ArcelorMittal

2 Finsbury Avenue

Engineering a Sustainable New Skyline


© Jad SYLLA

British Land RAMBOLL Sir Robert McALPINE HARE FOCCHI SINCE 1914

Authors:

George Amy
Project Director
Sir Robert McAlpine

Kathryn Castledine
Senior Sustainability Manager
Sir Robert McAlpine

Luca Cenni
Senior Design Manager
Focchi Group

David Chapman
Sustainability Lead UK
ArcelorMittal Steligence

Marion Charlier
Central Engineering Lead
ArcelorMittal Steligence

Jonathan Davis
Preconstruction Technical Director
William Hare

Jonathan Lancaster
Associate Director
Ramboll Structures

Emily Samoluk
Senior Sustainability Manager
British Land

Project Team

Client:	Bluebutton Developer (2FA) Limited
Developer:	British Land
Architects:	3XN, Adamson Associates
Structural Consultant:	Ramboll
M&E and Services:	Ramboll
Sustainability Engineer:	Atelier Ten
Sustainability, Behaviour, and Innovation Consultant:	GXN
Contractor:	Sir Robert McAlpine
Steelwork Contractor:	William Hare
Steel Supplier:	ArcelorMittal
Façade consultant:	FMDC Ltd
Façades:	Focchi Group
Fire:	OFR Consultants
Project Manager:	Gardiner & Theobald LLP
Cost Consultant:	Core Five LLP
Planning Consultant:	DP9 Ltd
Heating / Ventilation Contractor:	Hotchkiss

This technical leaflet has been created to provide a detailed insight into the solutions implemented in the structural design of 2 Finsbury Avenue (2FA). It outlines the key engineering approaches, materials, and technologies used to ensure the building's low carbon target, offering a comprehensive understanding of the technical considerations behind its construction. This document was prepared by British Land, Ramboll, Sir Robert McAlpine, William Hare, Focchi Group and ArcelorMittal.


© 3XN+British Land

A Tower Like No Other

2 Finsbury Avenue (2FA) is a 38-storey, 106,000 sqm development set to redefine sustainable high-rise design in the City of London. From the outset of this project, British Land's ambition was to create a "Tower Like No Other", with an emphasis on making this a showpiece, sustainable structure in the heart of the Broadgate campus.

With this ambition, Ramboll, 3XN, GXN, Adamson Architects and Sir Robert McAlpine explored a range of different structural schemes including timber, steel and concrete options, weighing each alongside their relative embodied carbon performance (see Figure 1).

Optimising the structural grid

A key factor during this stage of the design was achieving a balance between optimising structural grids for carbon whilst maintaining a viable, lettable open plan office floorplate. The consented scheme utilised a diagonal array of beams in each tower, leading to an irregular column layout in the lower combined podium structure, see Figure 3. This inefficient planning grid was resolved by Ramboll using in-house parametric tools to optimise the layout, without using costly and carbon intensive transfer beams. The layout adopted was able to match orthogonal grids in the podium and the towers, see Figure 4. Three double-storey raking structures were introduced to transfer the tower grid onto the podium grid in place of transfer beams.

