

The Lloyd's Register Foundation Lecture and Dinner 2013 **CROSSRAIL:** DELIVERING EUROPE'S LARGEST INFRASTRUCTURE PROJECT

Andrew Wolstenholme OBE FREng, Chief Executive Officer, Crossrail





Lloyd's Register Foundation

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23 September 2013 6.00pm for 6.30pm Venue Prince Philip House, 3 Carlton House Terrace, London SW1Y 5DG

ABSTRACT

Crossrail is Europe's largest infrastructure project, and among the most significant infrastructure projects ever undertaken in the UK. It will deliver a high-frequency, high-capacity service linking Maidenhead and Heathrow in the west, to the City, Canary Wharf, and Shenfield and Abbey Wood in the east. Six tunnel boring machines (TBMs) are currently weaving their way under London, already over a third of the way through their 42km journey. Nine new central London underground stations are being constructed in some of the busiest and most treasured parts of London. On the surface, over 60km of track will be electrified and 27 stations will be upgraded.

The safety, technical, environmental and stakeholder challenges of the project are immense, and meticulous planning, monitoring, collaboration and innovation all play a key role in successful delivery. Andrew Wolstenholme, Crossrail's CEO, will give a unique insight into how this colossal feat of engineering is being brought to reality: "This is not just a world-class railway. We want to fast-track the progress of London", he says.

Andrew Wolstenholme OBE FREng Chief Executive Officer, Crossrail

Following five years in the army and 10 years with Arup, Andrew joined the airport operator BAA plc in 1997 as construction director for the Heathrow Express rail link. He went on to lead the delivery of the £4.3 billion Terminal 5 programme and became BAA's director of capital projects running the £10 billion development programme across seven UK airports. In 2009, Andrew joined the Balfour Beatty Group as director of innovation and strategic capability. In 2011, Andrew joined Crossrail as its new chief executive officer.

CROSSRAIL





New twin-bore tunnels measuring 21km in length will be built under central London, with tunnelling starting in spring 2012.

The tunnel boring machines (TBMs) will weave their way between existing underground lines, sewers, utilities and building foundations at depths of up to 40 metres to create the tunnels required to deliver the new railway.

New train services, reduced journey times

- Crossrail will deliver new train services and reduced journey times with up to 24 trains per hour between Paddington and Whitechapel during peak times.
- Each Crossrail train will be around 200m long and be able to accommodate up to 1,500 passengers.
- Around 200 million passengers will travel on Crossrail each year.







DLR

Connaught Tunnels refurbishment

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ENGINEERING UPDATE

As Crossrail approaches the halfway mark, a number of key milestones have been reached:

- Seven out of eight TBMs are now in position boring the tunnels under London..
- The western tunnels are nearing completion.
- The widening of the Connaught Tunnel was completed ahead of schedule.
- A 1,000 tonne TBM was driven over the Northern Line at Tottenham Court Road and despite coming within 85cm of the tunnel caused only 1mm of displacement.
- 1 million tonnes of spoil has been removed to Wallasea Island.
- Over 17km of TBM tunnel has been constructed.
- Nearly 15km of spray concrete-lined tunnel has been completed.









SUSTAINABILITY

SOCIAL

- 2,375 people have sat the Tunnel Safety Card test at the Tunnelling and Underground Construction Academy (TUCA) with a 87.4% pass rate.
- 1,563 have attended pre-employment training.
- Crossrail has so far employed 243 apprentices. The target over the lifetime of the project is 400.

The establishment of a TUCA is central to Crossrail's delivery plans and its legacy to the industry. TUCA will not only ensure that Crossrail has the skills needed for its construction but will be retained post-Crossrail as a specialist training centre for other tunnelling projects, thereby acting as a legacy to the UK construction industry.

TUCA facts:

- TUCA is located at Aldersbrook Sidings on the border of Newham and Redbridge; Newham is one of the top 5% of most deprived boroughs in England.
- TUCA will offer training to at least 3,500 people in underground construction alone over the lifetime of the project.
- TUCA will be the only soft-ground tunnelling training facility in Europe. Currently the nearest known tunnelling training centre is the hard-rock training centre Hagerbach in Switzerland.
- TUCA will provide the specialist skills needed for Crossrail and other tunnelling and infrastructure projects.
- TUCA will operate as an independent, not-for-profit organisation and become a long-term provider of tunnelling and underground construction skills to the construction industry.





