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Edited and written by **Martin Cooper**

## Industry Report

# STRUCTURAL STEELWORK IN ACTION

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# TOWER POWER

The City's tallest tower has presented a series of engineering challenges to designers and contractors installing its structural steel.

**T**opping out at 62-storeys and 278m-tall, Twentytwo at 22 Bishopsgate is the City of London's tallest building, and second only to the Shard in western Europe.

Although the project is still under construction – it is due for completion at the end of the year – the building is already a landmark structure as it towers over the Square Mile's other skyscrapers.

As one would expect, there is a host of large numbers connected with this mammoth superstructure. It contains 17,000t of structural steelwork, a total which required more than 14,000 individual crane lifts to install. Holding it all together are 300,000 bolts and forming the floors, there is 170,000m<sup>2</sup> of metal decking.

The new development is being built on the plot of the previously stalled Pinnacle scheme. It incorporates the below-ground elements of its predecessor, including three floors of basement and a raft slab supported on piled foundations.

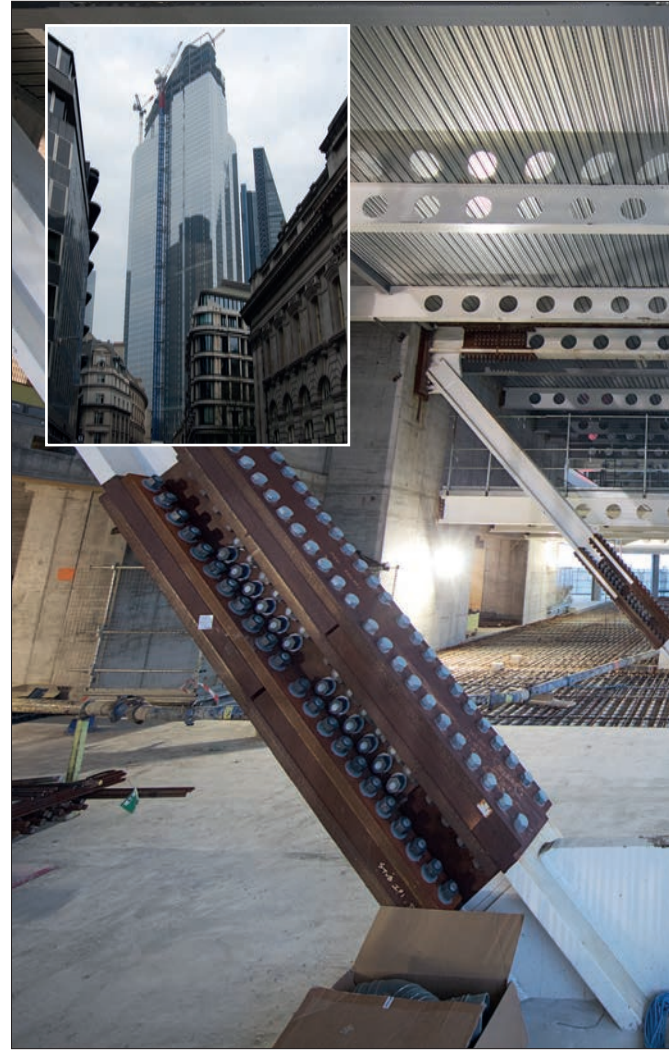
From ground level upwards it is a steel framed structure surrounding a large central core, with minimal internal columns ensuring long clear spans of up to 17m. Twentytwo will eventually offer an impressive 118,000m<sup>2</sup> of flexible workspace for all sizes of businesses.

The building will be the first of its kind to house a food market, while other amenities will include an innovation hub, gym, wellbeing retreat and spa, a restaurant and London's highest free public viewing gallery.

Constructing one of Europe's tallest structures on the site of a previous scheme was always going to throw up a few snags.

## KEY FACT

**17,000t**  
Amount of  
structural  
steel used



“Reusing the foundations was the project's biggest challenge,” says WSP project engineer Diego Padilla Philipps. “In the end, we reused 100% of the existing piles, although some are not in the most convenient positions for the new structure.”