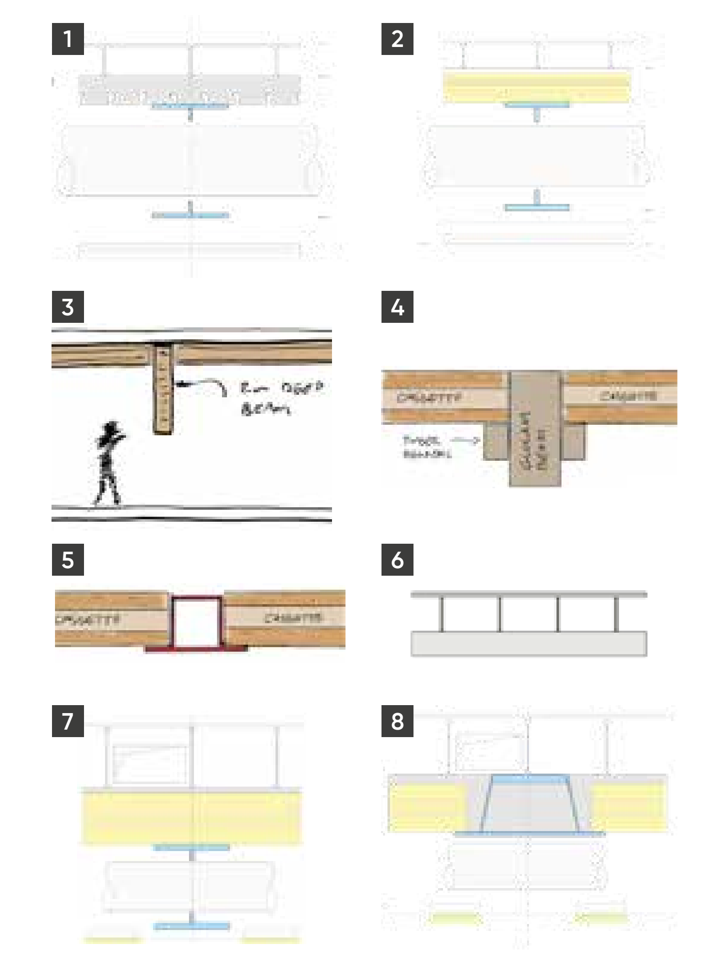


Figure 1: © Ramboll

Figure 2: © ArcelorMittal, photo taken during job site visit in May 2025

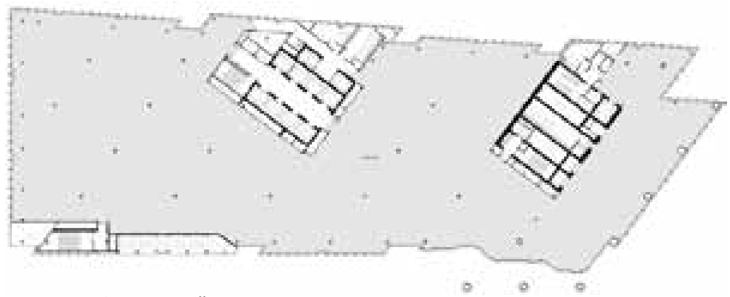


Figure 3: © Ramboll

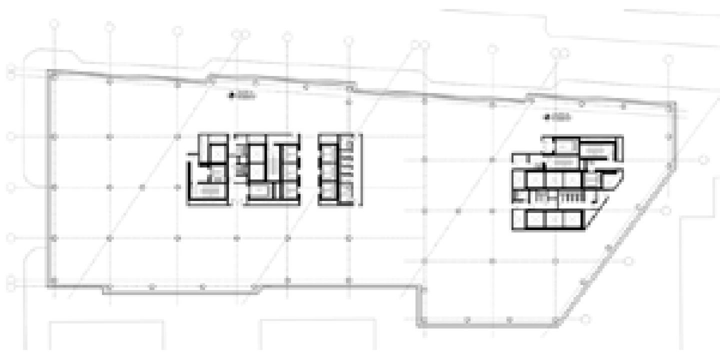


Figure 4: Mapping of the tower grid onto the podium grid, © Ramboll

Designing with hot rolled sections instead of built-up welded sections

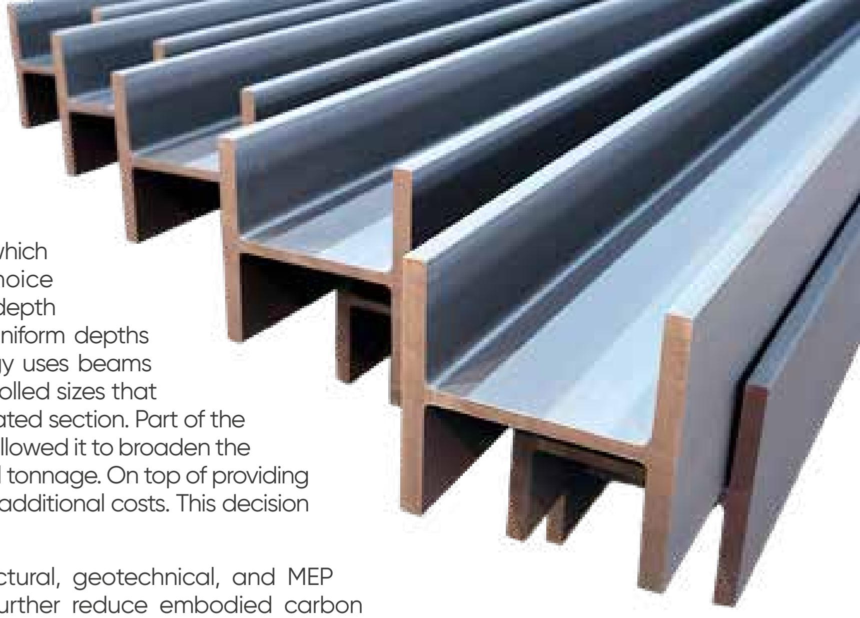


Figure 5: © ArcelorMittal

This design strategy utilises rolled sections in place of beams built up from plates. This was in large part due to the relative carbon intensity of rolled vs plated sections, which was between 2-3 times less per tonne of steel. This choice necessitated an allowance for some variance in the overall depth of structural beams across the floorplate, in place of the uniform depths usually delivered by built-up sections. The adopted strategy uses beams that range in depth between 525-550mm but crucially, are rolled sizes that have a much lower embodied carbon than an equivalent plated section. Part of the strategy was to open the supply range to Euronorms, which allowed it to broaden the section size choice and ultimately gave the lightest total steel tonnage. On top of providing a reduction in embodied carbon, this choice did not lead to additional costs. This decision also allowed continued procurement in later stages.

