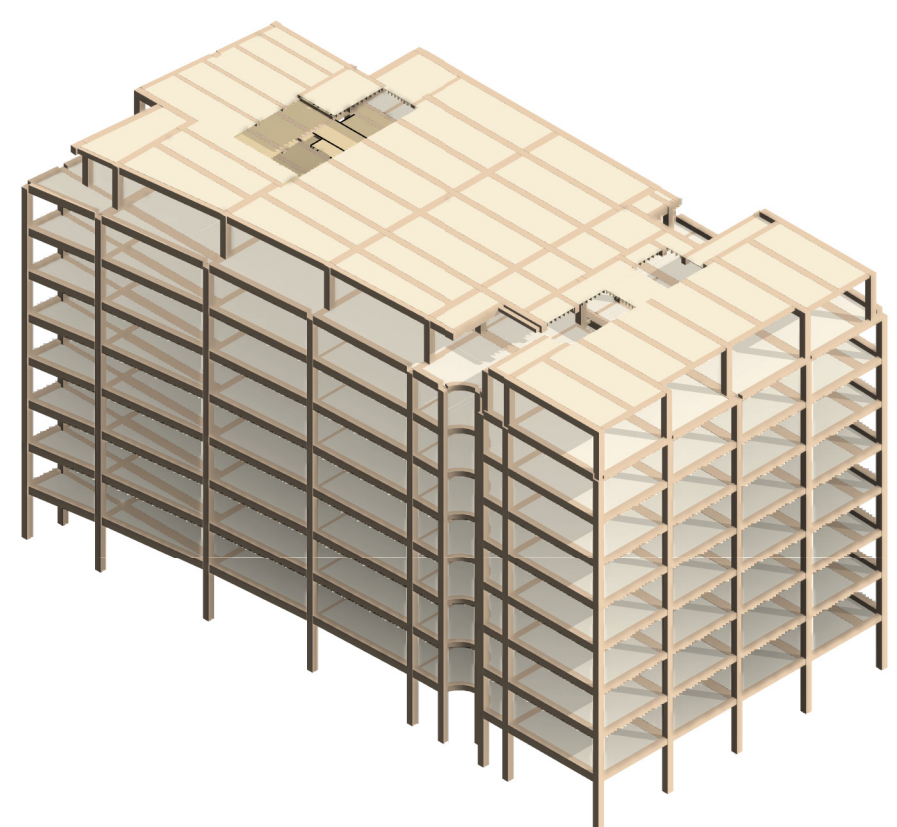
**Overall Concrete**



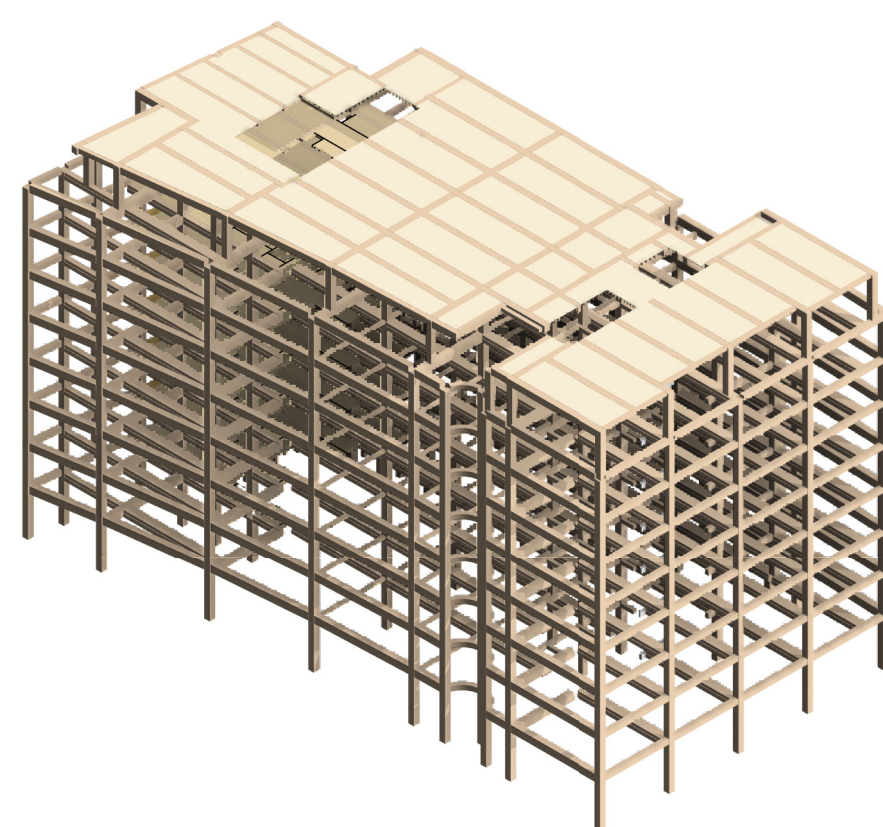
**Concrete Sub Structure**



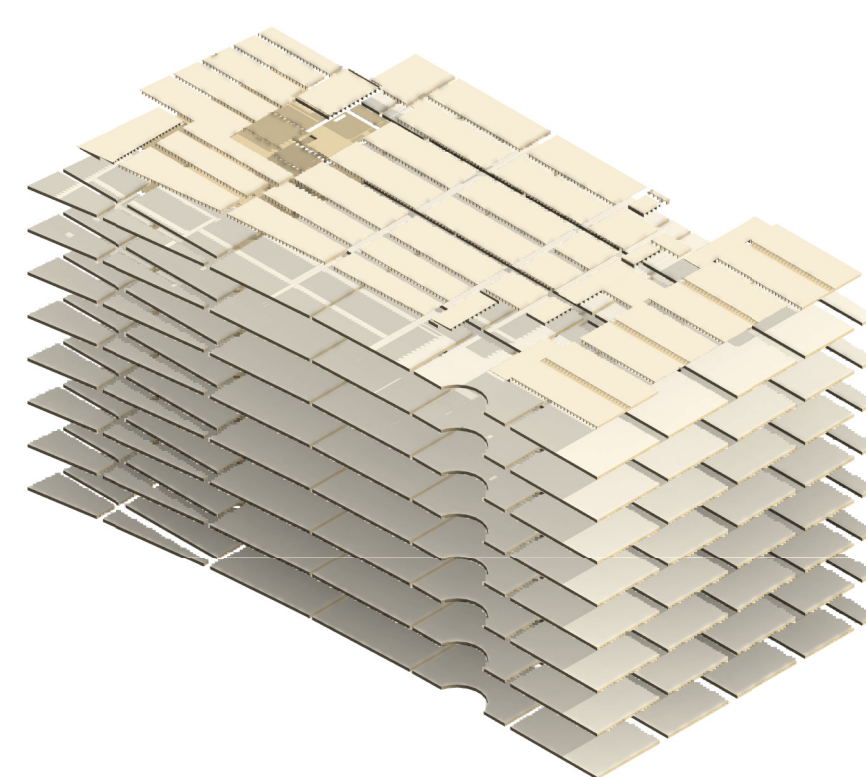
**Concrete Super Structure**



**Overall Timber**



**Glulam**



**CLT/Plywood + Joists**

**Embodied Energy - Demolished Structure**

Material	Category	Density (kg/m <sup>3</sup> )	Weight (kg)	Material CO <sub>2</sub> (kg)	Site Emissions CO <sub>2</sub> (kg)	Total CO <sub>2</sub> (tonnes)
Concrete - RC Pile	Structural Foundations	2500	5643	62	15	0.08
Existing Concrete - Cast In Situ	Structural Columns	2500	2052	23	5	0.03
Existing Concrete - Cast In Situ	Structural Foundations	2500	2855	31	7	0.04
Existing Concrete - Cast In Situ	Structural Framing	2500	11244	124	29	0.15
Existing Concrete - Cast In Situ	Walls	2500	118931	1308	309	1.62
			140725	1548	366	1.91

**Embodied Carbon for Steel**

**Columns**

Material	Density (kg/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Weight (kg)	Embodied CO <sub>2</sub> e (kg CO <sub>2</sub> e per kg)	Total CO <sub>2</sub> (tonnes)
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**Beams**

Material	Density (kg/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Weight (kg)	Embodied CO <sub>2</sub> e (kg CO <sub>2</sub> e per kg)	Total CO <sub>2</sub> (tonnes)
HTS_Concrete - C30/40	2500	2.19	5479	0.177	1
HTS_Metal - Steel - General	7850	0.91	7125	2.050	15
		3.10	12604		16

