FACT FILE
25 Moorgate, London
Main client: **Barings Real Estate**
Architect: **Morrow + Lorraine**
Main contractor: **Blenheim House Construction**
Structural engineer: **Heyne Tillett Steel**
Steelwork connection designer: **Peter Dann**
Steelwork contractor: **HBE Services**
Steel tonnage: **200t**

Steelwork creates outstanding results

Following on from the previous article, another City of London office block is aiming to achieve the highest sustainability ratings once a major refurbishment is complete.

Central London has become a hotbed for refurbishment projects as the carbon savings and sustainability benefits drive the sector forward.

Reconfiguring and extending an existing structure has become commonplace, and invariably seen as a cost-effective alternative to the complete demolition of the building.

Steel-framed structures have proven to be ideal for this type of scheme, as new steel floors or extensions can be bolted to the existing frame, while the material's lightweight attributes quite often allow the foundations to be reused.

An example of this low-carbon refurbishment trend is currently taking place at 25 Moorgate in the City of London, where an existing seven-storey steel-framed office block is being converted into a modern nine-storey commercial building. In recognition of the scheme's sustainability credentials, the project is aiming for BREEAM 'Outstanding', which is the highest available rating.

Designed by architects Morrow & Lorraine, the project involves adding two new floors to the top of the building, reconfiguring the core, strengthening works to the existing frame as well as various additional steel elements to the façade and in the basement.

Prior to adding any new steelwork to the structure, the design team first had to ascertain whether the existing foundations would be sufficient to be reused in the scheme.

"The building is only 20-years old, but the records showing how deep the piles are, were not readily available," explains Heyne Tillett Steel Associate Richard Nuttall. "So, a load analysis was undertaken to determine the net change in foundation loading to verify re-use of the existing structure.

"These values were checked against the original design loads, which were stated on archive drawings, with the maximum increase being 15%. Parallel seismic testing was used to verify the depth of the most highly loaded pile, which was then used by the project's geotechnical engineer to back-calculate the pile's capacity based on the known soil conditions. This testing was carried out during the main basement works, where new lift pits and below ground drainage trenches were formed."

Once this preliminary work was complete, the foundations were confirmed to be of a sufficient depth, as well as having the capacity for the new steelwork elements. A bit of a design balancing act has also been achieved, with modern BCO requirements allowing for a reduction on the floorplate live loading, which allowed the increase in loading from the two-storey vertical extension to be offset.

Two new steel-framed floors are being added to the building.

Terraces with plenty of greenery are a feature of the new 25 Moorgate scheme.

"We always design for an onsite bolted connection, as it helps with prefabrication of the steel elements and it has safety benefits."

New steel beams and columns form terrace extensions on some upper levels.

The core has been reconfigured to accommodate four lifts.

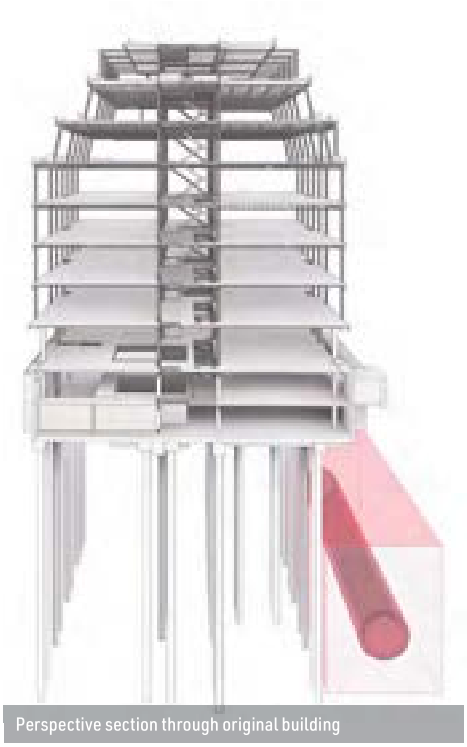
Before the steelwork programme started, some demolition work had to be undertaken by the main contractor. This included removing a rooftop plant deck and the partial demolition of the centrally-positioned steel-braced core.

As the new building will have dual-access, from Moorgate and the adjacent Coleman Street, the four lift shafts have been rotated by 90 degrees within the reconfigured core, creating a more efficient ground floor lobby.

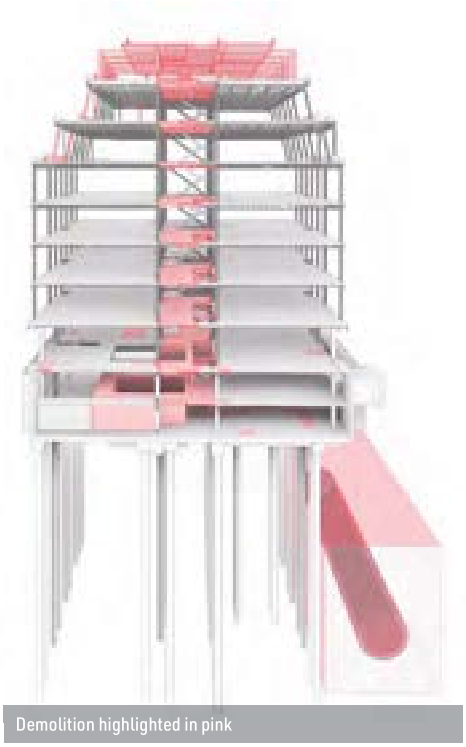
As the initial programme was being undertaken, a deck was installed at first floor level that allowed steelwork contractor HBE Services to work simultaneously at ground floor and in the basement, while work in the core was being undertaken on the levels above.

