



# CROSSRAIL SUSTAINABILITY REPORT 2015







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# FOREWORD



It's been an incredibly busy year for Crossrail. The project is 60 per cent complete and we remain on schedule to deliver a world-class railway, safely and within the available funding.

Crossrail is the first project in the UK of this scale to consider sustainability in its decision making from day one. We think about sustainability holistically, taking a whole life view on the project. This means delivering a world-class railway on time, safely and within the available funding while minimising the amount of energy and resources used during the construction programme and during operation for its 120 year design life.

We aim to minimise the impacts of Crossrail's construction phase and maximise the benefits. We have committed to working with a diverse supply chain to ethically source materials used on the project and will continue to help drive improvements in safety, skills, learning and expertise to handover to the next generation of infrastructure projects.

We aim to achieve whole life energy savings through the design of stations and rolling stock; to deliver wider social and environmental benefits in safe, accessible and comfortable public spaces; and to secure London's place as a competitive world city through its contribution to the integrated transport network.

The scale of the challenge is considerable. However, we have been able to go much further than previous projects in embedding sustainability in our decision making. We have attempted to deliver sustainability in every area of the programme - from energy efficiencies, air quality and beneficial reuse of spoil, to skills, supply chain benefits, a public art programme, an accessible railway and much more.

In the past year, we have made significant progress on our construction programme. A key focus during this reporting period has been on the works to complete Crossrail's tunnel drives by the spring of 2015. 98% of the spoil removed from our sites has been beneficially reused and the vast majority of it carried by rail and barge significantly reducing the number of lorry journeys on the streets of London. Over three million tonnes of this spoil is helping to create a new wetland habitat for birds on the Essex coast in collaboration with the RSPB.

In collaboration with our principal contractors we surpassed our target of creating 400 apprenticeships across the project. This investment is delivering the most significant injection of new talent into the UK tunnelling and construction industry in a generation. With three years left to go on the project, we will continue to work together to help develop a skilled future workforce.

We are adding to this skills legacy through training at our state-of-the-art Tunnelling and Underground Construction Academy.

The UK supply chain continues to benefit from Crossrail with 61 per cent of contracts awarded to firms outside of London. Crossrail is estimated to be supporting 55,000 jobs throughout the country, benefiting every region in the UK.

The construction of Crossrail has resulted in one of the most extensive archaeological programmes ever undertaken in the UK. Over 10,000 items spanning 55 million years have been unearthed and will be analysed to help reveal and document this important history.

Safety remains our number one value. We strive to make Crossrail a safe place to work. It is our view that one of Crossrail's legacies must be to make the construction industry safer.

We continue to pioneer the protection of vulnerable road users when in the proximity of our worksites and those operating vehicles on Crossrail business. 8,039 drivers have been trained by Crossrail so far and we are the first project to mandate additional safety equipment on all HGVs.

Despite all these efforts there was a fatality involving a cyclist during the year. It is essential that we learn the lessons from these tragic incidents and do everything we can to prevent them ever happening again. Our thoughts remain with the family, friends and work colleagues.

As the tunnelling works draw to a conclusion, the focus of the project moves towards fitting out the tunnels and stations and installing the systems required to operate the railway. There will be increased activity on the surface sections of the route, both to the east and west, where Crossrail connects to existing Network Rail infrastructure. Once these systems are in place, extensive testing will be undertaken ahead of the central London section opening in 2018.

Constructing Crossrail has involved gathering together a wealth of knowledge. Sharing this knowledge, best practice and learning with the rest of the industry, including Thames Tideway and High Speed 2, will continue to be an essential part of our work.

Our fourth annual sustainability report offers a detailed record of Crossrail's performance between April 2014 to March 2015 and highlights the innovative work taking place across the project. The coming year will present new opportunities and challenges. We will continue focus on delivering a sustainable railway.

**Andrew Wolstenholme OBE, CEO Crossrail Ltd**

# CROSSRAIL

## MOVING LONDON FORWARD

### Building London's new east to west railway sustainably

By 2030 the Capital's population is set to reach 10 million. Its transport system must be ready to service this increasing demand. Crossrail is a key part of the UK's plan to maintain London's place as a world-class city by supporting considerable growth and maintaining the highest standards in urban transportation.

