Victoria renaissance

A steel frame, largely sourced from EAF production facilities, is helping an office development in central London achieve its ambitious sustainability targets.

Located on the site once occupied by one of London's oldest and best known department stores, the UK's largest 100% electric, net zero carbon office development is taking shape.

105 Victoria Street was previously the home of the flagship Army & Navy store, which had operated from the site since the 1870s. The store closed in 2021 and the plot will now be occupied by a 16-storey steel-framed building that can boast the area's largest ever pre-let agreement.

A finance firm is moving from Mayfair to make 105 Victoria Street its new London headquarters. The firm is taking 12,541m² across five floors at the ultra-sustainable building.

The future tenant's commitment to Victoria is said to reflect an anticipated, emerging shift in the market of occupiers looking beyond their historical locations for office space that supports their sustainability, recruitment and retention aims.

Alexander Morris, Managing Director at BentallGreenOak, says: "Our team is committed to providing premium workspace for the next generation of occupiers, who expect strong sustainability credentials and top-tier facilities as standard. Beyond this, it was crucial to us to partner with occupiers aligned with our environmental, wellbeing and social sustainability strategies, which have been the guiding principles of this development."

Starting at ground floor, the steel-framed structure sits atop a two-level concrete basement and is designed around a regular grid pattern, with minimal internal columns and spans of up to 14.5m-long, providing the open-plan office spaces modern-day clients want.

Two cores, east and west, rising to floors 11 and 15 respectively, provide the steel frame with its structural stability.

The height difference also forms a stepped design, whereby each floorplate decreases in size – east to west - creating a terrace on all the upper levels. Above the uppermost offices at level 15, there is a final outdoor zone that accommodates the plant.

Targeting BREEAM 'Outstanding', EPC A and WELL Platinum, the building includes 2,322m² of green space and terracing. These start at the eleventh floor, which is the largest outdoor area and includes a 200m 'walk and talk' track for on-the-move meetings and an allotment that will allow the building's restaurants to grow their own vegetables.

Throughout the steel frame, beams with bespoke cellular openings, to accommodate the building's services within their depth, have been used. These sections also support precast flooring planks, which typically measure 2,400mm × 9,000m and weigh up to 8t each.

"This flooring solution was chosen as it offers adaptability and creates the desired clean and smooth soffit, as the underside of the precast planks, as well as the beams and services, will be left exposed in the completed scheme," says Skanska Construction Director Rohit Gorasia.

As carbon is one of the main drivers in the scheme's design, another sustainable credential is being achieved with the sourcing of the steelwork. The majority of the beams and columns have been sourced from Electric Arc Furnace's (EAF) production facilities. This material is considered to be much greener and more efficient in terms

The steel frame is stabilised by two concrete cores.

FACT FILE
105 Victoria Street, London
Main client: **BentallGreenOak, Welput**
Architect: **Kohn Pederson Fox, Adamson Associates**
Main contractor: **Skanska**
Structural engineer: **AKT II**
Steelwork contractor: **Severfield**
Steel tonnage: **5,300t**

The steel design incorporates terraces on all of the upper floors.

One of the feature fish-belly beams is lifted into place.

With Buckingham Palace in the background, 105 Victoria Street sits at the heart of the area's commercial zone.

of energy consumption for the production process than the more traditional Basic Oxygen Steelmaking (BOS).

As well as fabricating, supplying and erecting the steelwork, Severfield is also installing the precast flooring planks. Both the steel sections and planks are being lifted into place using the site's four tower cranes. The project has two pit lanes for deliveries, along the north and south elevation, which were used to supply the materials to the cranes for installation.

"Sequencing has been a key consideration for our erection programme," says Severfield Project Associate Director Michael Bryars. "Having divided the project into four zones, we erect two floors of steelwork in each area before moving onto the next zone.

"Once the two levels of steel are installed, we place the precast planks into position. Anymore steelwork than two floors would make it difficult to manoeuvre the precast planks into position."

Installed during the early part of the steelwork programme, four fish-belly transfer beams were the only steel elements that have been too