In order to remedy this pile position challenge, transfer structures have been introduced at basement level and level two to support columns that do not have a pile directly below them.

The basement level transfer structure is a 15m-long plate girder weighing approximately 97t, which supports a single column that extends up to the full height of the building.

Meanwhile, the level two transfer structure is another giant steel member that also transfers loads from perimeter columns. This plate girder weighs in excess of 100t and is 14m-long.

An existing access route to the basement loading bay meant that steelwork contractor Severfield had to design, fabricate and erect a structure dubbed the “Rhino” truss because of its shape.

“This is circa 150t in weight and was erected using two tower cranes. We had to get a special dispensation from the manufacturer to uprate the cranes for the erection of this truss,” explains Severfield project manager Kyle Fletcher. “It is made up of site bolted booms, nodes and diagonals, with



## PROJECT TEAM

**Project:** Twentytwo, 22 Bishopsgate, London  
**Main client:** AXA IM – Real Assets and Lipton Rogers Developments  
**Architect:** PLP Architecture  
**Main contractor:** Multiplex  
**Structural engineer:** WSP  
**Steelwork contractor:** Severfield

Above: Steel outriggers at levels 25 and 41 add extra structural stability

the heaviest node weighing approximately 20t.”

In order to maximise the building’s floor space and help the remainder of the perimeter columns locate on existing pile positions, the structure’s lower columns, up to level 7, are mainly inclined.

As the columns are raking outwards, there are some large structural reactions and transfer forces. To counteract this, the floor beams are slightly larger on these levels and installed in a diagonal position, as opposed to being perpendicular to the core.

Like most UK high-rise commercial buildings, the superstructure comprises a composite design of cellular beams supporting metal decking and a concrete slab. This provides a diaphragm action restraint to the perimeter columns.

## “ Reusing the foundations was the project’s biggest challenge. In the end we reused 100% of the existing piles

The centrally positioned core contains 35 lifts, providing direct access from the entrance lobby to all levels. Squeezing so many lifts into one core, without intruding on any of the valuable floor space, meant a long slender core design was chosen.

Consequently, the core cannot provide the necessary structural stability for the superstructure’s steel frame during high winds. This has required the installation of two giant outrigger stability systems positioned on two intermediate floors, adding some stiffness to the building and controlling sway and acceleration.

Padilla Philipps uses a skiing analogy to describe the work the outriggers perform. “If a skier has his arms straight down by his sides, there is very little stability. However, by introducing poles with arms outstretched one can maximise stability.”

Positioned at levels 25 and 41, both of which are double-height floors containing plant equipment, the outriggers are large floor to ceiling V-shaped trusses that link the core to the perimeter columns and provide bracing.

There are three sets of outrigger trusses on both floors, all of which extend from the building’s east elevation, through the core and then connect to the west perimeter columns.

They were fabricated and erected in sections to form trusses typically made up of a top and bottom boom, plus internal diagonals.

The internal diagonals are installed with the bolts pinned in oversized holes to allow movement in the truss when the building deflects with axial shortening under gravity loads during construction. These do not become “active” until the building is fully loaded, at which point they are tightened.

The trusses vary in size depending on their locations, but the largest is approximately 15m by 7.6m, when fully assembled.

Installation of the final steel beam at the end of March was the culmination of over two years’ work, which began when Severfield placed the project’s first column in January 2017.

Commenting on the successful conclusion of the steel erection programme, Multiplex project director Andrew Feighery said the work had gone remarkably well, considering the unique challenges of a such a tall building.

He also pointed out that the amount of steel in the structure is twice what went into the Eiffel Tower.

Fletcher adds: “It’s not all that often you are presented with the opportunity to work on a project of this scale, and it was a great, landmark moment to erect the last piece of steelwork.