As the multidisciplinary partner responsible for civil, structural, geotechnical, and MEP engineering, Ramboll leveraged its broad expertise to further reduce embodied carbon through coordinated design strategies and close collaboration with the steelwork fabricator, William Hare Ltd.

Adjusting the ductwork placement

Beams with web openings combine function with flexibility. They are lightweight, long-spanning, structural elements that enable the design of vast column-free spaces and allow services to pass through the openings (see Figure 6).

As Ramboll developed the MEP design, they were able to utilise the access floor void which reduces the reliance on large rectangular openings in the steel elements. Large openings in highly stressed regions typically increase the weight of the beams as extra material/stiffeners can be required to resist the vierendeel bending induced around the openings. Instead, a more regular steel penetration layout was adopted, typically with 275mm circular openings and a reduced provision for rectangular openings placed away from the beam ends (high shear zones), helping reduce the overall tonnage of the beams (see Figure 7).

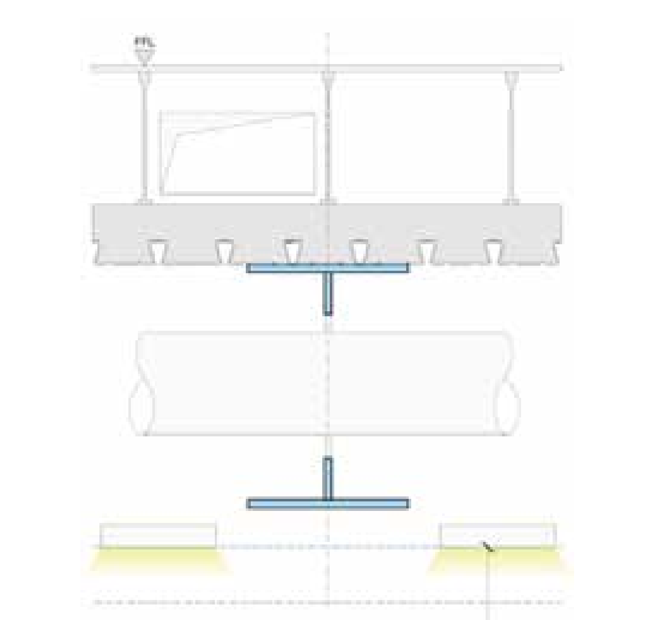


Figure 6: © Ramboll

Figure 7: © Ramboll

Adapting the deflection requirement to maximise the strength demand-to-capacity

Another key engineering initiative to reduce the material consumption was to design in an increased deflection zone, which maximises the demand-to-capacity (D/C) ratio of the beam. In many cases, floor to ceiling zones restrict the deflections zones and underutilise the steel material as they become governed by the serviceability limit state as opposed to the ultimate limit state. In allowing the beams to deflect (within prescribed limits) to the maximum available zone, the beams achieve a higher strength utilisation factor, making more efficient use of the material.

Adopting trapezoidal decking

Another significant saving was realised in adopting trapezoidal decking in place of re-entrant decking (see Figure 8). This saving was made possible by OFR's probabilistic fire severity assessment, which allowed the R120 fire compartment requirement at each floor to be reduced to R90. This fire requirement can be met by the trapezoidal decking without increasing the thickness of the concrete slab, and as such led to both savings in the volume of concrete required, and also due to the increased stiffness of the decking, a reduction in thickness of decking required to achieve the specified spans. The combined impact of this yielded significant embodied carbon savings in the scheme.

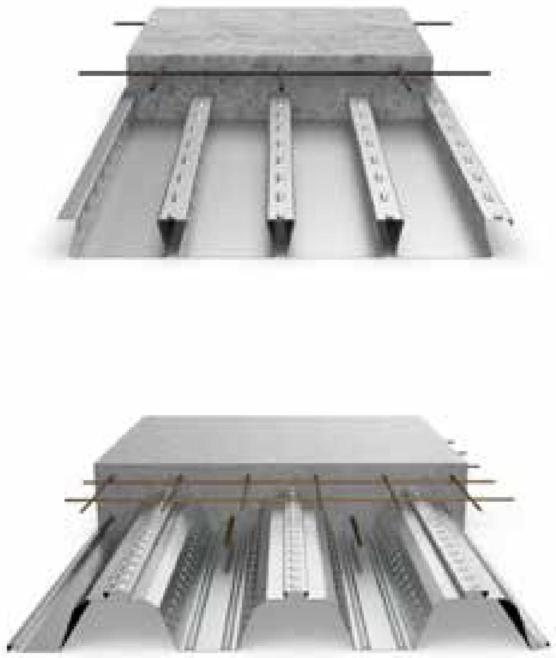


Figure 8: Re-entrant decking (above) and trapezoidal decking (below) © ArcelorMittal

