**FACT FILE**
**Leeds Bradford Airport terminal building**
Main client: **Leeds Bradford Airport**
Architect: **Millar Design + Management**
Main contractor: **Farrans**
Structural engineer: **Dudleys Consulting Engineers**
Steelwork contractor: **Elland Steel Structures**
Steel tonnage: **800t**

There are three floors, with the lowest level being partially subterranean due to the sloping site.

# Set for take-off

**Leeds Bradford Airport's regeneration programme is relying on structural steelwork's numerous attributes for the construction of a new terminal extension.**

'Yorkshire's Airport' it proclaims in large lettering above the main terminal building. A proud boast for Leeds Bradford, which may not be the only airport in England's largest county, but it is the one that can offer international flights.

Currently there are services to many European destinations, with Spain being the most popular. In 2023, just under four million passengers used Leeds Bradford Airport (LBA) and these figures are expected to increase. Consequently, the airport is seeking to expand its facilities and services; there is an aspiration to offer flights to North America and the Middle East.

To facilitate the expansion, big changes are afoot as a phased redevelopment programme, which includes the construction of a new three-storey terminal extension building, is now underway.

This privately funded £100M scheme, known as LBA:REGEN, will see the construction of the 9,500m² terminal building as the first phase. Once it is complete, a second phase will then see the airport's existing facilities refurbished.

The work will result in the creation of additional aircraft stands, more seating, faster security, new shops and eateries, a larger baggage reclaim area and immigration hall, as well as improved access for passengers with restricted mobility.

How the completed extension and the refurbished existing facility will look.

Commenting on the construction work, Vincent Hodder, CEO of LBA, says: "This project represents the culmination of thousands of hours of planning, consultation and design. As one of Yorkshire's most significant infrastructure projects, we and our passengers are immensely excited to see it develop in the coming months. Once complete, this project will deliver the airport that our passengers, airlines and region need and deserve."

Rising up on a plot previously occupied by a surface car park, a steel framed solution has been chosen for the terminal building. Connecting to the eastern end of the existing terminal, the new structure is 120m-long × 41m-wide and reaches a maximum height of 15.5m at the apex of its peaked roof.

"The requirement for long internal spans and a tight construction programme, meant that a steel frame with composite beams and metal decking were the obvious material choices," says Dudleys Consulting Engineers Senior Engineer Luke Drinkwater.

To this end, the building is designed around a regular column grid, with perimeter members set at 5.5m and 6.25m centres, while internally the pattern is 12.5m × 11m. The internal structural grid was driven by the client's desire to have a minimal number of columns to facilitate future flexibility and to aid passenger movement through the terminal.

The lowest level of the terminal extension's three floors is partially subterranean, due to the site sloping in an easterly direction, away from the existing buildings.

## Steel sequencing

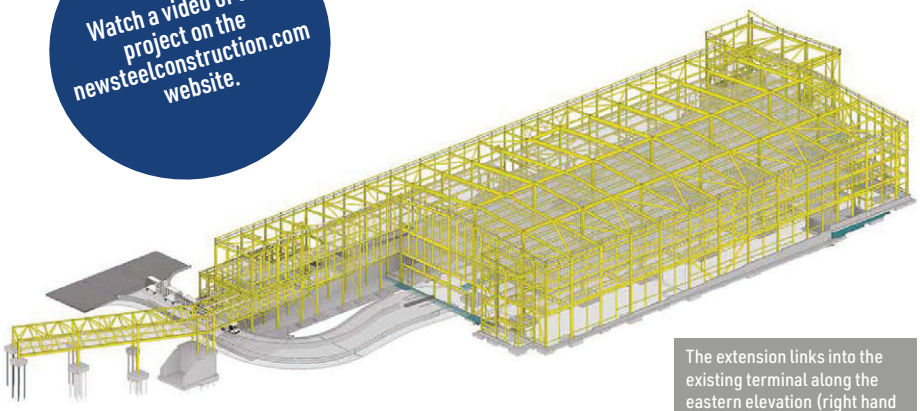
Watch a video of this project on the newsteelconstruction.com website.