**Embodied Carbon for Concrete**

**Foundations / Piles**

Material	Density (kg/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Weight (kg)	Embodied CO <sub>2</sub> e (kg CO <sub>2</sub> e per kg)	Total CO <sub>2</sub> (tonnes)
HTS_Concrete - RC Pile	2500	79.56	198911	0.177	35
HTS_Concrete Foundations - C35/45		12.07	0		0
		91.64	198911		35

**Columns**

Material	Density (kg/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Weight (kg)	Embodied CO <sub>2</sub> e (kg CO <sub>2</sub> e per kg)	Total CO <sub>2</sub> (tonnes)
HTS_Concrete - C40/50		32.48	53036		15
		32.48	53036		15

**Beams**

Material	Density (kg/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Weight (kg)	Embodied CO <sub>2</sub> e (kg CO <sub>2</sub> e per kg)	Total CO <sub>2</sub> (tonnes)
HTS_Concrete - C30/40	2500	2.19	5479	0.177	1
		2.19	5479		1

**Structure Walls**

Material	Density (kg/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Weight (kg)	Embodied CO <sub>2</sub> e (kg CO <sub>2</sub> e per kg)	Total CO <sub>2</sub> (tonnes)
HTS_Concrete - C30/40	2500	148.74	371856	0.166	62
HTS_Concrete - C35/45	2500	738.06	1845138		334
HTS_Concrete - Mass concrete	2400	74.30	178325	0.106	19
		961.10	2395319		414

**Structure Floors**

Material	Density (kg/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Weight (kg)	Embodied CO <sub>2</sub> e (kg CO <sub>2</sub> e per kg)	Total CO <sub>2</sub> (tonnes)
HTS_Concrete - C30/40		1156.02	2655719		465
HTS_Concrete - C35/45	2500	461.05	1152617		200
		1617.07	3808337		664

**Embodied Carbon for Timber**

**Columns**

Material	Density (kg/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Weight (kg)	Embodied CO <sub>2</sub> e (kg CO <sub>2</sub> e per kg)	Total CO <sub>2</sub> (tonnes)
HTS_Wood - Glulam	470	410.72	193040	0.764	147
		410.72	193040		147

**Beams**

Material	Density (kg/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Weight (kg)	Embodied CO <sub>2</sub> e (kg CO <sub>2</sub> e per kg)	Total CO <sub>2</sub> (tonnes)
HTS_Wood - Glulam	470	1049.11	493081	0.764	377
Wood - Dimensional Lumber	470	2.99	1404	0.764	1
		1052.10	494485		378

**Floors**

Material	Area (m <sup>2</sup> )	Density (kg/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Weight (kg)	Embodied CO <sub>2</sub> e (kg CO <sub>2</sub> e per kg)	Total CO <sub>2</sub> (tonnes)
HTS_Wood - Plywood	732	500	13.18	6588	0.889	6
HTS_Wood - Structural Lumber	845	500	15.21	7605	0.889	7
HTS_Wood CLT	49745	470	1705.56	801612	0.456	366
		51322	1733.94	815805		378

Rev	Date	By	Eng	Amendments
P3	29.09.20	SH	AR	Issued For Planning
P2	07.09.20	SH	AH	Revised Preliminary Issue
P1	17.08.20	SH	AH	Preliminary Issue
Rev	Date	By	Eng	Amendments

- This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
  - Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check drawing has been printed to the intended scale the above bar should be 100mm
- All proposed details shown are based on archive drawings and limited opening up works. Assumptions have been made regarding existing construction. All proposed details are preliminary only and final detailing will be required following completion of further opening up works

**Concrete Assumptions**

- Concrete sourced 10km from site
- C32/40 w/ 50% GGBS for all foundations (piles, pile caps, Ground beams, basement and ground floor slabs)
- 50% GGBS in remaining RC
- Rebar 97% recycled content, 300km
- FSC plywood formwork reused 3 times (general not applicable for visual concrete) 5% site waste (concrete)

**Steelwork Assumptions**

- 20% recycled content
- Sourced from 300km from site
- Connections assumed to be 10% of frame

**Demolition Assumptions**

- Values include energy released by site plant during demolition period

**Other Assumptions**

- All figures exclude sequestration and are taken up to practical completion only
- All items transported to site using HGV lorries
- Organic waste impacts from formwork considered in practical completion
- No direct consideration of site program considered (eg. concrete slower than steel)
- Site emissions considered, though transport carbon attributed to excavation assumed to have been excluded

Rev	Date	By	Eng	Amendments
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**100 Grays Inn Road, WC1X 8AL**

Drawing Title  
**Embodied Carbon Assessment**