Available Steel Grades

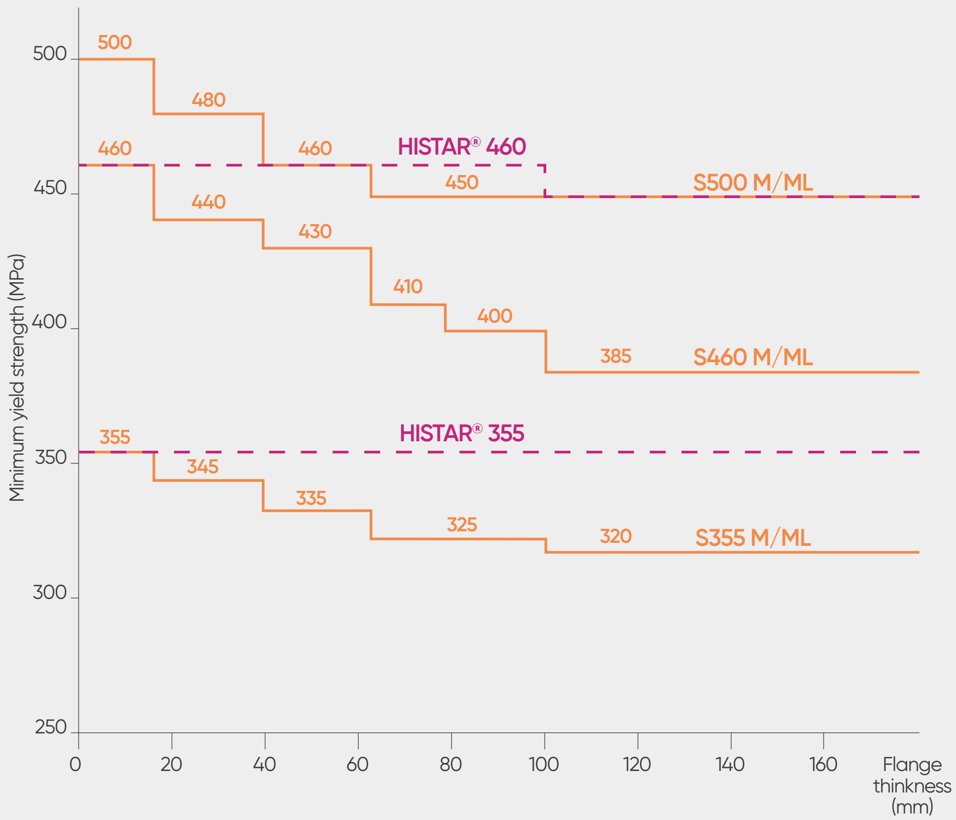


Figure 9 : Minimum yield strength according to material thickness for HISTAR® steels and European grades

High strength steels

HISTAR© steel, developed by ArcelorMittal, is a high strength, low-alloy steel widely used in tall building construction for its excellent mechanical properties and economic benefits. Its exceptional yield strength, combined with high ductility, allows for thinner and lighter structural elements without compromising safety or performance. This reduces material usage and increases efficiency. Additionally, HISTAR's unique production process ensures consistent quality and better weldability, making it ideal for complex designs.

The yield strength of HISTAR®460 decreases only 10MPa to 450 N/mm^2 after 100mm of nominal thickness, compared to the 320 N/mm^2 of the industry standard S355 (see Figure 9).

For illustrative purposes, Figure 10 compares the ultimate loads for a column (HD400x1086) in different grades. It also presents the influence of slenderness on the load-bearing capacity of columns in different steel grades, highlighting the advantages of HISTAR® 460 for such applications.

Steel grade S460 was used in 2FA for columns where the weight was greater than 150 kg/m, and HISTAR®460 was chosen for the heavier columns with flanges thicker than 60mm (those above 500 kg/m). This combination led to savings in steel weight, embodied carbon and cost.

Collectively, the engineering approaches described above enabled the project to achieve a steel frame intensity of approximately 93 kg/m^2 (excluding metal decking), demonstrating an efficient use of structural steel while meeting the project's performance requirements.

Sawtooth Façade, and Snowflake Geometry

The façade uses structural silicone glazing, with cranked units of 1500 × 3875mm and a depth of 200mm. These cranked pieces produce a sawtooth feature on-plan (see Figure 11), formed by combining a 500mm opaque metal panel with a 1000mm vision double glazed unit. The system is suspended from the floor slab via bespoke brackets, which is all obscured by a spandrel panel. The geometry was refined to ensure continuous air- and water-tightness, and incorporates a key "flip" at diagonal lines (internally termed Flake), where the sawtooth orientation reverses, creating a variable façade expression.