▸ 20

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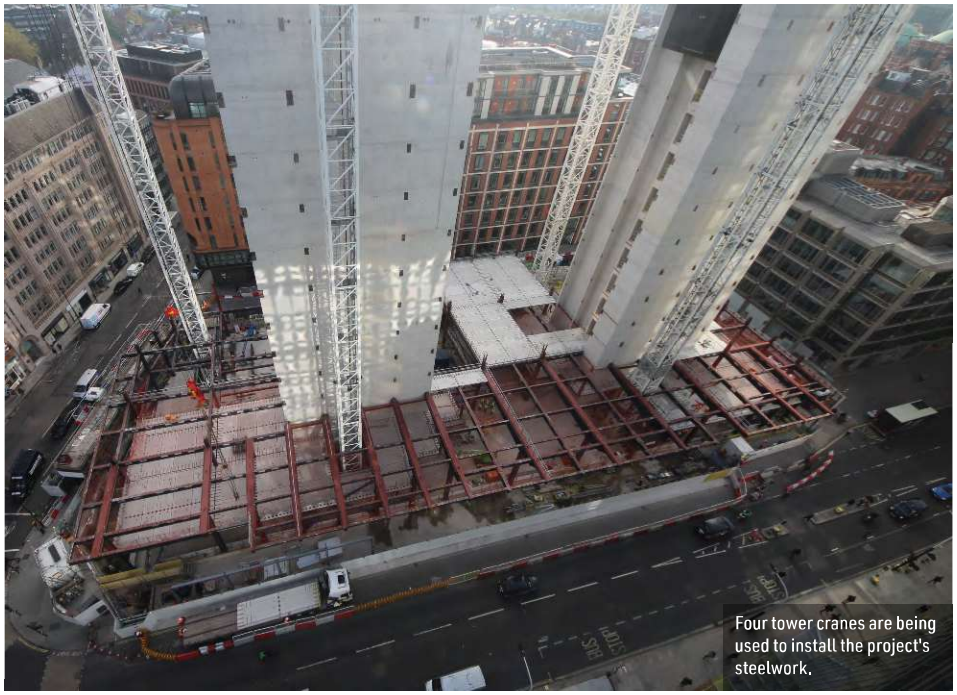

Four tower cranes are being used to install the project's steelwork.

The fish-belly beams create a triple height entrance area along the Victoria Street elevation.

▸19 heavy for the tower cranes to lift.

Measuring 17.5m-long × 2.8m-deep and weighing 30t each, the beams are the largest in a series of members that are positioned at the underside of the second-floor level along the building's main north elevation.

In order to lift the four beams into place, a 300t-capacity mobile crane had to be brought to site and set-up in within the delivery pit along Victoria Street.

The series of fish-belly transfer beams help form and support a 3m-wide cantilever, for all of the upper floors along the Victoria Street elevation. This creates a pedestrian colonnade along the building's northern elevation, while inside the structure, the beams create a triple height ground floor space adjacent to building's main entrance.

This large open ground floor space will accommodate numerous retail units set around a 'Village Square' which will be open to the general public.

On the south side of the ground floor, there will also be a large feature spiral cycle ramp and central staircase leading to the basement gym, a cycle shop for repairs, secure bike parking, showers and a drying room for use by cyclists, walkers and runners. These facilities will wrap around a multipurpose arena and auditorium to be used for sports, PE classes and business events.

105 Victoria Street is due to complete in Summer 2026. ■

'Fish-belly' beams

The description of "fish-belly" beams used at the Victoria Street development is a rather disingenuous description of carefully designed and fabricated members weighing up to 30t each. David Brown of the SCI comments on the use of web-tapered fabricated members.

The "fish-belly" beams are web-tapered fabricated sections acting as a continuous member over a column support. With the deepest section at 2.8m, the beams are clearly carrying a substantial bending moment from the 3m cantilever. Connecting a cantilever to a column would be a challenge, so to make the member continuous with a back span to balance the cantilever moment is a fine structural solution. When rolled sections do not have sufficient resistance, a fabricated member can be considered. Tapering both the cantilever and back spans as the bending moment diminishes is an economic solution to reduce the member weight and embodied carbon.

With very deep members, web buckling is likely to be a design constraint, so web stiffeners are expected where the shear is high. Web stiffeners may also be required at positions where subject to concentrated load and where the flanges change direction, since there is a component of the flange force in or out of the web.

When members are positioned on the top of columns (as opposed to the usual situation of the column being continuous) care must be taken to ensure the member is stable – that the top of the column cannot be displaced. At Victoria Street, a substantial stub has been welded to the underside of the member and web stiffeners aligned with the column flanges below. The stub is connected to the column below with very substantial splices, providing the necessary continuity between the column and the fabricated member.

Lateral torsional buckling of tapered members with compression in the bottom flange might be imagined to be a challenge, but software such as LTBeamN allows designers to model tapered members to determine M_{cr} with restraints to one or both flanges and various support conditions.

With the current emphasis on low embodied carbon, web-tapered fabricated members ought to make a welcome return to the designer's portfolio – not just for special cases such as at Victoria Street, but for more orthodox situations when unnecessary resistance can be removed. P449 offers more advice on web-tapered members and includes an example of a stepped change in profile, also as used at Victoria Street. ■