

Leica Geosystems World's Busiest Airport Heathrow Terminal 5



With the capacity to handle 30 million passengers and big enough to fit 50 football pitches over its five floors, Heathrow Airport Terminal 5 (T5) is one of the largest and most ambitious building and engineering projects in Europe.

The £4.3bn project consists of the main terminal building, 2 satellite buildings and 60 aircraft stands, and has required the diversion of 2 rivers, the realignment of a perimeter road, extensions to the London Underground Piccadilly Line and Heathrow Express, a dedicated M25 spur road and a 4,000 space multi storey car park.

Working in partnership with a team of contractors, Leica Geosystems has played an important role in delivering precision and accuracy to help meet the stringent standards demanded by BAA, and the flexibility to help overcome the unique civil engineering challenges associated with the delivery of such a complex project.

UK's tallest control tower

The new 87 metre high, fully operational control tower at Heathrow is the tallest control tower in the UK and provides air traffic controllers with a 360° view of Heathrow's airfield and the land between the T5 buildings. Construction of the structure was one of the most technically challenging engineering projects ever carried out at the airport.

The site itself is in the middle of Heathrow's airfield, surrounded by existing aircraft stands and adjacent to one of the busiest taxiways in Europe, therefore it was vital that build had to be achieved with the highest degree of accuracy and precision with no impact on Heathrow's existing day to day operations.

The position of the top of the cab, the lifting yoke and the lifting towers totalling a weight of over 1150 tonnes, were all continuously monitored throughout the project using GeoMoS giving a real-time positioning accuracy of 10mm.



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“Real time monitoring gave the team the ability to lift accurately and monitor the process constantly with total confidence” David Rolton, Chairman of Rolton Group, who were responsible for the temporary works design.

24/7 RTK correction capability

With such a compact and constantly changing site, permanent control points were difficult to sustain. Therefore in order to maintain the highest degree of accuracy and control it was decided by the T5 project team to erect two permanent dual-frequency Spider controlled System500 GPS reference receivers.

“The base stations provide both continuous RTK measurements for site based GPS units and precise measurements for post-processing positioning. With both base stations, control points can be checked or re-established to within better than 5mm in absolute plan position anywhere on site.... Having two base stations enables wide radio coverage and continuous back up facilities.” Graham Clarke, Chief Land Surveyor T5, Mason Land Surveys.

Graham continues, “The ease and speed of ‘one man’ operation with the GPS make it the instrument of choice for most surveyors working external to the buildings. The system is independent of the site control network making it ideal for as-build checks on medium accuracy (+/- 25mm) works. The rapid surveying of buried locations during the earth works phase of construction would have been impossible without GPS.”

High Definition Surveying technology was also used to create 3D object based as-built surveys where the accuracy of objects such as fence lines and lamp posts are critical and could only be achieved using high speed laser scanning.

Bored tunnel

With millions of passengers, passenger coaches, cargo vehicles and other airport vehicles estimated to use T5 every year it was vital that the existing transport services were extended to cope with the rise in throughput. Morgan VINCI, a joint venture between Morgan EST and VINCI Construction Grands Projects, won the contract to construct the tunnels associated with the project including:

- Airside Road tunnel
- Heathrow Express extension
- Piccadilly Line extension
- Stormwater Outfall tunnel
- A3044 service tunnel

Ranging in diameter from 8.1m - 2.9m, various tunnel boring machines were used to excavate the 9km of tunnels. At one point along its route, the tunnelling team were just metres away from existing underground services. Careful monitoring and safety measures ensured that there was no unexpected ground movement or disruption to existing services. The surveying and monitoring of both the Heathrow Express and Piccadilly Line extensions used GeoMoS and x10 TCA2003 on a fibre optic network.



Even ground

The earthworks project associated with the project were vast and presented a multitude of challenges for the CA Blackwell Earthmoving Division. Approximately 18 million of tonnes of earth had to be excavated to enable the underground structures for the rail station, baggage systems and service tunnels, as well as the main foundations for the terminal and satellite buildings to be built.

To maximise on-site productivity and to ensure accuracy and control at every stage of the project, CA Blackwells turned to Leica's GradeSmart 3D.



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The onboard GradeSmart 3D solution gave CA Blackwells real-time grade and project information that allowed the dozers to continually monitor, control and grade levels automatically without the need to wait for an engineer to put pins in the ground before grading could begin – thus allowing the site to be graded much more quickly and effectively than with traditional methods.

Stringless 3D paving

The next generation of commercial aircraft will be larger and heavier than even today's Boeing 747s and the demanding tolerances of concrete slab laying required at both the new T5 and other areas at London Heathrow Airport meant that AMEC Civil Engineering and BAA specified the use of Leica's revolutionary 3D Machine Guidance System for Slipform Pavers.

This five year project deployed the world's first entirely stringline-free paving system at a major international airport.

After installation of the systems, the Leica 3D systems have seen an end to stringline guidance delivering huge cost savings with a better quality surface, laid with precision, reliability and speed boosting onsite productivity.

As the five year, multi-billion pound, multi-disciplined programme of works draws to an end, the sheer size and complexity of build is clear to appreciate. Construction had to contend with the multifaceted challenges associated with such a large and significant site, that brought together a multitude of different contractors and suppliers all working with the same goals and objectives to fulfil and exceed BAA's stringent standards of design and safety. Built with precision, accuracy and speed Leica Geosystems has been trusted as the supplier of choice in helping to deliver the world's busiest airport. ■



At a glance:

Project: £4.3bn Heathrow Terminal 5 construction

Contractors: AMEC Civil Engineering, Balfour Beatty, CA Blackwell Ltd, Mason Land Surveys Ltd, Morgan VINCI joint venture, Rolton Group

Instruments used:

- TPS and GPS surveying instruments
- High Definition Surveying™ scanner
- System500 reference receivers
- 3D machine automation systems
- Software solutions including Spider and GeoMoS.

Project facts:

- Europe's largest building site, employing around 6500 people
- T5 will significantly boost Heathrow Airport's existing passenger capacity
- Over 13.5km of tunnels have been constructed as part of the project including extensions to the Piccadilly Line and Heathrow Express
- T5 is the largest single span building in the UK