“A project of this scale in the centre of London possesses a variety of inherent and unique challenges, which, due to the skillset and experience of all involved, did not affect our ability to deliver to programme with an outstanding safety record.”

# LEARNING FRAMEWORK

A steel frame design has been adapted to allow developers to change an office development into student accommodation



**A** steel framed residential scheme is set to add some much-needed accommodation for Aberdeen's large student population. Known as the Triple Kirks, the project comprises three interlinked blocks (11, 12 and 13-storeys high), offering 337 en-suite accommodation units and ancillary facilities, that wrap around a spire dating from the 1840s.

The spire once served three separate churches, hence the Triple Kirks name. These structures fell into disrepair a long time ago and when developer Dandara purchased the site only the protected spire remained.

Alongside the construction programme, restoration and refurbishment work is being undertaken to the spire so that it will become a feature element within the completed development.

The building was initially to be redeveloped as a Grade-A office building, but changing market conditions led to the decision to transform it into high-end student accommodation, helping to deliver a key element of the city's new masterplan – by providing people the chance to live as well as work and study in the city centre.

The Triple Kirks' apartments will regenerate the former religious site and fit seamlessly with Aberdeen City Council's vision for the rejuvenation of the Denburn valley area. At the same time, it will deliver a vital boost in the availability of student accommodation – as Aberdeen has been suffering from a critical shortfall for decades.

Explaining the design, Dandara engineering director Greg Kerwick says: "The project was always going to be steel framed, whether an office or student accommodation. On a tight and constrained site like this

## KEY FACT

**600t**  
Amount of  
structural  
steel used

steel has the advantage of being fabricated offsite. This results in far less material on the footprint, as it is brought to site and erected immediately. It is also quick to erect which is something we like."

Altering the design from a commercial office block to a residential building did, however, mean a rethink of the steel frame. The office was conceived as a braced frame, but the accommodation block's design contains many more windows along each elevation, meaning there is no room for traditional cross-bracing.

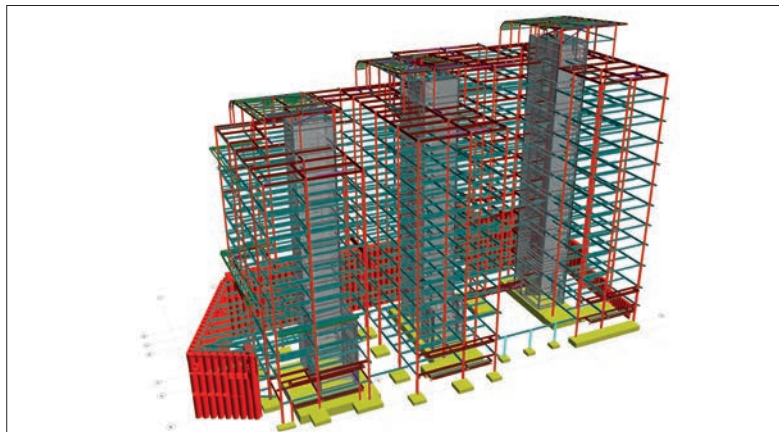
The solution was to install three jump-formed concrete cores, one for each of the conjoined blocks, and use these for the overall structural stability instead of bracing. Radiating from the cores, the floors are then formed with a composite design using metal decking and a concrete topping supported on steel beams.

Before steelwork contractor EvadX started onsite, Dandara had prepared the site by installing the cores and pad foundations, demolishing some remaining church walls and, importantly, constructing a 10m-high continuous flight augur piled retaining wall along three sides of the site's footprint.

The site sits at the bottom of a slope with ground level access from the B986 dual carriageway, one lane of which has been closed to create a delivery yard. To the north and east of the site, Schoolhill and a smaller thoroughfare, Belmont Street are actually 10m higher.

This means that what is essentially ground floor level is referred to as Level -3, with the ground floor being the main entrance along Schoolhill.