Crossrail will be a major new suburban rail service for London and the South East. The new railway will be a high frequency, high capacity service linking 40 stations over 118 kilometres, from Reading and Heathrow in the west to Shenfield and Abbey Wood in the East. It will reduce congestion by increasing central London's rail capacity by 10 per cent. The new east-west route will

bring an additional 1.5 million people within 45 minutes of London and reduce central London journey times. The entire route will be accessible, delivering a world-class experience for passengers.

The project will deliver 21 kilometres of new twin-bore tunnels, 10 new stations, improvements to 30 more and upgrades to existing rail infrastructure.

The new trains will be over 200 metres long and be able to carry 1,500 people – almost twice as much as current London Underground services – creating a more comfortable passenger experience.

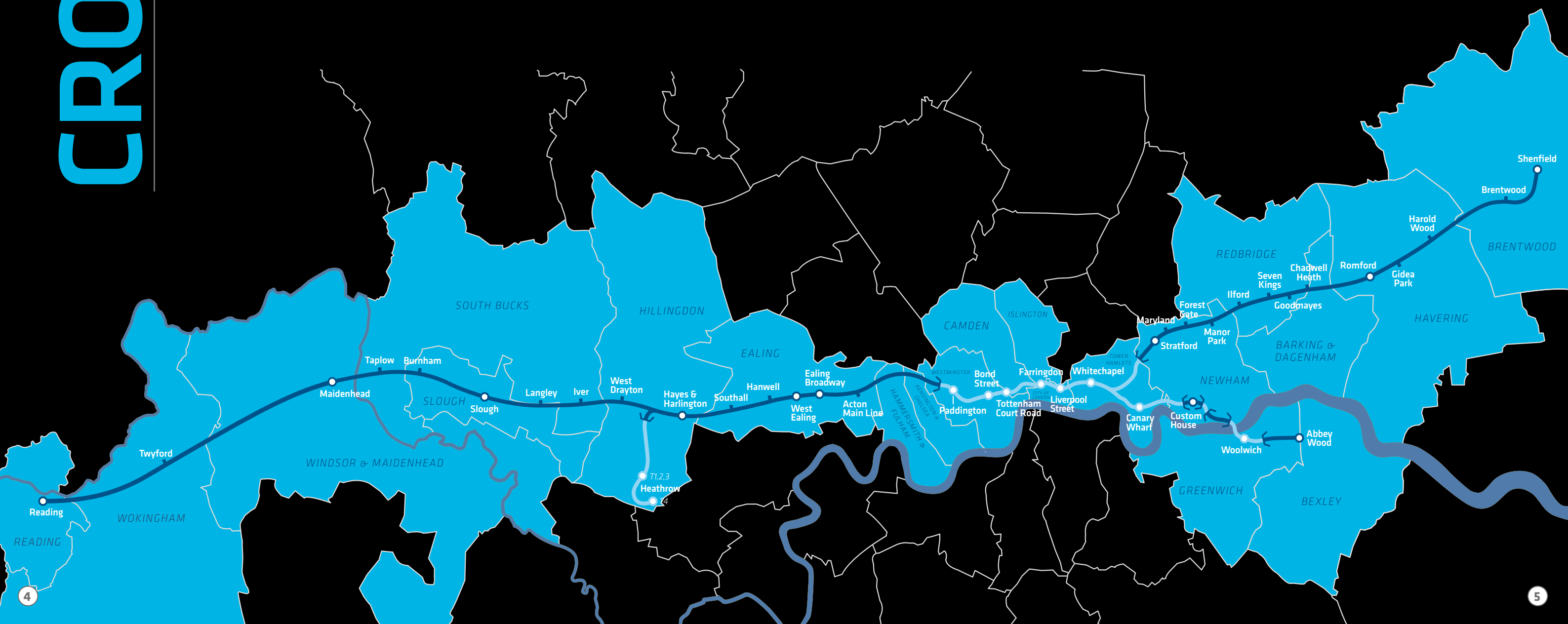
In addition to the railway and trains, oversite developments and urban realm improvements have been incorporated into the construction programme. This will see the delivery of three million square feet of high quality office, retail and residential space at twelve key sites

above new Crossrail stations, whilst £130 million of urban realm improvements will create more than one million square feet of improved public spaces.

A total funding package of £14.8 billion is available for the delivery of Crossrail. The new railway will support regeneration across the capital and benefit the UK as a whole. It is estimated Crossrail will generate at least £42 billion for the UK economy.