This had programme benefits and also allowed HBE to deliver and manoeuvre all of the steel sections into the basement, before other trades started working at ground floor, when access would have been far more challenging.

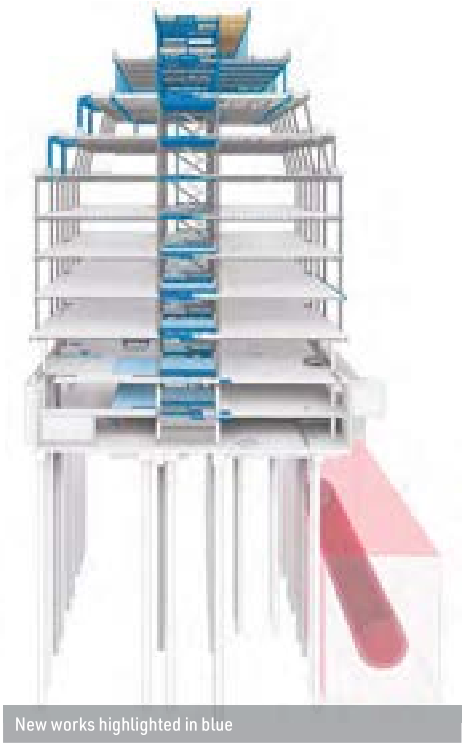
The building's basement was previously used as a car park, but it is now being converted into a cycle storage area with changing facilities.



Perspective section through original building



Demolition highlighted in pink



New works highlighted in blue

▸19 Creating some extra space, steelwork has formed a new floor in a basement area which was previously a double height plant space.

Once the basement steelwork was installed, the erection process moved to the existing upper floors. New steel beams were installed to reconfigure the core, while some bracing elements were also moved.

Vertical bracing was relocated at ground floor to suit the new architectural layouts, resulting in existing column lines being strengthened with welded 12mm plates to resist this additional vertical load.

Peter Dann Associate Andrew Gilbertson (the company has been employed by HBE to design the project's steelwork connections) says: "We always design for an onsite bolted connection, as it helps with prefabrication of the steel elements and it has safety benefits.

"However, the location will dictate what connection is used and consequently we've had to use some welded connections on this project, where bolts could not be installed."

Elsewhere, within the existing floorplates, some down-stand beams have had their service penetrations infilled with steel strengthening plates, as these members are now used as transfer structures, supporting columns from the new upper floors.

"The steel columns for the new floors are mostly erected around the existing grid pattern, but as there are steps along both of the main elevations, some transfer beams have been needed," explains HBE Services Operations Director Stuart Ellis.

Enhancing the projects sustainability goals, the new scheme will feature terraces on every level from fifth floor upwards. They will have planted areas, creating welcoming break-out spaces for the tenants.

On levels five and six, the existing floorplates have been enlarged into the terraces, with a couple of extensions. Matching the mansard design of the building, these extensions have been formed with the installation of new steel columns and connecting beams.

The majority of the steel columns, forming the two new upper levels have a bolted connection to an existing column below, which has been made via a bespoke detail that penetrates the roof slab.

The new upper levels will accommodate two levels of offices and plant, arranged around generous outdoor areas. As the two-level plant deck will be exposed to the elements, it has been formed with galvanized steel members.

25 Moorgate is due to be complete by mid-2025 ■

25 Moorgate

Refurbish, extend and reconfigure are key words at 25 Moorgate, meeting the IStructE objective of "build less". David Brown of the SCI comments on some aspects of the project.

Most designers will have read the IStructE guide "Design for zero" – essential reading for all involved in construction. The objective is to recognise a designer's responsibility to minimise greenhouse gas emissions, "making carbon as important as safety in our calculations".

Some might bristle at the implication that anything can approach safety as the first priority, but the statement demonstrates the importance of minimising carbon. The 2023 IStructE guide *'Circular economy and reuse: guidance for designers'* (also essential reading) presents a hierarchy of design actions, which commences with "build nothing". If construction is to proceed at all, then the first priority – with the greatest impact – is to repurpose, refurbish and reuse, as demonstrated at the 25 Moorgate project.

Reviewing the imposed load on the floors was clearly important to allow the addition of two new floors. Research has shown that many designers still allow for 5 kN/m² for offices, when the UK National Annex and the British Council for Offices (BCO) both specify 2.5 kN/m². Reducing the imposed floor load by 50% makes a huge difference to the entire structure, including the foundations. The reason for using the higher load is usually to allow for future change of use, but as the IStructE guidance observes, the future is unknown. The recommendation is to adapt and strengthen if necessary in the future – the solution adopted at 25 Moorgate, demonstrating this approach is entirely possible.

It is common for designers to add a further 1 kN/m² for moveable partitions. Good designers will know that value does not appear in BS EN 1991-1-1, and use a value of 0.5, 0.8 or 1.2 kN/m², depending on the weight of the partitions. Use of lower values might be seen as only a modest reduction in load, but every little counts in the drive to reduce embodied carbon.

Looking to the future, perhaps some guidance on methods of strengthening and how to allow for the existing stresses might be helpful. More immediately, the British Constructional Steelwork Association has sponsored a guide on designing steel structures to minimise embodied carbon, which should be available in the next few weeks. ■