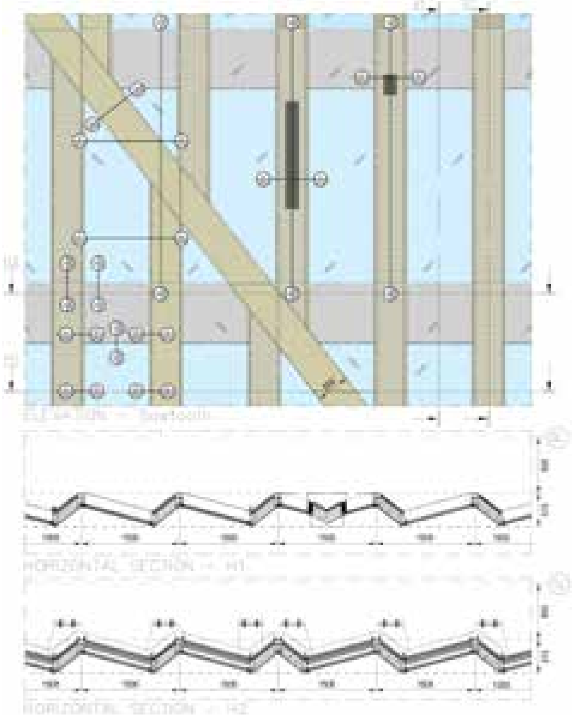


Figure 11: © Focchi

Within this system, planar openings known as Amenity Cuts introduce fully glazed units with double-height mullions, up to 2500 × 7500mm and 330mm deep, supported at the lower slab, unrestrained at intermediate level, and laterally stabilised at the top via diagonal beams, with spandrels concealing slab edges.

At the intersections of diagonals and façade geometry, highly complex "Snowflake" units are formed: up to ten elements combined within a single unit and fully integrated with bespoke sealing systems. There are around 130 such units, including eight particularly intricate corners, which required significant design development to achieve buildability and performance.

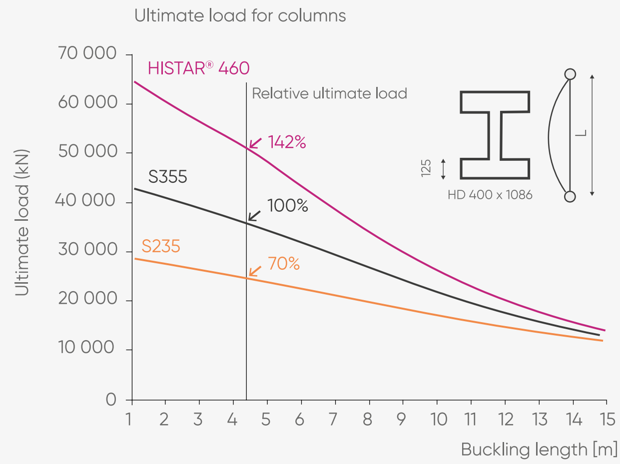


Figure 10: Influence of the slenderness on the load carrying capacity of the columns in HISTAR® and conventional steels

Embodied Carbon Opportunities

British Land appointed Atelier Ten to challenge and reduce the building's embodied carbon from the outset. By embedding themselves within the design team through early-stage sustainability workshops and close engagement with the supply chain, they helped unlock carbon-saving opportunities across the project. Leveraging their industry-leading experience in low-carbon design, Atelier Ten played a key role in cutting the building's embodied carbon from 755 $kgCO_2e/m^2$ to 656 $kgCO_2e/m2$ GIA at completion of Stage 4 design.

With collaboration identified as a core project pillar, early technical advice and engagement from industry steelwork specialists William Hare was secured through an extended pre-construction services agreement (PCSA) with SRM and British Land. This early contractor involvement directly informed the structural design strategy, enabling significant reductions in steel tonnage, and subsequently embodied carbon.

Through SRM leveraging William Hare's deep-rooted supply-chain knowledge, the project team was able to efficiently specify optimised structural elements that balanced minimum material weight, procurement certainty, and low-carbon manufacture. This approach ensured that materials were procured from suppliers with demonstrable commitments to net zero pathways, while maintaining alignment with programme, cost, and buildability requirements.

A key outcome of this collaborative approach was the use of XCarb® recycled and renewably produced (RRP) – ArcelorMittal's low carbon-emissions steel initiative – developed to support the decarbonisation of steel production within the construction industry. ArcelorMittal's XCarb® RRP applies to steels produced in an electric arc furnace (EAF) using up to 100% scrap and 100% renewable electricity.