Archaeology

The construction of Crossrail through the heart of London will result in one of the most extensive archaeological programmes ever undertaken in the UK. Crossrail currently operates over 40 worksites, and archaeological investigations will be carried out at each site ahead of main construction works to build the central stations.

The finds uncovered include prehistoric animal bones, Roman remains, human remains from the infamous 'Bedlam' psychiatric hospital and remnants of Britain's industrial past. An extremely rare piece of UK amber, estimated to be 55 million years old, is also on display.

A 'Bison to Bedlam' public exhibition was held during July and October 2012 to celebrate the halfway point in the archaeology programme. 3,000 people attended the exhibition, where they were able to get up close and personal with over 100 different finds from across the route, as well as enjoy a host of talks by members of the archaeology team working across the project.

ECONOMIC (continued)

As well as easing many of London's transport headaches, it will encourage regeneration and social inclusion and provide access to thousands of job opportunities. Crossrail is a key part of London's plan for growth over the years ahead.

A project of national significance, Crossrail will will create 55,000 business opportunities and support around 75,000 full-time jobs throughout the supply chain.

Overall, the benefits of Crossrail are estimated to be at least £42 billion.



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Location of suppliers	Number of suppliers	% of supply chain
UK	1701	97%
Rest of the world	50	3%
Total	1751	

2. UK location

Location of suppliers	Number of suppliers	% of supply chain
London	650	38%
South east	327	19%
Rest of the UK	724	43%
Total	1701	

3. Size (UK businesses)

Location of suppliers	Number of suppliers	% of supply chain
Large	626	42%
SME	850	58%
Total	1476	

ENVIRONMENTAL

 Crossrail is using material excavated during construction works to create a large wildlife reserve at Wallasea Island,



eight miles north of Southend-on-Sea in Essex. Wallasea Island will be the largest and most important coastal habitat creation scheme in the UK.

- The Civil Engineering Environmental Quality and Assessment Award Scheme (CEEQUAL) has been adopted for all the civil engineering works and a Building Research Establishment Environmental Assessment Method (BREEAM) has been developed for the central area subsurface stations.
- As the Crossrail trains approach the deep central area stations, they will be on a slight uphill gradient which will assist with braking. They will leave the station on a slight downhill gradient that will assist acceleration. This will help minimise long-term energy use.
- Regenerative braking is the ability to use motors in reverse as an electric brake and return energy to the electrical supply system. Crossrail trains will be fitted with regenerative braking leading to a saving of at least 20% of total energy consumption.



CROSSRAIL SUPPLY CHAIN

Companies from right across the UK are winning work connected to Crossrail.

This map gives a snapshot of the tens of thousands of businesses that will end up benefitting over the lifetime of Europe's biggest construction project.

Watson Steel, Bolton, supplied 2,500 tonnes of steel to Farringdon

ed over 1,000 tonnes of steel to Limmo Peninsul and Pudding Mill Lane

> Street Crane Co Ltd, High Peak, manufactured and installed ten cranes

Keller Ltd, Coventry, pilin grouting and structure ring to numerous rossrail sites

Ashridge Engineering, Dkehampton in Devon, designed control and measurement uipment for water mains

> 10 tonnes of steel to rossrail sites





The PODFather, Edinburgh, supplied PDA system to capture arrivals and departures from Crossrail sites

Mammoet, Newcastle, supplied cranes and other specialist equipment to help assemble and transport tunnelling machines

> Cleveland Bridge, Darlington, supplied almost 2,500 tonnes of steel to Bond Street and Canary Wharf

Laing O'Rourke factory, Steetley, constructing new Custom House station and nanufacturing components for three other

UKDN Waterflow, Solihull, essential works to London's sewers

eering. Poole. supi

HPC Products, Bournemouth, supplying tunnelling machines with oils and lubricants



As the UK's national academy for engineering, we bring together the most successful and talented engineers from across the engineering sectors for a shared purpose: to advance and promote excellence in engineering.

The Academy's work programmes are driven by four strategic challenges, each of which provides a key contribution to a strong and vibrant engineering sector and to the health and wealth of society.

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