





# Crossrail C300/410 & C435

Crossrail is one of **Europe's largest transport infrastructure** projects. Opened in 2022 the Elizabeth line, named after Her Majesty The Queen. The Elizabeth line will **transform rail transport** by increasing central London capacity by 10% and cutting journey times across the City. The programme supported the equivalent of 55,000 full-time jobs and **stimulate regeneration and economic growth**.



 Department for Transport <b>Crossrail</b>	 Department for Transport <b>£1.5bn</b> (multiple contracts)	 <b>2011</b> - 2022	 <b>Build</b>
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C300 Western Running Tunnels comprised 6.4km of twin-bore tunnels between Royal Oak and Farringdon. Constructed using two 7.1m diameter Earth Pressure Balance (EPB) Tunnel Boring Machines (TBMs), it is lined with precast fibre-reinforced concrete segments, manufactured in a purpose-built facility. C410 involved Early Access Shafts and Bond Street and Tottenham Court Road Sprayed Concrete Lining (SCL) stations caverns. We identified an opportunity to merge C300 and C410 contracts, reducing the Target Cost by £80m and saving 12 months on the programme.

Both C300 TBMs passed beneath Lord Hill's Bridge. The 100-year old, steel-arched road bridge supports Royal Oak LU Station and is owned by Network Rail. In collaboration with Crossrail, we installed 1,225 piles beneath the bridge with tracks and platforms running on either side of the central pier, resulting in near zero settlement after the TBM drive.

C435 Farringdon Station works include eastern and western ticket halls and tunnel platforms. The scope includes the station building, accesses, platforms, cross passages, reception chambers, lifts and escalator barrels using sprayed and in-situ concrete lining. Farringdon and Barbican tube stations, tube and national rail lines, and the listed Moorgate Spur sidings, under Smithfield Market, are on the site boundaries. Within this constrained, urban environment, collaboration between wider contractors and stakeholders was paramount.



## ADDED VALUE

- £17m saved through our Optimised Contractor Involvement (OCI) proposals
- C300 TBMs crossed with 850mm clearance from the top of the London Underground Northern line platform tunnel, and 520mm below the overlying escalator barrel, with no disruption to LU services
- By using the TBM-driven tunnel (part of C300) as a pilot tunnel for C410 station caverns, achieved 7 month programme saving. This TBM pilot tunnel allowed the full C410 platform excavation and enlargement to be completed with spoil transported via TBM conveyors towards Royal Oak for removal by rail. This removed 50,000 lorries from the road
- Tunnelling teams worked an eight-hour shift, the result of our research into the benefits of shortening the traditional twelve-hour shift to prevent fatigue
- BREEM Excellence awarded at design phase for Farringdon Station – the only railway station in the UK to achieve this



This was a fantastic achievement that clearly demonstrates what can be achieved with a well specified TBM and close control. There was excellent collaboration between London Underground, Crossrail and the tunnelling contractor [...] during the planning and implementation of this interface, which has contributed greatly to this success.

**Tim Morrison**  
LU Principal Civil Engineer



**6.4km**

twin-bore running tunnels  
under major assets

**3.416km**

of SCL platform tunnels and  
cross passages across all  
stations

**1<sup>st</sup> in the UK**

onboard TBM refuge  
chamber

**30,200m<sup>2</sup>**

Farringdon Station  
footprint

**30+ sites**

running concurrently  
at peak

**1M+ m<sup>3</sup> tonnes**

of spoil removed and  
redirected to create  
Wallasea Island bird  
sanctuary