Working out how to support the retaining wall during the construction process was another challenging aspect



## PROJECT TEAM

**Project:** Triple Kirks, Aberdeen  
**Main client:** Dandara  
**Architect:** Halliday Fraser Munro  
**Main contractor:** Dandara  
**Structural engineer:** Dandara  
**Steelwork contractor:** EvadX

of the scheme due to the confined nature of the plot. Once the steel frame, which ties into the wall for its three lowest levels, was complete, the wall had full support. Up until that point a series of 356UC steel props had been installed. These large steel members each absorbed approximately 2,000kN of load from the wall.

“There wasn’t room for hydraulic props, so using steel beams was the best option as the steel frame and floors can be built and cast around them,” says Kerwick.

“Once the steel frame had been erected, the beams were cut up and removed in pieces, with the holes in the floors then filled in.”

The steel frame totals 600t, but the piece count is very high, as there are no particularly long spans, with no beam longer than 6.5m. The grid pattern is also very irregular, as it has to encompass three different room sizes, all of which are present on each floor, as well as amenities such as a gym and reception area.

Typically, the design has a central corridor with accommodation units situated either side. Blocks one

Left: Steel’s flexibility came to the fore as the design was easily changed from a commercial block to a residential scheme

Top right: Three cores supply the frame’s stability

Bottom right: Visualisation of the completed project

“There wasn’t room for hydraulic props, so using steel beams were the best option as the steel frame and floors can be built and cast around them

and two sit to the north of the spire and block three is positioned to the south. Two and three are linked via a narrow corridor structure that wraps behind the spire.

The new building never touches the spire, and open courtyards on either side of it allow natural light to penetrate the student units that face the retained feature.

“We used pretty much the entire footprint of the site for the new building, excluding the area around the spire, and consequently there was no room to position a mobile crane,” says Kerwick. “All of the steel was erected via two luffing jib tower cranes which have been installed within the steel frame’s footprint.”

“Once the project nears completion the cranes will be dismantled and the gaps within the frame will be simply in-filled with metal decking, similar to the procedure necessary for the large props.”

Dandara envisages that Triple Kirks will become Aberdeen’s premier student accommodation site, housing a number of live/study and overseas residents, helping to address a well-documented shortfall of rooms.

# ACTION STATION

The former Eurostar terminal at Waterloo station, is being revamped with a new section of roof, requiring a high degree of complex design work.



**T**he former Waterloo International rail passenger terminal at the western side of London's Waterloo station is being revamped to accept domestic train services and accommodate shops, bars and restaurants.

The structure fell out of use when London's Eurostar terminus moved from Waterloo to St Pancras International in 2007. It is now undergoing a major refurbishment, which includes preparing the five platforms to accept domestic train services.

A two-storey shopping and leisure complex will be situated in the former Eurostar arrival and departure lounges, beneath the platforms.

Improving access around the Waterloo station concourse is also ongoing and this work includes the construction of a steel roof that now covers the gap between the original Victorian-built Waterloo station canopy and the adjacent curved and glazed roof of the Waterloo International terminal structure.

"Previously there was no need for this infill roof as passengers would have entered the Eurostar terminal at a lower level where a now dismantled canopy sheltered them," explains Wessex Capacity Alliance engineering manager, Chris Kitching.

"We have now installed a new composite steel bridge, which will allow passengers to access the revamped terminal at platform level and this is why the high-level infill roof was needed."

Bourne Steel divisional manager Andy Davies adds: "In simple terms, the infill roof is a rectangular steel framed box, tapered along one side to accommodate the shape of the Waterloo International structure and over-sailing the two station roofs."

## KEY FACT

**300t**  
Amount of structural steel used

The new roof structure is 52m long by 18m wide and 26m high at the western end. It is 21m high at the eastern end and is supported at either end by steel framed and glazed gable walls.

The eastern gable wall is supported by Waterloo's 1840s-built masonry walls, but otherwise, the new structure is self-supporting. It sits within millimetres of the Waterloo International roof and the adjacent 19th century Waterloo roof, but does not touch either.

