

**Report for the London Assembly Transport Committee****Document History:**

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## **Crossrail: London Assembly Transport Committee report**

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### **1 Introduction**

Crossrail Ltd (CRL) is forecast to be delivered on time and within its funding envelope of £14.8bn. CRL is pleased to report that good progress has been made on the projects delivery over the last 12 months. In June 2015 CRL reached a major milestone with the completion of the 42kms of twin bored tunnels required underneath London's streets. Following the completion of tunnelling, the focus for the project has transitioned over the last 12 months towards the fitting out of the central section stations, laying of the rail track in the tunnels and the installation of the various systems that will enable the railway to operate. Overall CRL construction is now 70% complete.

This report has been produced for the London Assembly Transport Committee ('the Committee') following a written request to CRL's Chief Executive for an update on the progress of the project dated 11 November 2015.

This report provides an update to the information provided ahead of, and following CRL's previous appearance before the Committee on 14 January 2015. The report provides an overview of construction progress and particular issues that were identified within the Committee's letter. The report shall therefore provide updates on:

- Project progress: construction milestones and forecast deliverables for 2016;
- Budget and financial performance;
- Skills and employment strategy;
- Environmental sustainability;
- Health and safety performance;
- Route extensions to Ebbsfleet and Hertfordshire; and
- Project risks.

### **2 Progress: construction milestones and forecasted deliverables for 2015**

#### **2.1 Progress & achievements**

During 2015 the project reached a number of key milestones Page 4 overleaf provides a selection of images which help to illustrate some of the key achievements.

The rest of the section will provide updates on the following areas of the Crossrail project:

- Central section works;
- Track and system installation works;
- Surface section works; and
- Future milestones



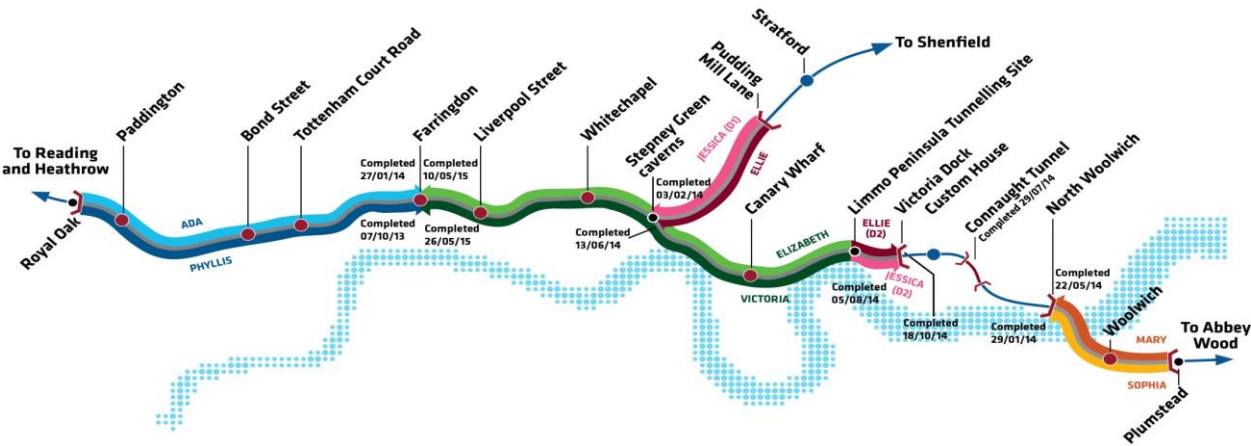
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- Key for images on page 4:**
1. Archaeology dig at Liverpool Street
  2. 400 apprentices milestone event at Bond Street
  3. TBM Victoria arriving at Farringdon marking the end of tunnelling
  4. Proposed artwork at Paddington station sponsored by Heathrow Airport Ltd and the City of London Corporation
  5. Stoke Poges bridge replacement works
  6. Multi-Purpose Gantry installing rail track
  7. Wallasea Island
  8. Platform construction works at Tottenham Court Road
  9. Crossrail Place open (Canary Wharf station over-site development)
  10. CGI of Crossrail train

**2.2 Central Section works**

At the beginning of 2015 CRL had completed 90% of tunnelling with eight out of the ten tunnel drives completed and two Tunnel Boring Machines (TBMs) remaining in operation. The last two machines Elizabeth and Victoria carried out the final few kilometres of tunnelling over the first half of 2015. Both machines travelled from Whitechapel to Farringdon with Elizabeth completing the journey on 10 May and Victoria on 26 May. To mark the completion of this important milestone, CRL hosted an event attended by the Prime Minister, Mayor of London, Secretary of State for Transport, route MPs, London Assembly Members, local residents across the route and workers from across the project.

