

SOLVING THE 'MORE FOR LESS' EQUATION

Commitment and innovation are key to the success of Taylor Woodrow's recent Underground feats, the firm's TfL Sector Director JEZ HASKINS tells PAUL STEPHEN

In a city where Transport for London's motto is 'every journey matters', leading civil engineering firm Taylor Woodrow's challenge is to deliver sophisticated infrastructure upgrades while simultaneously keeping Londoners on the move.

Working in joint venture with BAM Nuttall, the team has done just that by completing the recent upgrade of Tottenham Court Road Tube station, closely followed by the upgrade of Victoria Tube station, which is due for completion in 2018.

Both projects are integral to increasing capacity on the London Underground, which is experiencing strong levels of passenger growth year on year.

It's expected that Tottenham Court Road will accommodate up to 200,000 passengers a day as a key interchange station with the Elizabeth Line (Crossrail) coming into use in December 2018, and perhaps Crossrail 2 in the future. The team has built a new ticket hall that is six times larger than the original, and provided step-free access from street to platform by installing eight new escalators and six new lifts.

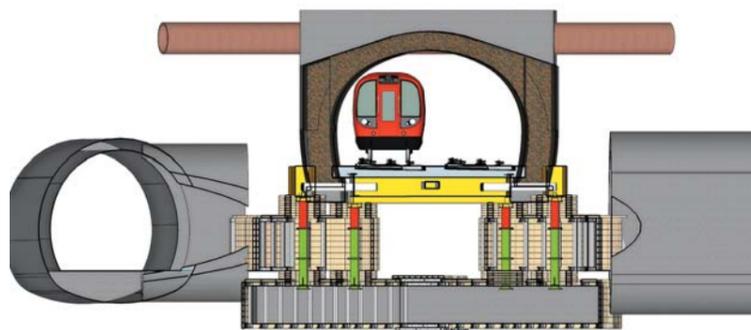
All works have been conducted while maintaining the operation of the station below ground, and the road network above ground; this includes one of the busiest road junctions in Central London.

Says Haskins: "A focus on detail, respect, innovation and relationships is at the heart of our approach. The scale of these upgrades means that disruption is inevitable. Our job is to come up with solutions that not only deliver the best value for our customer, but make the whole process easier on passengers, traffic, residents and businesses wherever we can."

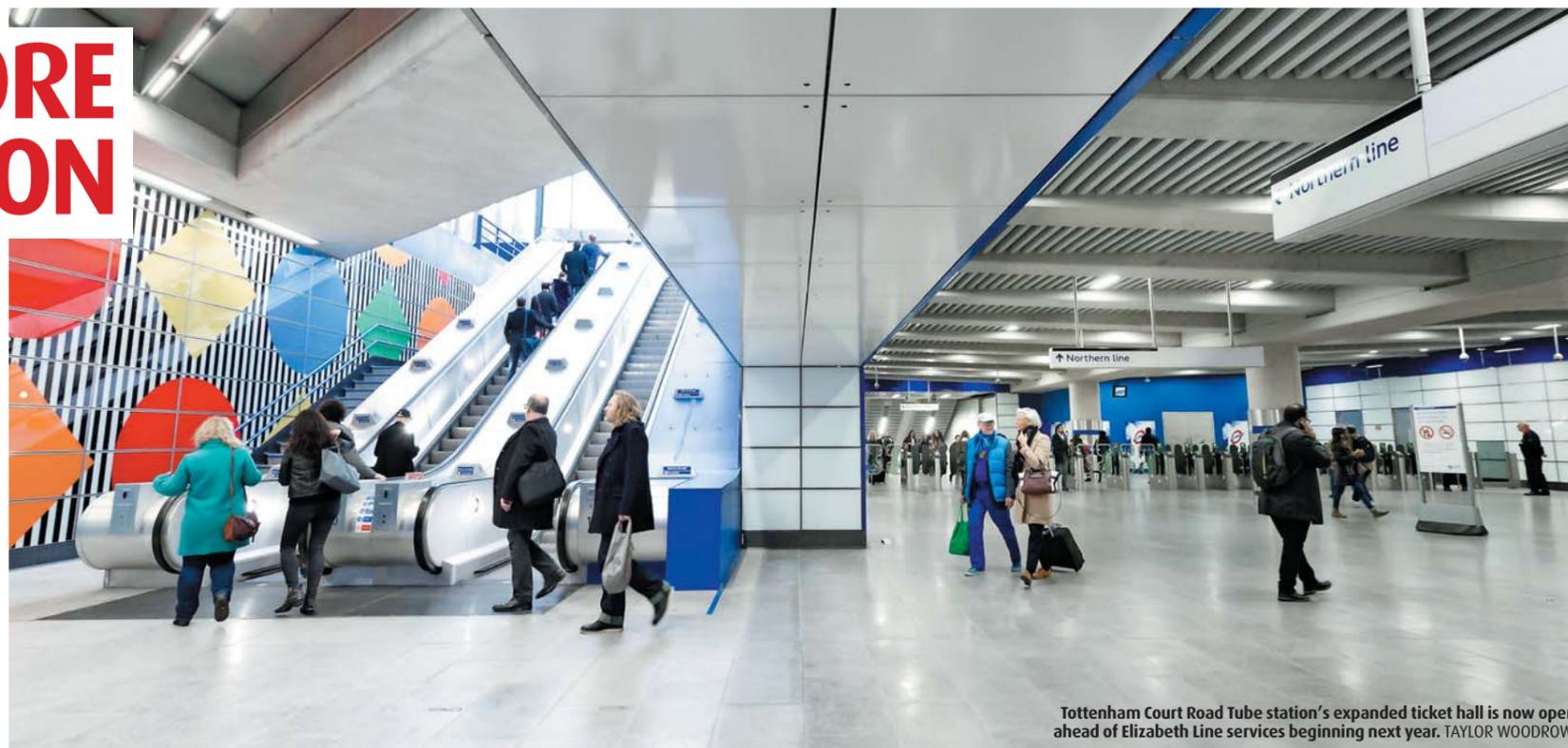
The importance of the road network around Tottenham Court Road Station meant that many complex traffic management arrangements were needed to keep traffic moving throughout the various stages of the project. The team developed and maintained close relationships with stakeholders, undertaking detailed collaborative planning that would take everyone's needs into account. It's an area undergoing major development, and which also relies on maintaining footfall to its retail outlets. Not disrupting their operations was, therefore, of primary importance to the team.