A steel framed solution was the only viable design for the project. A lightweight structure was needed because no foundations could be installed to support it. Piling the site was impossible as a number of tunnels as well as Waterloo station's underground ticket hall sit beneath the site.

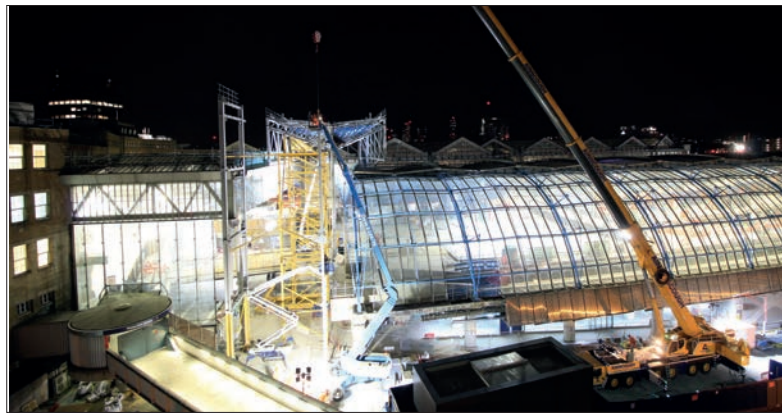
"The entire roof structure including glazing is only 400t," says Kitching. "But however light this may be, we still needed to work out where the loads could be transferred to and if we could free up any capacity from the existing structures."

The solution involved nifty juggling of loads and required the buffers in the Waterloo International structure to be moved 50m down line. This was feasible as domestic trains are shorter than Eurostar trains. So by moving the risk of train impact away from the new roof, nearly enough load capacity was found for the new structure.

"Nearly" is the operative word, as the roof still needs two 508mm diameter circular hollow section (CHS) columns to support it in the middle.

"Using circular columns means the steelwork is less harsh on the eye, and importantly, they have been located so they do not hinder the important views in the station concourse," adds Kitching.

The vistas which Network Rail is keen to preserve are



## PROJECT TEAM

**Project:** Waterloo station redevelopment, London  
**Client, architect, structural engineer and main contractor:** Wessex Capacity Alliance (Mott MacDonald, Skanska, Aecom, Colas, Network Rail Joint Venture)  
**Steelwork contractor:** Bourne Steel

the views of the Grimshaw Architects-designed Waterloo International arches above the former Eurostar terminal tracks, and Waterloo's listed Victory Arch and stairs at the station exit.

As well as providing additional support to the roof, the CHS columns allow the structure to have a central area with a 26m clear span. However, as no foundations can be installed, the CHS members are founded directly on top of the Waterloo International platform slab.

Because of its propped cantilever design, the slab is subject to movement of up to plus or minus 100mm, so the columns are placed on bearings to allow for any shift, which would otherwise crack the new roof's glazing.

Forming the main span of the roof is a 52m long spine truss, which is 4.2m deep and weighs 27t. It was brought to site in three sections, with the longest element, which spans between the CHS columns, weighing 13.5t.

The central spine truss supports a series of eight pairs of gullwing trusses that sit perpendicular to the main structure, forming overhangs on either side. Each wing measures approximately 8.3m long by 4m deep.

**Left:** One of the roof trusses is made ready for erection  
**Right:** The working area was extremely tight, squeezed between the station and the adjacent offices  
**Below right:** Computer generated image of the completed roof

“The entire roof structure including glazing is only 400t, but we still needed to work out where the loads could be transferred to

Steelwork for the project was erected by a 300t-capacity mobile crane.

Keeping the frame stable during erection was one of the main challenges for steelwork contractor Bourne Steel. Due to the confined nature of the site, the structure was erected on substantial temporary works comprising two towers over 20m in height, a “planar” trestle and a temporary lattice girder spanning approximately 25m between the towers.

The temporary works enabled sequential erection from east to west and the installation of the gullwing trusses and roof steelwork, without the spine truss being fully complete. The temporary towers and truss also allowed the wing trusses to be set at the correct level before de-propping, when the building load was transferred to the feature columns.