**Illustration 1: TBM tunnel drive map (100% complete)**



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Completion of tunnelling across the project was an important milestone but we have also continued to build momentum in the delivery of the ten brand new stations in central and south east London. Provided below is a summary of progress over the course of 2015 and a summary of progress at each of our central section stations plus progress at Abbey Wood station which is being delivered by Network Rail.

**Table 1: 2015 Central Section achievements**

1	Farringdon - All Platform Primary Enlargement Completed	Q1 2015
2	Western Outer Signalling - Relock Recontrol Data Change Complete	Q1 2015
3	Infrastructure Complete for Systemwide Installation at Plumstead	Q2 2015
4	Handover Victoria Dock Portal Equipment Rooms to Systemwide	Q2 2015
5	Thames Tunnel Available for Systemwide Installation	Q2 2015
6	Stage 0 – TfL Rail (CRL Train Operating Company) takeover Great Eastern Services from Maryland to Brentwood	Q2 2015
7	Opening of retail sections at Canary Wharf station	Q2 2015
8	Completion of major running tunnels	Q2 2015
9	Complete Signalling Design for Trainbourne Equipment	Q2 2015
10	Fisher Street - All works that require access via Fisher Street Complete	Q3 2015
11	Drive Y Westbound - Cutter Head Removal Complete	Q3 2015
12	Systems Access to Running Tunnels Royal Oak Portal to Farringdon	Q4 2015
13	Handover to Systemwide Eastbound & Westbound Running Tunnels Victoria Dock Portal to Stepney Green	Q4 2015
14	Pudding Mill Lane - Portal Area handed over to Systemwide	Q4 2015

### Paddington

- Completion of “top down” excavation to the Paddington station structure including temporary structural elements and the casting of all slabs down to platform level.
- Completion of installation of all permanent structural walls and columns including the 8 elliptical central support columns
- Completed removal of all the temporary plunge columns, which supported the structure prior to the completion of the permanent walls and columns

### Bond Street

- Completion of bulk excavation to Bond Street Station Ticket Halls
- Installation of Eastern Ticket Hall structural slabs to Levels -3, -4 and -5 (base slab)

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- Completion of platform structures within Eastbound and Westbound platform tunnels
- Substantial completion of platform tunnel cross passage concrete installation
- Commencement of installation of Platform Edge Screen structures within Eastbound and Westbound platform tunnels
- Commencement of ventilation shaft construction activity to the Western Ticket Hall

### Tottenham Court Road

- Handover of platforms and tunnels from tunnelling contractor to station works contractor
- Handover of Goslett Yard Box from tunnelling contractor to station works contractor
- Completion of design gate for platform edge screen and MEP under platform modules
- First installation of platform edge screen steelwork
- Completion of the hoarding to enable C610 access to East and West platform track
- Design gate pass for Western Ticket Hall and Goslett Yard Box

### Farringdon

- Completion of all the contract tunnelling works.
- Successful possession works at the West Ticket Halls to allow connection of the Crossrail station to the existing Integrated Ticket Hall safely completed and handed back to passenger operations on time. Possessions on the East Ticket Hall successfully completed and handed back on time to install hoarding to allow construction of the Barbican Bridge and Hayne Street Shaft
- Commencement of steelwork in the East and West Ticket Halls
- Completion of the square shaft at the West Ticket Hall
- Commencement of blockwork in the Ticket Halls
- Commencement of Platforms and track slab in the Tunnels
- Completion of cast secondary lining to the Eastbound station tunnel

### Liverpool Street

- Liverpool Street East and West ticket halls have progressed through Gate 3 design
- Broadgate ticket hall archaeology investigation complete with over 3000 bodies exhumed from the former Bedlam burial ground, and Roman finds recorded
- Broadgate ticket hall basement excavation complete – the last major box excavation on Crossrail
- Moorgate station alternative access installed allowing for early demolition of Metropolitan ticket hall. Installation of new ticket hall roof panels has commenced
- Moorgate ticket hall stage 1 (south of existing ticket hall) demolition completed and concrete structure completed to roof level
- Blomfield shaft structure reached its final height of five storeys above ground level, and cable management systems installation has commenced
- Some tunnel passages handed over to the station team, with the platform level slab completed in Access Passage 1

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### Whitechapel

- All major excavation works have now been completed at Whitechapel Station, with the completion of excavation to the West Stair shaft, which will form the new secondary means of escape from the London Overground northbound platform
- Civil works at both Durward Street and Cambridge Heath shafts are significantly advanced, with both structures now above ground level, and due to be completed by Q2 2016. Within the shafts, blockwork and MEP fit out has commenced, and vent shaft installation by the Systemwide Contractor will commence in Q1 2016
- The escalator barrel excavation within Durward Street shaft by the SCL Contractor has been completed, which will form the access from Whitechapel Station to the new Crossrail platforms
- Demolition of the existing brick arch bridges at Winthrop Street and Durward Street was completed, to allow continuation of installation of the new concourse steelwork over the London Overground platforms
- The temporary ticket hall is currently undergoing testing and commissioning, to enable closure of the existing station in January 2016. This will enable refurbishment of the existing station building to commence in Q1 2016