The electricity used comes from renewable sources such as wind and solar, and is supplied via a recognised Guarantees of Origin scheme (GoOs, or REGOs in the UK for Renewable Energy Guarantees of Origin). Third-party verified EPDs (Environmental Product Declarations) are available for the different products from the XCarb® RRP portfolio. For 2FA, XCarb® RRP hot rolled sections have been used, in the above-mentioned HISTAR®460 grade, with a corresponding carbon footprint of 333 kg CO_2e/t [A1-A3]. XCarb® RRP hot rolled coils with Magnelis coating (900 kg CO_2e/t [A1-A3]), have also been procured to manufacture steel floor decking and ductwork. The use of XCarb® RRP allowed for significant physical reduction of embodied carbon, enabling customers to report lower Scope 3 values. These project-specific CO_2 savings are particularly valuable on a scheme such as 2 Finsbury Avenue, which relies on significant volumes of structural steelwork along with clear client ambitions to minimise its embodied carbon footprint.

British Land's requirement for third-party verified EPDs, combined with Atelier Ten's rigorous and transparent reporting, gave the project team confidence that the embodied carbon reductions achieved at 2 Finsbury Avenue were robust, measurable and evidence-based.

Hot Rolled Sections: 333 kg CO_2e/t

Hot Rolled Coils with Magnelis®: 900 kg CO_2e/t

Figure 12: ArcelorMittal XCarb® recycled and renewably produced EPDs

© Focchi

Procurement strategy

This successful procurement of low carbon-emissions steel was achieved thanks to an early and efficient collaboration between the client, contractor and steel manufacturer. Indeed, to enable informed decision-making, the project team, with support from ArcelorMittal, undertook a series of technical briefings to explain the XCarb® RRP manufacturing process, certification methodology and associated carbon accounting. This early engagement upskilled the wider team, provided confidence in the robustness and auditability of the claimed carbon reductions, leading to the adoption of XCarb® steelwork at scale on this project.

Detailed assessments were undertaken by William Hare to provide blended procurement options for the project, balancing cost and carbon savings for the steel frame (see table below).

Option	Steel Blend	Package Carbon Intensity (kg CO_2/m² GIA)
Base Offer	70% EAF / 30% BOF	104
Aspirational 1	70% XCarb / 30% EAF	98
Aspirational 2	80% XCarb / 20% EAF	88
Aspirational 3	100% EAF	87
Aspirational 4	95% XCarb	76

William Hare proposed a solution whereby 95% of hot rolled steel was procured as XCarb® RRP, supplemented by increased (EAF) steel for the remaining elements (only 1.7% of blast furnace steel). William Hare worked closely with ArcelorMittal to align rolling schedules with project material and programme requirements from an early stage. This pragmatic, risk-managed strategy enabled the team to reach ambitious carbon savings while ensuring a robust procurement route.

As mentioned above, further carbon optimisation was achieved using Magnelis-coated steel coil for the decking, which offers enhanced durability. The replacement of the initial re-entrant deck with a trapezoidal deck decreased the manual-handling weight and temporary works considerations, avoiding potential additional propping. William Hare mitigated these issues by utilising their established supply-chain relationships to process Magnelis coils through the existing rolling mills, followed by fabrication at UK-based decking partners. This enabled off-site cutting and processing, preserving construction productivity and eliminating programme or buildability constraints.

This integrated, supply-chain-led approach demonstrates how early technical collaboration can deliver measurable embodied carbon reductions, while maintaining commercial and construction certainty for complex, large-scale projects. The project has been successful, where a procurement of 88% of XCarb® for steel rolled sections was achieved.

The steelwork achieved an 87% reduction in emissions compared with the equivalent quantity of industry-standard steel, saving 52 kgCO_2e/m² GIA (A1-A3) from the overall project Whole Life Carbon Assessment. A further reduction of 7 kgCO_2e/m² GIA from the transport (A4) was realised, because the XCarb® steel was transported through Europe by rail, compared with road which is typical for 'average' UK steel.

- In Q3 2020 (RIBA Stage 2), early engagement with SRM and William Hare focused on demountable construction and programme.
- During 2021 (RIBA Stage 3), early advice on recycled steel was provided from February, followed by further engagement including a presentation to SRM and British Land in April 2021.
- Throughout Q1-Q2 2022 (RIBA Stage 4), early advice on sustainable steel was delivered, alongside a visit by British Land, SRM, and William Hare to ArcelorMittal Luxembourg.


© Jad Sylla

Figure 13: © Sir Robert McAlpine

Steel reuse

Circularity has been a key part of the sustainability story at 2 Finsbury Avenue. Sir Robert McAlpine oversaw the demolition of the existing 2-3 Finsbury Avenue buildings, which allowed an opportunity for material recovery, return and re-use in the new building.

Strategic innovation consultants GXN were commissioned by British Land to develop a sustainability vision, which included conducting a detailed pre-demolition audit to identify key materials from the existing 2-3 Finsbury Avenue buildings for reuse or recovery. A circular economy statement and a first Upcycling Catalogue were produced which idenfitied the high value materials and outlined opportunities for transforming them for a second life.