This was exacting work as Davies explains: “Each gullwing truss had to be in an exact pre-set position before the frame was de-propped and the glazing was installed, so they needed to be individually surveyed, checked and then released by our designers before the erection sequence could continue.”

The new roof was completed early this year.

# READY TO LIFT OFF

A steel framed terminal extension, featuring internal spans of up to 36m, is the centrepiece of Manchester Airport's Transformation Programme.



**R**anked as the third busiest in the UK, Manchester Airport is currently undergoing a large-scale expansion programme that will ensure it maintains a position at the heart of the north of England's transport network.

Known as the Manchester Airport Transformation Programme, the scheme, which began in July 2017, consists of an extension to the existing Terminal 2, the construction of a 3,800-bay multi-storey car park, a new baggage sorting hall and three new piers, one of which has a link bridge.

The Terminal 2 extension is the centrepiece of the project and is scheduled for completion in April 2020. The six-storey extension is 160m long, has a gross internal floor area of 86,500m<sup>2</sup> and will increase the terminal's overall size by 150%. The new structure has required just over 9,000t of steel, which equates to 9,000 individual pieces needing more than 130,000 bolts.

Founded on 1,345 continuous flight augur piles, the terminal's compositely designed steel frame is predominantly based around a regular 12m by 9m grid pattern. Three sway frames, which run the length of the extension provide the overall structural stability, while a movement joint cuts the building in half, alleviating any challenges associated with its length.

"It's a very complex steel frame and so the best design was to go with sway frames as opposed to stability-giving concrete cores," explains Laing O'Rourke project leader Tim Brown. "This method was also quicker as the steelwork was able to start being erected without us having to wait for any cores to be completed."

BuroHappold director Julian Sheppard adds: "The client

## KEY FACT

**9,000t**  
Amount of  
structural  
steel used in  
the terminal  
extension

“It's a very complex steel frame and so the best design was to go with sway frames as opposed to stability-giving concrete cores

was keen for us to minimise the number of movement joints, because they create operational issues, but this created a massive structural analysis challenge for us – how to analyse the steelwork with significant gravity and lateral forces including blast as well as controlling the enormous build-up of thermal thrusts and stresses, caused by the lack of movement joints.”

The solution was to adopt several analysis models for each primary load case, as these were more manageable. Then, the team wrote computer programmes to pull the separate analysis models together to create a combined model.

“This meant we were able to alter variables as the design developed and have the software easily process large amounts of data very quickly. This data processing technique proved essential in delivering the steel design to the tight programme,” says Sheppard.

The design also allowed William Hare to erect the extension in three sway frame strips. Beginning with the central frame, which was erected to its full height, the two adjoining areas on either side were then completed using a similar method.





## PROJECT TEAM

**Project:** Manchester Airport Transformation Programme  
**Client:** Manchester Airports Group  
**Architect:** Pascal and Watson  
**Main contractor:** Laing O'Rourke  
**Structural engineer:** BuroHappold  
**Steelwork contractor:** William Hare

## TRANSFORMING AN AIRPORT

As well as the Terminal 2 extension, structural steelwork has played a leading role in a number of other parts of the Manchester Airport Transformation Programme.

Of the project's three planned piers, the first one and its connecting 250m long link were recently handed over. It required William Hare to erect 1,650t of steel.

A steel framed baggage handling facility is being constructed adjacent to the existing terminal. Measuring 220m long by 14m high, this 33m wide single span portal frame required approximately 500t of steelwork.

Connecting the terminal extension to the new multi-storey car park, is a recently installed 45m long steel bridge. Weighing close to 100t, the structure was fully assembled offsite to minimise disruption. It was then transported to its final position using self-propelled modular transporters and then lifted into place by one 750t capacity mobile crane.