### Canary Wharf

- The remaining elements of the station were completed, testing and commissioning was carried out, training was provided and Canary Wharf Contractors Ltd achieved Practical Completion of their works on 7 September 2015, 4 months ahead of schedule
- The Canary Wharf Group's Over Site Development (OSD) retail and park opened to the public on 1 May 2015
- The pedestrian walkway and lifting bridge that connects North Quay DLR Station to the Crossrail Station and the OSD opened to the public on 18 November 2015
- Cofely GDF Suez Ltd started their planned and preventative maintenance contract on 7 September 2015 to look after the station and its assets until handover to RfL in 2018
- The Evening Standard Progress 1000 event was held in the station on 16 September 2015, giving some of London's most influential people an opportunity to see an early piece of completed Crossrail infrastructure
- Pre-work has commenced on site in advance of the railway systems installation contracts starting in February 2016

### Custom House

- The Station superstructure including all bridges and Station entrance structure have now been completed
- Fit out of the Station is progressing with 86% of screeding, 92% of piping and 84% of cable management systems being completed
- Successfully handed over the East and West bound track slabs to C610 systemwide contractor to commence laying of track and construction of switches
- Provided access to systemwide contractors to their specific plant and equipment rooms



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### Woolwich

- Completion of the platform structure
- Successful completion of structural works below ground level
- Completion of piling works to the station vent building

### Abbey Wood

- Interim station opened to passengers
- Old station building demolished
- Construction work commenced on new station structure

## **2.3 Track and system installation works**

Having completed the major tunnelling work required on the project, CRL's focus is now on the complex task of fitting out the new tunnels and stations with the necessary infrastructure and railway systems to enable TfL-run services to commence through central London and Docklands in December 2018. This phase of works includes the installation of track, tunnel ventilation, high voltage power, traction power, signalling, communications and overhead line equipment.

Crossrail's trains will be powered by overhead lines on the surface sections of the route and by an overhead catenary system in the new tunnels. Full height platform screens will incorporate passenger information displays and space for advertising will also be installed at the new central section stations. The first prototype of the doors has been constructed at manufacturer Knorr-Bremse's facility in Wiltshire.

There are two key logistics centres which will support the next phase of work at Plumstead in south east London and Westbourne Park just west of Paddington. The logistics centre at Plumstead is complete whilst the construction of the logistics centre at Westbourne Park is underway.

CRL has now taken delivery of the first permanent rail on the project and to date has installed 6,550 linear metres of permanent track. There are five different types of track being used in the tunnels which reflects different needs at specific locations across the route. Once all track has been laid in the central section CRL will have installed more than 50,000 linear metres of rail track.

A number of bespoke machines are being used during this phase of the project including four purpose built multi-purpose gantries (see image on p4) which will transport and accurately position around 70,000 sleepers and rail in the central section. The gantries have now been delivered to CRL and are in operation from Plumstead.

The project is also utilising a bespoke 465 metre long concreting train that plays a key role in creating the standard track. The train is a mobile underground concrete batching factory which can operate 24 hours a day pouring concrete during the night with restocking and maintenance carried out during the day. Due to its length, the train is split in two and is located at Plumstead.

### **2.4 Surface section works**

The surface works are a £2.3bn package of enhancements being largely delivered by Network Rail and comprises railway and station enhancements on the routes west of Paddington to London Heathrow and Reading, and routes east of Pudding Mill Lane and Plumstead to Shenfield and Abbey Wood.

The progress of works on the surface section of the route is now more than 50% complete. On the western section the work on two significant pieces of infrastructure, the Stockley Flyover and the Acton Dive Under have continued to make progress. Both of these will enable the railway to run more efficiently by reducing delays caused by the interaction between services at the junctions with Heathrow and with Acton Yard respectively. The first section of the Stockley Flyover is now complete and in operation and excavation work has finished on the Acton Dive Under which is due to be completed in 2016.

Schedule 7 planning applications have been approved at a number of stations along the western section over the course of 2015 including at West Ealing, Southall, Hayes and Harlington and West Drayton and subsequently major station overhauls have commenced at these stations as well as at Ealing Broadway which received planning approval in 2014.

On the north east spur upgrades are taking place at thirteen stations in east London and Essex including the installation of lifts, platform extensions and ticket hall upgrades. Track upgrade work has also been carried out over the course of this year at Brentwood, Shenfield and Chadwell Heath which will help to provide a more reliable service for passengers.