Below the surface, two new overbridges were constructed above the existing Central Line platform tunnels to expand capacity for pedestrian access from a new Central Line passenger tunnel.

The scale of the challenge was enormous but, undaunted, the team rose to it by carefully devising an innovative and bespoke solution.



Victoria station upgrade's propped slab, just 0.6 metres below the running rails of the District and Circle Lines. TAYLOR WOODROW.



Tottenham Court Road Tube station's expanded ticket hall is now open ahead of Elizabeth Line services beginning next year. TAYLOR WOODROW.

Haskins explains: "The existing platform tunnels are twin bores with cast iron segmental linings, located one metre below and adjacent to a large Victorian brick sewer. The sewer could not be moved or disturbed without risking leakage. The solution included driving over 90 horizontal steel piles of up to 20m in length from the adjacent Royal Mail Rail tunnel that is no longer in service to form a support raft beneath the sewer."

"In the original design, the overbridge tunnel was to be driven using traditional timber handworks, a slow and manual process. However, the team worked with civil engineering firms OTB, Halcrow and Dr Sauer & Partners to develop an alternative design. This involved a machine-excavated shotcrete cavern spanning over the crown of the platform tunnels, which enabled London Underground to continue operating a full service on the Central Line below."

"As well as being the first project to install a shotcrete cavern over a live operational railway, the team also had to cut out the crown of the Central Line tunnel and install the permanent overbridge beams during two 52-hour possessions. While the works required exceptionally detailed and meticulous planning by all involved, in the end it proved simpler, quicker and safer than alternative traditional techniques, and meant less ground movement."

Meanwhile, over at Victoria, the station serves more passengers than Heathrow Airport each year and is located at the centre of a major transport interchange, woven around a dense population of residents and stakeholders, including two of the capital's long-standing and Grade 2-listed theatres.

The team are providing step-free access while almost doubling the size of the existing Southern ticket hall. They have already opened a new Northern ticket hall and constructed approximately 300m of concrete-lined link tunnels between the two halls.

Over the seven-year project (which commenced in 2011), they will have safely accommodated approximately 595 million passengers and 61 million vehicles through their worksites while transforming this vital node in the transport network.

Within the station, the District and Circle lines (D&C) underpass was integral to the project as it essentially linked the extended South ticket hall to the new North ticket hall. However, the dimension from the top of the running rails to the top of the underpass roof slab was just 0.6m, so innovative thinking was needed to give enough clearance for construction while maintaining the London Underground Standard requirements of a 'step free' tunnel.

The original solution was to support the D&C tracks with concrete walls perpendicular to the track, and segmentally

underpin large sections of the tunnel walls in six segments to form supporting beams. This would be primarily constructed from within the D&C tunnel, and would require a minimum of 17 weekend track closures of the D&C line. This was unacceptable to the team, due to the level of disruption and risk of overrun due to the nature of the work.

A propped slab was developed that moved the focus of construction from the operational D&C tunnel and into the adjacent new link tunnels below, thereby reducing the requirement to close the railway to passenger traffic.

This change in the construction approach meant that the propped slab could be constructed in a six-day blockade over the Christmas period, which was already scheduled for track work shared with other

“ The team were the first to work on a sprayed concrete cavern directly above a live platform during traffic hours. ”

Jez Haskins, TfL Sector Director, Taylor Woodrow

parties. It reduced delivery costs, mitigated risk, and significantly reduced passenger disruption.

The upgrade's design also involved six points at which the new tunnels would break into the existing station tunnels. The team successfully incorporated 'propples' connections in the design to remove the need for any temporary support in the station at these points, maximising operational space throughout the works.

Haskins concludes: "With the London population growing at a rate of twice that of the rest of the UK, the demand for constant and efficient transport is high. Upgrades such as Tottenham Court Road and Victoria are essential in meeting this growth."

"TfL aspires to deliver more for less, as funding for major capital projects becomes harder to secure and ever more projects compete for the available investment. So ensuring that we apply the lessons learnt from projects such as Tottenham Court Road and Victoria will be essential. Projects such as these, delivered by committed teams over seven or more years now set the new minimum level of expectation from which future projects can build upon to introduce the next level of innovation, collaborative working and delivery efficiencies."

"Exciting times are ahead and we are very much looking forward to being involved in future challenging major projects to support London's future growth." ■