**Left: The terminal forms the centrepiece of an airport-wide expansion programme**  
**Right: All of the terminal's floors are compositely designed**

William Hare had up to 10 steel erection teams on site, each with its own dedicated crane. Having so many cranes on one site was logistically challenging, especially as they could not overslew the adjacent airfield or the operating Terminal 2 building.

The middle sway frame section of the extension accommodates three modular mega-risers, each

measuring 8m by 11m and containing many of the building's services.

Each riser consists of eight fully assembled modules, each weighing 8t. Once the central area's steelwork was completed, and before the side sway frames were erected, the modules were lifted into place through gaps left in the frame.

"We had to lift the modules into place in this way as a much larger crane would have been needed to lift the modules over and into the completed steel frame," says William Hare project manager Richard Branford.

"A lot of detailing had to be done on the steel modules and the bracketry they fit to inside the voids as there was only millimetres of clearance during the lifting process."

The overall layout of the structurally-independent extension mirrors the adjacent steel framed terminal building. Once construction is complete, the two will be connected, as various breakout zones will be formed in the existing partition to allow a seamless transition between the two structures.

The ground and first floor of the extension accommodate arrivals, the second floor is departures, and the third is the international departure lounge with retail units. The fourth mezzanine level has restaurants and VIP lounges, and the uppermost level is a plant zone. While the lowest three floors occupy the extension's entire footprint, the upper floors are set back and overlook the departures level.

Consequently, much of the departures zone is a triple-height 36m-wide column-free area. This is created by a series of 2.5m-deep trusses positioned at roof level. These large steel elements were brought to site in three pieces, assembled on the ground before being lifted into place as one 36m-long section.

The Terminal 2 extension is scheduled to open in April 2020.

# STORAGE SOLUTION

Steelwork is the ideal framing solution for distribution centres and one logistics park in the East Midlands is currently completing its third phase with the material.



Once renowned for its shoe making businesses, Northamptonshire has in recent times reinvented itself as the centre of the UK's distribution infrastructure. The county's geographic location in the heart of England is a key attraction, as is being close to the UK's main motorways and the area's good links to the port of Felixstowe via the A14.

This has helped the county to attract leading retailers and logistics firms, as well as branded food and consumer goods manufacturers, to set up distribution centres on its many purpose-built sites.

One of these is Warth Park, a 64ha logistics and business park, adjacent to the A45 near Raunds, where a third phase is now under construction.

The latest work includes two new steel framed distribution centres for Howdens Joinery (known as Units 2 and 3), which will add to the company's existing on-site warehouse (Unit 1), which was completed as part of Warth Park's phase two (*see box*).

Steel is the most commonly used framing solution for the construction of distribution centres and the material has a sector market share of approximately 90%.

The material enables the creation of large clear spans – crucial for today's modern distribution centres – easily and economically. Designers also like the fact that a steel frame can be easily modified, strengthened and extended if a user's future requirements change.

"There are always options when it comes to designing and building a warehouse, but the main reasons we've gone for a steel framed solution are cost and speed of construction," says Winvic Construction project

## KEY FACT

**3,250t**  
Amount of structural steel used

manager Nick Lakin.

"The steelwork for Unit 2 was erected in just nine weeks, which allowed us to get all of the trades, such as cladders and roofers, quickly on site to follow on behind the progressing steel programme."

Unit 2 is the larger of the two distribution centres, with a total area of 61,900m<sup>2</sup>, and its steel erection programme was completed slightly ahead of that of its neighbour, although both have an overall completion date of November 2019.

Measuring 314m long by 190m wide, with a maximum height to eaves of 16.3m, Unit 2 has five 38m wide internal spans and required a total of 2,200t of steelwork.

It will feature a total of 56 cross docks and 19 level access doors, while internally, it is sub-divided into three separate zones by two partition fire walls.