At Ilford Yard, a major stabling depot on the east of the route, work has continued to progress well, with internal fit out of the new buildings underway in preparation for construction of the new sidings before delivery of the first Crossrail trains in 2017.

In May 2015, TfL through its appointed train operating company, MTR (Crossrail), took over the existing stopping service from Liverpool Street (mainline station) to Shenfield from Abellio Greater Anglia under the TfL Rail brand. This will eventually become a part of the future Crossrail service once the line and stations have been upgraded and new rolling stock has been introduced.

At Abbey Wood, the temporary ticket hall opened in October 2014 to allow the demolition last year of the old ticket hall which is making way for the new landmark Crossrail Abbey Wood station. Work has begun on the foundations of the new station, whilst over a mile of new track has been installed from Abbey Wood to Plumstead portal, through which trains access the new tunnelled section beneath Woolwich and the Thames.

Over the Christmas period a major programme of improvements to prepare the existing railway for Crossrail has been delivered by Network Rail in outer London, Berkshire and Essex. More than 3,000 workers were out on the railway over a ten day period delivering £60m of upgrades, including major track and signalling work at locations including Maidenhead, Acton, Old Oak Common, Stockley and Gidea Park to increase capacity and improve the reliability of the railway; station upgrades at a number of locations including Southall, Hayes & Harlington, West Ealing, Forest Gate and Gidea Park; work to electrify the railway in west London and Berkshire; and upgrades to overhead electric wires in east London and Essex.

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### 2.5 Future milestones

Looking ahead, 2016 will be another critical year for CRL. There will be a significant increase in activity to fit out the new stations and install rail track throughout Crossrail's 42km of new tunnels. Provided below is a summary of projected milestones for 2016.

1	Complete tunnels from Limmo to Stepney Green ready for track installation.	Q1 2016
2	Bond Street Station - completion of Platforms and Platform Edge Screen to support track installation.	Q1 2016
3	Royal Oak Portal - Head House complete for Systems installation.	Q2 2016
4	Farringdon - Completion of Civil's Construction of the Lindsey Street Box at Farringdon Station (PDA Milestone 4).	Q2 2016
5	Liverpool Street – SCL works complete from Moorgate Shaft and hand over shaft to C502	Q2 2016
6	Track Concreting complete Victoria Dock Portal to Stepney Green.	Q2 2016
7	Commence Floating Track Slab Installation at the Barbican	Q2 2016
8	On Network Works – Driver Only Operation (DOO) equipment complete Harold Wood Station.	Q2 2016
9	Woolwich Station equipment rooms ready for systems Installation	Q3 2016
10	Tottenham Court Road - Completion of Western Ticket Hall civil works	Q3 2016
11	C360 - Eleanor Street Shaft Equipment Rooms, access available for Systems installation.	Q3 2016
12	On Network Works - Slew Remainder of North Kent Line	Q3 2016
14	Whitechapel - completion of Westbound Platform and Platform Edge Screen to support track installation.	Q4 2016
15	Pudding Mill Lane - Complete Civil Works for NR to Commence Up Electric Works	Q4 2016
16	Permanent Way Complete within Tunnels.	Q4 2016

**Table 4: 2016 projected key milestones**

### 3 Budget and Financial Performance

Based on the latest information provided to the CRL Sponsors in September 2015, CRL reported the following cost forecast:

- The CRL P95 AFC and AFCDC are forecast to be £14,519m and £12,314m respectively; and

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- Total expenditure from the commencement of the CRL Project (1 April 2007), including Land and Property commitments was then approximately £7.95bn.

### Notes:

*AFC – Anticipated Final Cost - Anticipated Final CRL Direct Costs plus Network Rail costs in delivering the Surface Section works and the costs of the Depot, with the Network Rail Financing Costs excluded.*

*AFDCDC – Anticipated Final CRL Direct Costs – the aggregate of all Costs incurred or forecast to be incurred by CRL but excluding third party delivered spend (Network Rail and Depot).*

*P95 – confidence level of 95%.*

The contingency for the programme is held at a number of different levels including an element held by the CRL Sponsors and the CRL Board. CRL's view is that the contingency levels are adequate for a programme of the scale and complexity of Crossrail. There is a continued focus on delivering value for money, and within that, on controlling the volume and value of change to ensure that the Project remains within its available funding.

CRL has finalised the business plan for 2016/17, establishing a budget for the year of approximately £1.5bn for works within CRL control and will continue to further progress plans for a transition back into to TfL.

During 2016/17, the majority of CRL expenditure will be on: Stations fit-out works and Systemwide works including traction power and track works.