In partnership with Ramboll Structures and Demolition Contractor Cantillon, SRM successfully managed to dismantle 98 steel beams from levels 4-5, totaling 26 tonnes of material. William Hare coordinated the deconstructed steel, working with Cleveland Steel to test, defabricate and deliver into their facilities for re-fabrication. With the audit trail in place, William Hare warrantied and CE marked the reused steel in early 2025, before installing it back into the new building at levels 26 upwards. Not only does this provide circular benefits, but it has also saved 27 tonnes of carbon (A1-A4) in total, as compared to average UK blend for rolled steel sections.

Fabrication considerations

From the outset, British Land and the wider delivery team set a clear ambition to address the carbon associated with all aspects of the steel scope, spanning procurement and fabrication. This drove a collaborative approach to influence design decisions and explore innovative "proof of concept" solutions aligned with circular economy principles. A strong design for manufacture philosophy was implemented in close coordination with William Hare, including the development of connection families optimised for automated production and bespoke node designs that reconcile aesthetic and functional requirements while minimising work content and welding consumables.

Innovative Design for Manufacture and Assembly (DfMA) strategies were also applied to bespoke elements to enhance prefabrication and efficiency. In parallel, early engagement with the fire strategy enabled optimisation of the intumescent coating. Opportunities were identified to reduce protective coatings by grouping beams based on their utilisation, removing it where applicable, thus allocating high-value finishes selectively. This integrated approach ultimately delivered measurable reductions in both embodied carbon and cost, while maintaining compliance with performance requirements.