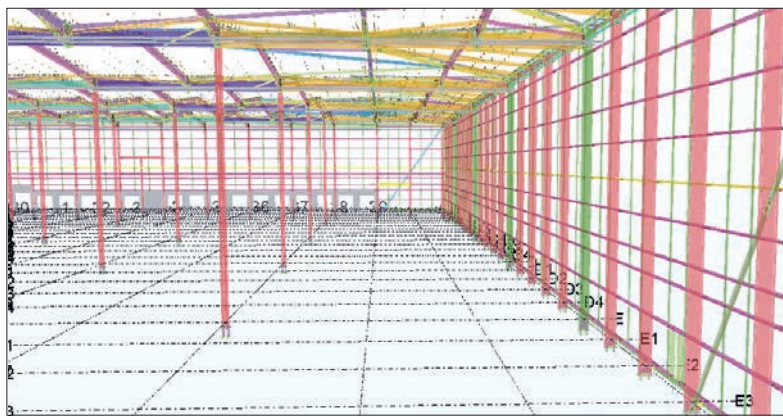
Within the footprint of the five span steel frame, the unit accommodates a three level office block positioned along one of its gable ends. Additional office space is also provided by an attached 370m<sup>2</sup> single-storey pod located alongside the northern elevation.

Providing 3,700m<sup>2</sup> of space, the three-level offices are based around a 7.5m by 7.5m column grid pattern. It measures 60m long and 22m deep and its beams support metal decking to form the two upper floors.

Externally, the majority of this gable façade (four spans) has glazed cladding, as opposed to the horizontal composite panels, which clad the other elevations. The glazing extends beyond the current length of the office block and adds some flexibility to the overall scheme.

"The extra glazing has been installed in case the client wishes to extend the office block in the future," says Lakin.

Project steelwork contractor Caunton Engineering has



## PROJECT TEAM

**Project:** Warth Park, Raunds, Northamptonshire  
**Main client:** Roxhill Developments  
**Architect:** UMC  
**Main contractor:** Winvic Construction  
**Structural engineer:** RPS  
**Steelwork contractor:** Cauntun Engineering

## PHASES 1 AND 2

Roxhill Developments first contracted Winvic in 2013 to construct new highways infrastructure and undertake a major cut and fill earthworks scheme to reprofile the site, which sloped up to 10m, to create plateaus for the distribution centres.

Phase 1 was completed the same year and included the delivery of a 3,900m<sup>2</sup> steel framed warehouse for DPD, with steelwork being fabricated and erected by Cauntun Engineering.

Three further steel framed distribution centres were completed during phase 2, which finished in 2016. These consisted of a 12,000m<sup>2</sup> warehouse for Airwair International (steel by Cauntun), a 38,200m<sup>2</sup> warehouse for DSV (steel by Severfield), and Howdens Joinery's initial Warth Park facility (Severfield), which offers 60,880m<sup>2</sup> of floor space and a three-level office block.

Left: Unit 2 is 314m in length  
 Top right: The larger Unit 2 contains a three level office block  
 Below right: More floor space has been created by omitting one row of columns

“ There are no internal columns for the final 20m of the structure

been subcontracted on a design and build basis for both buildings. The company's senior structural engineer Jay Hutton adds: “The portal framed structure, particularly the overall stability, has been designed with the extended 160m-long office already taken into account.”

The steel design for Units 2 and 3 incorporates a hit and miss configuration for the internal columns, whereby one row of columns is omitted every other bay. This design creates more space for the end-user, but in Unit 2, even more column-free floor area was required by the client at one end of the structure. This request led the design team to use a double-miss configuration for the columns at one end of the structure. “This means there are no internal columns for the final 20m of the structure and so the adjacent columns had to be designed so they could absorb additional vertical and horizontal forces,” says Hutton.

The smaller Unit 3 has a total area of 28,100m<sup>2</sup> and measures 208m long by 131m wide, with a maximum height to eaves of 16.3m. This four-span structure required 1,050t of steel and also includes a 1,600m<sup>2</sup> two level office block.

As well as the two distribution centres, Winvic's \$45M phase 3 work also includes the construction of new associated infrastructure, such as a development road and a 15m-span bridge for an existing road.