During the 2014/15 financial year, CRL's direct and indirect costs were £213m lower than budget and CRL spent £42m less than forecast during Q1 2015/16. A number of factors contributed to this including re-phasing of aspects of work including drawdown of programme contingency. Due to the re-phasing of the programme this expenditure will carry over to the remaining years of construction.

Cost pressures remain on the project which continue to be addressed by Crossrail's Board and management team to ensure that CRL delivers the project within the funding.

CRL continues to forecast that the delivery of the Project will be achieved within the £14.8bn funding envelope set by the Crossrail Project Sponsors following the 2010 Comprehensive Spending Review (CSR).

## **4 Skills and Employment Strategy**

CRL provided an update on its Skills and Employment Strategy in its 2015 submission to the Committee, and has continued to promote training and employment opportunities across its four main skills objectives:

- Maintaining safety;
- Inspiring future talent;
- Supporting local labour, and;
- Revitalising the skills base.

Over the past year the notable areas of progress have been:

#### **4.1 Tunnelling and Underground Construction Academy (TUCA)**

Crossrail and its partners have delivered the fourth year of training at TUCA. In total, there have been over 12,000 enrolments on TUCA courses since CRL agreed a five-year training contract with the National Construction College.

In August 2013, TUCA secured £4.1m of funding from the Skills Funding Agency, which enabled TUCA to deliver bespoke employment support to local people and provide pre-employment training to thousands. The total number of delegates undertaking pre-employment training at TUCA in 2014 was 384, and a further 377 so far during 2015.

An independent study into the economic impact of Crossrail's skills and employment activity conducted in July 2014 also estimated that investment in TUCA up to 2018/19 may result in a local GVA impact of £49m.

#### **4.2 Tunnel Safety Card**

CRL established an accredited Tunnel Safety Card (TSC) in September 2011 in response to an industry need for standardised tunnelling health and safety training. In mid-2015, the TSC was replaced by the upgraded Tunnel Safety Training Scheme (TSTS), which has built upon the original TSC following input from the sector via TUCA's employer delivery panel. 642 learners have been through either TSC or TSTS courses at TUCA during the first three quarters of 2015.

#### **4.3 Apprenticeships**

At the end of 2014, we successfully achieved our target of employing 400 apprentices by the end of the project. During 2015, a further 91 apprentices have been employed across the project, taking the total number of apprentices to 517 so far. 13% of our apprentices are female and 34% come from a BAME background. We will continue to build on these figures for the remainder of construction, as the project progresses through station fit-out, rail systems and urban realm development.

#### **4.4 Work experience**

Building on a suggestion from the London Assembly Transport Committee in 2012, CRL aimed to provide 500 work experience opportunities over the lifetime of the project. Overall, CRL, its partners and supply chain have provided 1,110 work experience opportunities to date.

#### **4.5 Graduates**

Crossrail partners employed 64 graduates in 2015. The CRL graduate scheme employed 11 graduate engineers in 2015. Overall, CRL and its partners have now recruited 459 graduates across the project.

### 4.6 Jobs Brokerage Service and new jobs

The latest reports from CRL's principal contractors indicate that 4,398 jobs have so far been created for local and/or unemployed people, of which 4,214 (96%) have been filled by local people and 890 (20%) by individuals who were previously unemployed.

CRL's Jobs Brokerage Service has been operating since March 2010, in partnership with Job Centre Plus, to ensure visibility of, and access to, contractor jobs. The Brokerage has established partnership arrangements with local employment initiatives route-wide. In total the Brokerage has supported 731 local people into work and/or apprenticeships. This compares favourably to the 644 job starts facilitated by Employment and Skills Managers on the Olympic Park between 2008 and 2012.

New Brokerage initiatives during 2015 have included a partnership with the Women into Construction project to boost work placements and job starts for women. We have also established a 'job guarantee' training scheme which sources candidates from employment support programmes across London.

The Job Brokerage scheme has been incredibly successful, however, as the nature of the project changes from civil engineering to the installation of complex railway systems have seen a significant drop in the number of applications through the service. As a result, CRL has decided to bring the scheme to an end in spring 2016. All future opportunities will still be accessible to local communities via Job Centre Plus and we are sharing the lessons we have learnt with the wider industry and future projects through our learning legacy strategy.

### 4.7 Young Crossrail

CRL's Young Crossrail (YC) programme aims to inspire the next generation of engineers and construction sector workers. Over the past year, we have managed to reach over 14,500 students and teachers, engaged with more than 100 schools, colleges and universities.

Our volunteers have given over 1,000 hours of their time to increase awareness and support for STEM subjects and careers. Activities in 2015 have included a networking event for girls from YC partner schools on National Women in Engineering Day, a challenge based around structural engineering during Tomorrow's Engineers Week and a strong presence at this year's Skills London and Skills Show exhibitions.