Figure 14: © William Hare

In a nutshell, incremental gains in specification achieved the CO_2 target

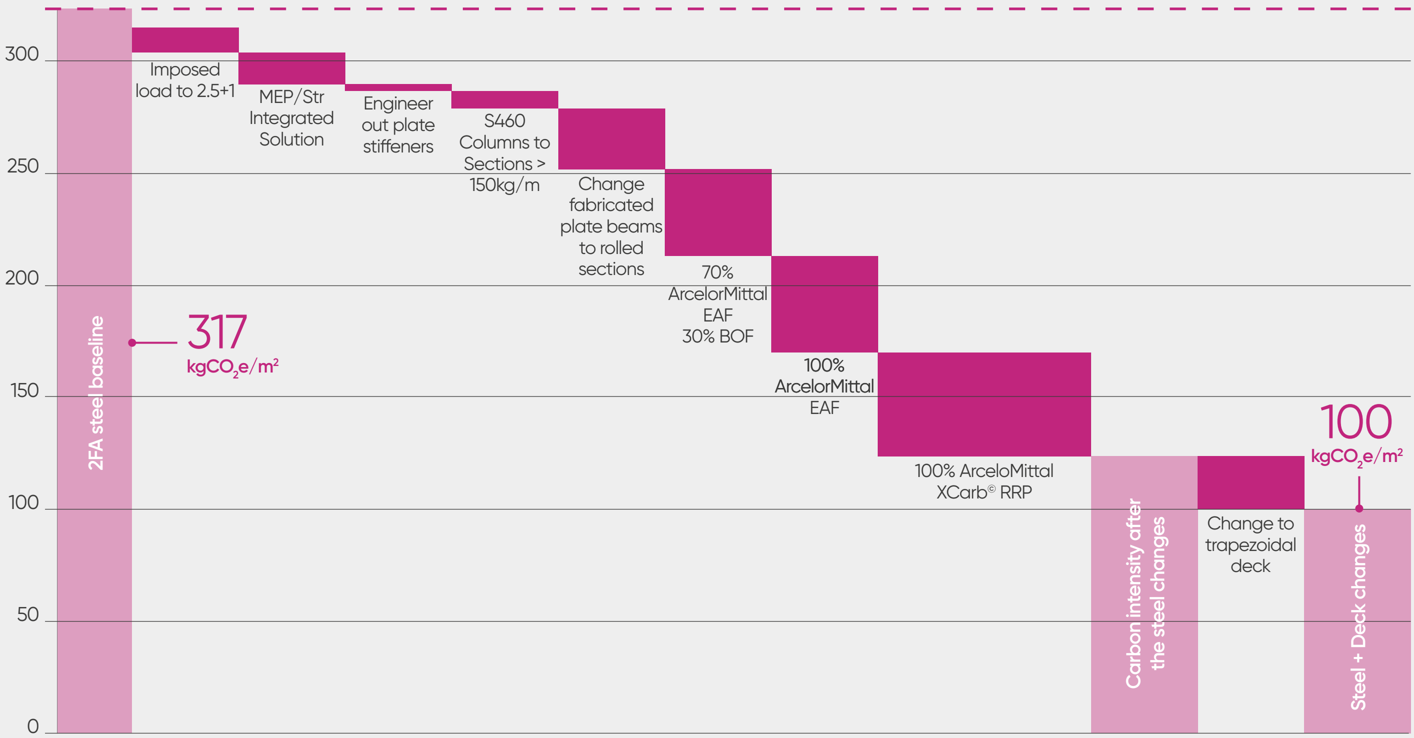
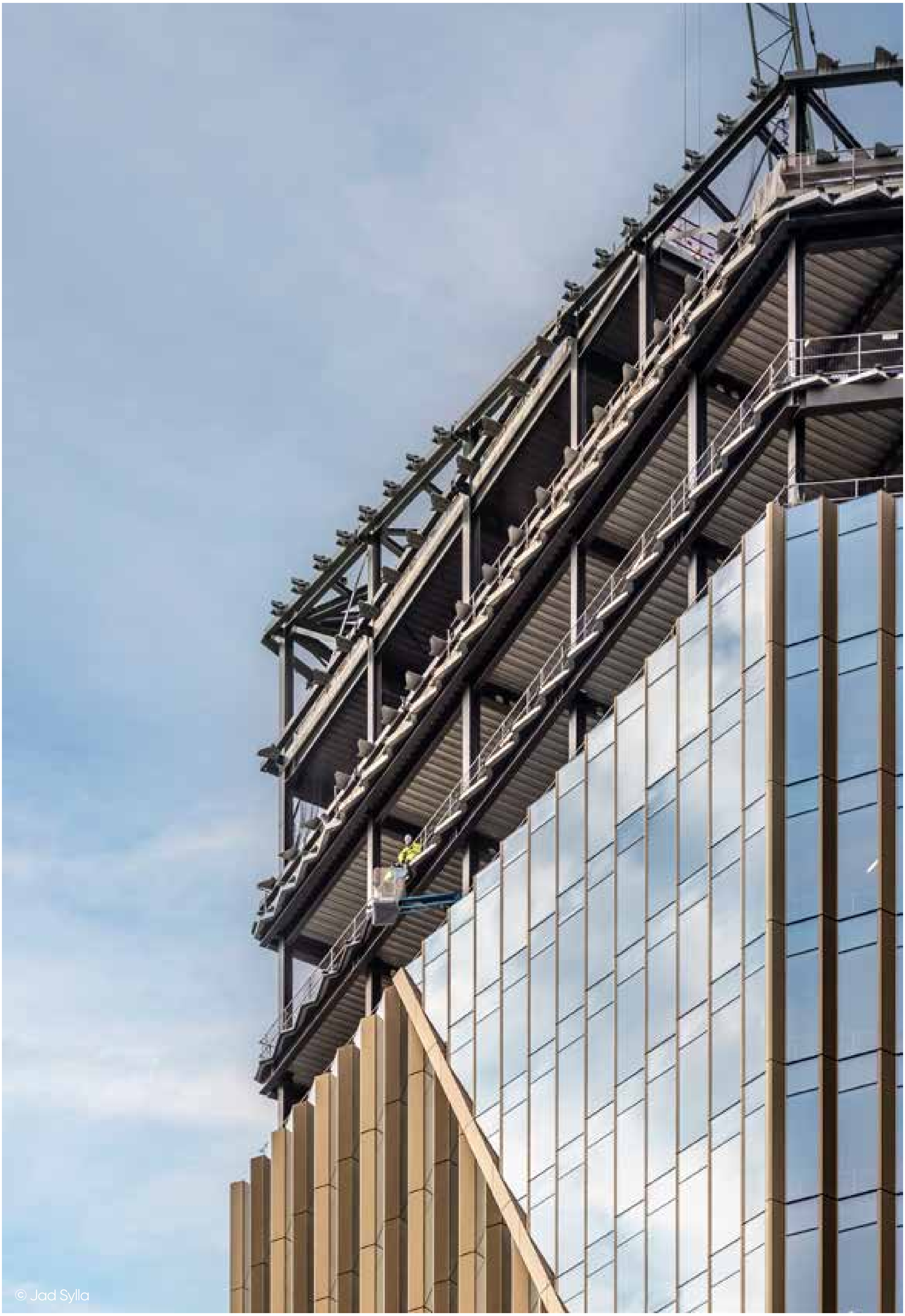


Figure 15: © Ramboll

Figure 15 summarises the benefits of the many actions taken by the project team, enabling the carbon baseline of 317 $kgCO_2e/m^2$ to be reduced to 100 $kgCO_2e/m^2$. Overall, 2 Finsbury Avenue exemplifies what can be achieved when ambitious client aspirations, strong engineering, early contractor engagement, steelwork contractor expertise and low carbon-emissions steel procurement are combined. The outstanding tower is an iconic addition, redefining the London Sustainable Skyline.

2 Finsbury Avenue is targeting BREEAM Outstanding, WELL Platinum, EPC A and NABERS 5-star certifications, setting a new benchmark for a highly sustainable workspace in London

© SRM – Sir Robert McAlpine



© Jad Sylla

ArcelorMittal Steligence®
24-26 Boulevard d'Avranches
L-1160 Luxembourg

steligence.engineering@arcelormittal.com