Using mobile cranes, Elland Steel Structures installed the project's steelwork and the metal decking in a five-phase programme.

The initial phase involved erecting one half of the new terminal closest to the existing buildings.

Working eastwards, phase two saw the remainder of the terminal completed, phase three consisted of the departure gate wing and phase four was the installation of the passenger bridge to the remote gates.

The final fifth phase of the programme was the erection of a small quantity of steelwork for a goods yard link corridor. ■



The extension links into the existing terminal along the eastern elevation (right hand side of image above).

This level will accommodate baggage handling and will have access, to and from airside operations, via a ramp.

The new steel frame includes a passenger bridge, which spans over the baggage tug ramp and connects the new terminal building to an existing walkway that serves a number of remote gates.

The bridge is a 36m-long, four-span structure, with 2.7m-high Warren truss girders on each side that support a floor deck at the bottom chord level and a roof at the top chord level.

There are some tight constraints, and the design of the bridge had to ensure that baggage tugs have enough clearance to pass underneath, while the structure also had to connect to the existing passenger corridor and aircraft stands which are located on a graded aircraft apron.

Above the baggage handling area, the middle floor of the new building will have arrivals and immigration areas alongside baggage reclaim, while the uppermost first floor will be given over to new shops and eateries. Both of the two upper levels will connect directly into the existing terminal, a factor that has played a significant role in the design and choice of steelwork members.

The floor to ceiling heights in the existing buildings are not very generous and a solution needed to be found whereby this design could be matched, to create a free-flowing terminal, while also accommodating the many services needed in the new extension.

"We chose composite Westok cellular beams, as they allowed us to have an acceptable floor-to-ceiling height, as the services are distributed within the structural zone," says Mr Drinkwater.

Westoks account for the majority of the two levels of floor beams used throughout the scheme. They are typically up to 850mm-deep sections with 500mm-diameter service cells.

Interestingly, this is not the first time these cellular beams have been used at LBA. They can clearly be seen in the existing terminal buildings, installed during previous construction phases. Consequently, Westok Design Team Manager John Callanan, says he was eager to assist with the steel design for LBA-REGEN.

"The first floor was relatively straightforward however the ground floor was more involved, requiring accommodation of complex loads from the baggage handling equipment and service runs. They were at a particularly low level within the beam depth, due to insulation being fixed directly to the soffit of the slab," he says.

Westok provided an economic solution with deep top tees so that the regular cell pattern across the beams could be located below the insulation zone, yet still achieving the tight member depth limit. In certain areas, heavily loaded primary beams were designed and manufactured as Westok plate beams with discreet service openings.

As well as accommodating services, the beams also provide a lightweight and efficient method to form the required long spans. They also support metal decking and a concrete topping for a composite flooring solution. On completion, this will distribute the horizontal load by diaphragm action across the building's footprint to vertical cross bracings along the elevations and other strategic locations throughout the structure.

All of the bracing, columns, beams and services will be left exposed within the completed building. This facilitates easy access for future M+E modifications, while also creating the desired modern industrial-looking interior, which most airport buildings prefer.

Although primarily a braced frame, there is one area that had to be designed differently. The zone that links the new build and existing terminal is slightly remote from the line of primary bracing, so one bay of columns and beams have been portalised to limit lateral deflections, but also to enable easy passenger movement by avoiding the need for bracing.

According to the airport, by 2030, LBA:REGEN has the potential to create 1,500 new direct jobs and 4,000 indirect jobs, as well as contributing a total of £940M to the local economy.

The project will also play a significant part in the airport's Net Zero Carbon Roadmap, with the installation of new efficient heating, lighting and machinery, as well as attracting airlines to deploy their newest, quietest and most efficient aircraft at the airport.

Phase one terminal extension is due to complete in Spring 2025. ■

The overall scheme will allow the airport to significantly increase the number flights and destinations on offer.

*"We chose composite Westok cellular beams, as they allowed us to have an acceptable floor-to-ceiling height as the services are distributed within the structural zone"*

The majority of the project's beams are cellular members, as the building will have numerous service runs.