## 5 Sustainability

CRL has publicly reported its sustainability for the last four years in the form of the Crossrail Sustainability Report, the latest of which was released in July 2015 presenting our performance between April 2014 and March 2015. We include a link to the report on CRL's website for the consideration of the committee [here](#). Particular highlights to end of 2015 include:

### Economic Sustainability

- 95% of the contracts awarded by Crossrail were to companies within the UK.
- 61% of suppliers are based outside of London.

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- 44% of small medium enterprises have said they made new contacts because of their work on Crossrail.
- For every £1 spent Crossrail will bring £1.97 of transport benefit once the service is operational.

### Environmental Sustainability

- 7m tonnes of material excavated during construction 98% of which has been beneficially reused.
- LED lighting will be used in all Crossrail tunnels and stations saving up to 38% energy compared to fluorescent lighting.
- 86% of construction equipment in the central section of the route fitted with emissions controls.
- Over 10,000 archaeological items spanning 55 millions years have been unearthed across 20 sites.

### Social Sustainability

- 4,398 job starts by local or previously unemployed people.
- 9,118 drivers attended lorry driver training courses.
- Over 10,000 people trained at TUCA.
- 1,110 young people undertook work experience.
- 517 apprenticeships created on the project.

CRL remains on target to reduce our construction emissions by 8% over the life of the contracts. The current reduction figures indicate that we are above this figure (12.9%), but with approximately 30% of the construction programme remaining we continue to focus on delivering this reduction.

Last year we reported a number of energy efficiency elements have been incorporated into the emerging design for the Crossrail rolling stock but were not able to say how this will impact on the overall carbon footprint. We can now report that while this continues to remain work in progress, current estimates are that the new rolling stock will save up to 30% of the energy currently used by the trains they will replace, while delivering faster journey times and an improved, air conditioned, passenger experience.

Finally, we are pleased to be able to report that the first phase of Wallasea Island was formally opened by the Royal Society for the Protection of Birds (RSPB) as Jubilee Marsh in September and completes Crossrail's commitment to this significant project of European conservation.

## 6 Health and Safety

Crossrail remains determined to improve health and safety standards, both on our own project and in the wider industry. Health and safety forms the core value for Crossrail and it is our view that one of Crossrail's legacies must be to make the construction industry healthier and safer.

Crossrail has further developed the Health & Safety Performance Index (HSPI) this year, making the metrics more challenging for contractors and ensuring they remain focused on

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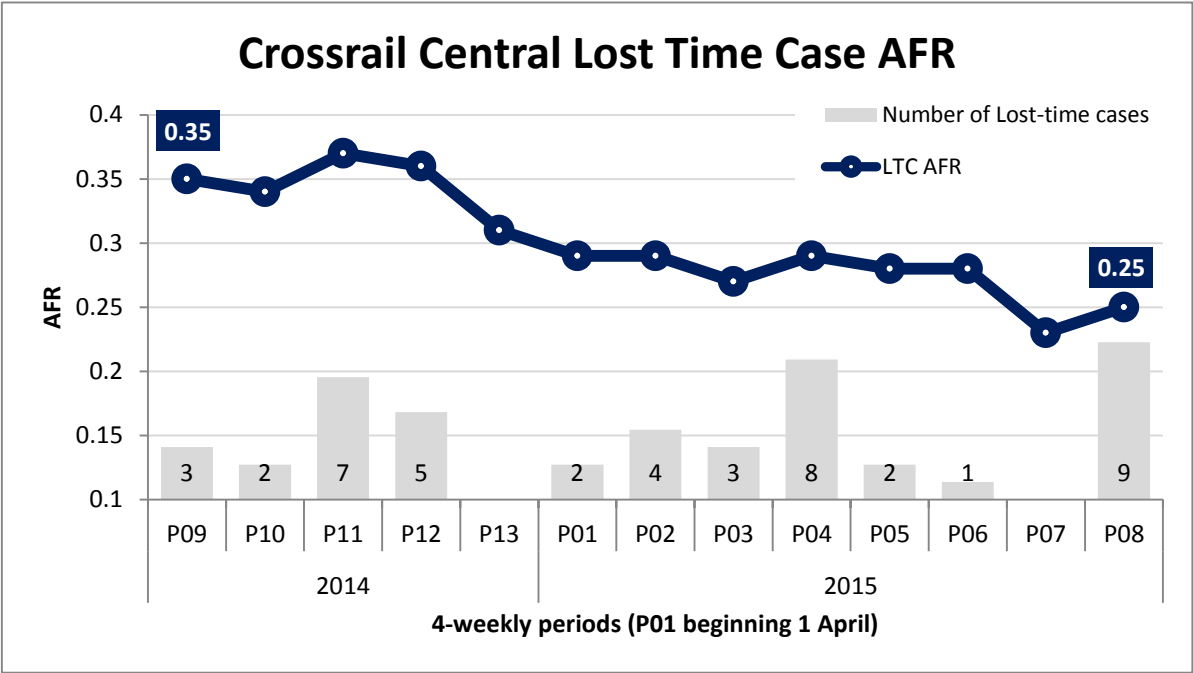
driving the right improvement activities through these leading indicators. HSPI remains the primary means of measuring Contractor health and safety performance, rather than the traditional Accident Frequency Rates (AFR) which we continue to monitor but only as secondary indicators.

Currently, 13 out of 16 contracts (81%) are achieving a HSPI score of 2.00 (scale of 0 to 3 with 1.0 reflecting contractual compliance) or above and all contracts exceed our minimum contractual compliance.

We maintain a focus on increasing reporting rates, including those for near misses, observations and good practices. In the last year, rates of reporting have increased by 74%.

Crossrail’s AFR has reduced by 29% over the last year. This included two full periods with no lost time injuries and four contracts that have now operated for over 2 years without a lost time injury.

Whilst this continued improvement is encouraging, there remains some way to go to achieve our ‘Target Zero’ aspiration, where no one is harmed by our activities.



**Table 5: Crossrail programme-wide LTC rates**

Improvement activities continue on the programme and have this year included the addition of a focus on diversity and inclusion. Our pioneering philosophy, that diverse and inclusive teams are those with the best health and safety performance, has been integrated into all the now familiar initiatives we undertake annually; including our Gateway assessment process, Stepping Up Week (two have been held this year) and the Have Your say Survey.



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The profile of mental health and wellbeing has also been raised significantly on the programme, with question sets within the now annual Have Your Say survey focusing on these important issues. Other initiatives have included completion of two best practice guides, the advent of an Incident Investigation course to upskill both Client and Contractor managers and a 'Behaviour Influences Behaviour' course for Crossrail employees, that educates attendees on how their behaviour, remote from the site as it may be, can influence site workers to behave unsafely.

In preparation for the transition from civils based work to the fitting out of the railway, updated Golden Rules and High Risk Activities were launched. These new rules are based on behaviours and are applicable to all situations.

A generic Programme Wide Induction (PWI), for use on all contracts was rolled out across the project. The new induction provides a consistent approach to induction across the programme, eliminating the need for individuals who move between contracts to be re-inducted whilst ensuring the material is delivered in an informative and engaging manner.

Crossrail continues to focus on lorry driver training and vehicle safety standards for the fleets of contractor HGV's servicing the various worksites across London. The project's bespoke upskilling programme, has now reached 9,118 drivers trained as at 23th November 2015. Vehicle safety compliance is still rigorously checked and recorded for each vehicle entering a Crossrail site. Compliance levels continue to exceed 98% for all Crossrail contracts as reported by Principal Contractors.

Crossrail is also responding to new risks, from an increase in vans being used on the project during the station and railway systems fit out phase of building the new railway. We are working in collaboration with TfL and Principal Contractors to rollout a new, 'Van Smart' driver training course which includes an 'on bike' element for van drivers.

Crossrail continues working in partnership with the Metropolitan Police, running exchanging places events near project worksites. Together with the Police and other CLOCS Champions Crossrail is planning another road safety exhibit at the 2016 Bike Show in February, to raise awareness amongst cyclists of the risks from blind spots when cycling near to HGVs.

Crossrail remains part of the TfL initiative on the progressive development of the Construction Logistics for Cycling Safety (CLOCS) standard. This industry led Work Related Road Safety (WRRS) activity is based on Crossrail's leadership in construction logistic and transfers our best practices and experiences to other projects through the new standard.

Crossrail was awarded the 'UK's Most Cycle Friendly Contractor/Developer Award for 2015' by the Club Peloton Charity.

## 7 Potential future extensions

Crossrail Ltd. is delivering a defined scope of work, as set out by our Joint Sponsors – TfL and the DfT. The National Audit Office report, looking at the Crossrail programme, noted in January 2014 that *"Sponsors and Crossrail Limited point to the relatively small number of sponsor requests for changes to programme scope – ten in all, of which four were implemented – as a demonstration of the stability of the project's governance arrangements and its clear scope."*

Proposals to extend the Crossrail route to Ebbsfleet and Hertfordshire are not part of the CRL scope and would need to be put forward by Crossrail's Joint Sponsors. CRL will assist in this work as and when is required by the Joint Sponsors.

### **8 Risk management**

Risk management continues to play a critical part in the successful delivery of Crossrail. CRL has continued to identify, assess and manage risks and uncertainties through a robust risk management process. Understanding and addressing uncertainties and risks is critical to ensure that the project remains within its funding envelope.

CRL has also cascaded its risk management approach to its main contractors and the wider supply chain. Contractors are required to follow CRL's Risk Management process to recognise and control risks to their works on site, and to use CRL's systems to report their top risks and risk management performance.

The robustness of Crossrail's risk management system has ensured that the project has sufficient contingency to manage risk at each level and at each phase of the programme. Provided below is a summary of four risks which remain on the project and an overview of how Crossrail is managing this risk:

#### **8.1 Station fit out**

Construction of the running tunnels is now complete and the focus of management attention is now on completing central section stations civils works and fitting out of mechanical and electrical equipment plus architectural finishes.

Central section station fit-out works are being delivered by contractors under Design and Build contracts which transfer design risk into the supply chain. CRL retains the responsibility for providing assurance that the designs fulfil Sponsors' requirements and will be acceptable to the Infrastructure Managers. These works will be coordinated and managed by the main construction contractors but delivered through a diverse set of specialist subcontractors.

A key aspect of the station fit out programme is the integration with railway systems installations; and good progress has been made in agreeing the detailed scope and schedule of room access between stations and systems contractors.

Risks associated with this phase are being managed with both sets of contractors through joint risk reviews.

Outside of the central section, Network Rail is responsible for £2.3bn of works to upgrade existing lines and stations to the West of Paddington and East of Liverpool Street to Shenfield. This work will continue and we do not anticipate any issues with the condition of stations in the west where there will be a number of complete station rebuilds. Where a complete rebuild is not taking place, improvements to the fabric of those stations will have been undertaken in advance of handover to TfL.

On the north eastern spur to Shenfield, TfL began running services through the appointed Crossrail operator MTR (Crossrail) in May 2015. This allowed the future CRL operator to gain

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experience of running a section of the future CRL route prior to the introduction of the new rolling stock. Station works to improve the fabric of these stations will continue following the commencement of services.

### **8.2 Railway integration**

Testing and commissioning strategies are well developed and have been communicated to all of the Crossrail contracts. The Crossrail railway services will be introduced on a staged basis.

Stage 1 (introduction of new rolling stock on the Great Eastern) will be preceded by extensive performance and integration testing initially at Bombardier's Derby test track and then at Network Rail's test track located in Melton, Leicestershire through 2016. Subsequent trial running on the Great Eastern in 2017 is fully co-ordinated with Network Rail and the required possessions have been secured.

Stage 2 testing of the route to Heathrow and the new national ETCS signalling system will be proven initially by Network Rail with their dedicated ETCS test train in early 2017, followed by trial running of the Crossrail train later in the year. This stage will also prove the interface between Old Oak Common Depot and the Great Western network – important for both Stage 2 and Stage 3 openings.

Stage 3 (introduction of the central operating section) will benefit from the completed proving of the train performance in the preceding two Stages, so will focus on the specific challenges of the new Crossrail signalling system, the transition interfaces with Network Rail, and the new central section infrastructure.

We intend to progressively start the dynamic testing between Canary Wharf and Abbey Wood at the end of 2017, extending to Paddington in early 2018. This approach provides several months of dedicated testing before the commencement of a further 1 month trial running period in July 2018. This period of testing will also prove the interfaces required for end-to-end running of Crossrail services which will be introduced in Stages 4 and 5 in 2019.

We are also intending to prove the performance of the critical interfaces between train systems and the three signalling technologies for the end-to-end railway at a dedicated integration facility – this will enable most compatibility issues to be resolved before actual physical testing begins. This approach builds on a similar strategy employed successfully by the Thameslink programme.

### **8.3 Rolling stock**

Transport for London is leading on the delivery of the contract for the manufacture of the rolling stock. This year has seen the Crossrail class 345 train move from its preliminary design stage towards the end of detailed design, with engineering components now defined plus agreement on the vehicle interiors, aesthetics and livery. This has culminated in the public launch of the vehicle design, plus the commencement of vehicle manufacture with the first car bodyshell being assembled on the production line in Derby.

Next year will see vehicle testing occurring at the factory plus on the national rail infrastructure. The rolling stock remains on-schedule to support introduction of the Crossrail service.

### **8.4 Old Oak Common depot**

The delivery of a depot at Old Oak Common is a core part of the contract let in 2014 for the design, build and maintenance of new rolling stock being led by TfL. Following demolition of the

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existing carriage sheds and site clearance, development of the Crossrail depot commenced with construction of the main physical structure - the Operations & Maintenance Centre (OMC) building that will be used to service and maintain trains under cover on nine roads.

The OMC building has had its foundations installed (including geo-thermal piles for energy-efficiency), the structural steelwork erected, the roofing fitted and is now nearing completion of the external cladding.

This year will see fit-out activity progressing within the OMC building, plus work on permanent-way and overhead line equipment installation ahead of the OMC building becoming available for operation from May 2017.