Sustainability has been at the heart of the project since its inception. It will have a long-lasting impact on how people travel around London and the South East and leave a lasting skills and learning legacy.

As the largest infrastructure project in Europe, Crossrail presents an excellent opportunity to lead in delivering a sustainable railway fit for the future.





# VISION & VALUES

**Crossrail's mission is to deliver a world-class railway that fast tracks the progress of London. Given the scale and importance of the project, we are committed to ensuring that sustainability underpins everything we do.**

Crossrail is the first project of this scale in the UK to consider sustainability in its decision making from day one. Taking a holistic approach, it aims to minimise the negative impact on the environment and maximise economic and social benefits throughout the railway's construction and into its operation. Activities span all aspects of London life, impacting many communities along the route and this responsibility is taken very seriously. For example, during Crossrail's 120-year design life 85 per cent of its carbon emissions will be expended in running the operational service. Energy efficiency has therefore been a core consideration in designing stations and rail infrastructure. The actions undertaken today will have long-lasting benefits for London, the South East and the UK.

The breadth of Crossrail's sustainable activities is diverse. It includes the beneficial reuse of excavated spoil; working with industry to ensure that plant and equipment used on site is energy efficient and not contributing to air quality problems; ethical sourcing requirements for procurement of construction materials; promotion of cycle and vehicle safety through compulsory training; safety equipment requirements for all lorries; and developing skills of the future workforce through the apprenticeship programme.

## CROSSRAIL VALUES

### SAFETY:

We put safety first

### INTEGRITY:

We keep our promises

### INSPIRATION:

It's in our power to change things for the better

### RESPECT:

We treat people as we'd like to be treated

### COLLABORATION:

We're stronger together

## CROSSRAIL'S SUSTAINABILITY VISION

### To build Crossrail sustainably by:

- Seeking to minimise the impact on the environment and the community throughout construction
- Ensuring a diverse supply chain benefits from Crossrail work and that materials used on the project are sourced sustainably
- Providing a legacy of skills, learning, expertise and experience that can be handed on to the next generation of major infrastructure projects
- Moving a step closer to a more inclusive and safer construction industry

### To design and deliver a world-class railway that can be operated sustainably by:

- Embedding energy saving and emissions reduction in the rolling stock and station designs
- Promoting safety, comfort and wider social and environmental benefits in the design of Crossrail stations, trains and public spaces
- Helping to secure London's place as a competitive world city

### This holistic approach is supported by two key priorities within the Crossrail organisation:

**Safety** – This is Crossrail's number one value. It is based on the beliefs that all harm is preventable, that everyone working on the project has the right to go home unharmed every day and that everyone must work together to achieve this.

**Innovation** – This is embedded within the organisation. The Innovate18 programme promotes new thinking and new ideas, many of which have an impact on sustainability for Crossrail and future projects.

Crossrail's sustainability performance is told through the well understood themes of social, economic and environmental sustainability and is designed to meet the aspirations of our joint sponsors (Transport for London and Department for Transport), stakeholders and future passengers.





# REPORT STRUCTURE AND SCOPE

This fourth annual report is a review of Crossrail's sustainability performance in the financial year April 2014 to March 2015. It covers the entire Crossrail programme which comprises the surface works being delivered by Network Rail as well as the central London works being delivered by Crossrail Ltd.

Crossrail's central section includes the construction of 21 kilometres of new twin-bore tunnels under London, 10 new stations, 12 above station developments and urban realm improvements.

The surface works involve the reconfiguration and upgrade of route infrastructure on 90 kilometres of three existing mainline railways to the west and east of London. The 'on network' programme involves the construction of a new Heathrow spur and new train stabling and maintenance facilities at Ilford, Old Oak Common and Plumstead.

The report has been designed to be comparable with sustainability reports from previous years. Data on Crossrail's performance is presented and supported by additional information to provide greater context. Performance is analysed and opportunities have been identified to improve sustainability on the project.

The report is illustrated with case studies that identify best practice and highlight innovations that have benefited the project or the wider industry.

The main part of the report is devoted to detailing Crossrail's performance against a number of performance indicators. It also includes a look forward to 2015-16, details of Crossrail's organisational profile, stakeholder engagement, reporting obligations and board membership.

# CROSSRAIL SUSTAINABILITY THEMES



## CROSSRAIL'S KEY SUSTAINABILITY PERFORMANCE INDICATORS

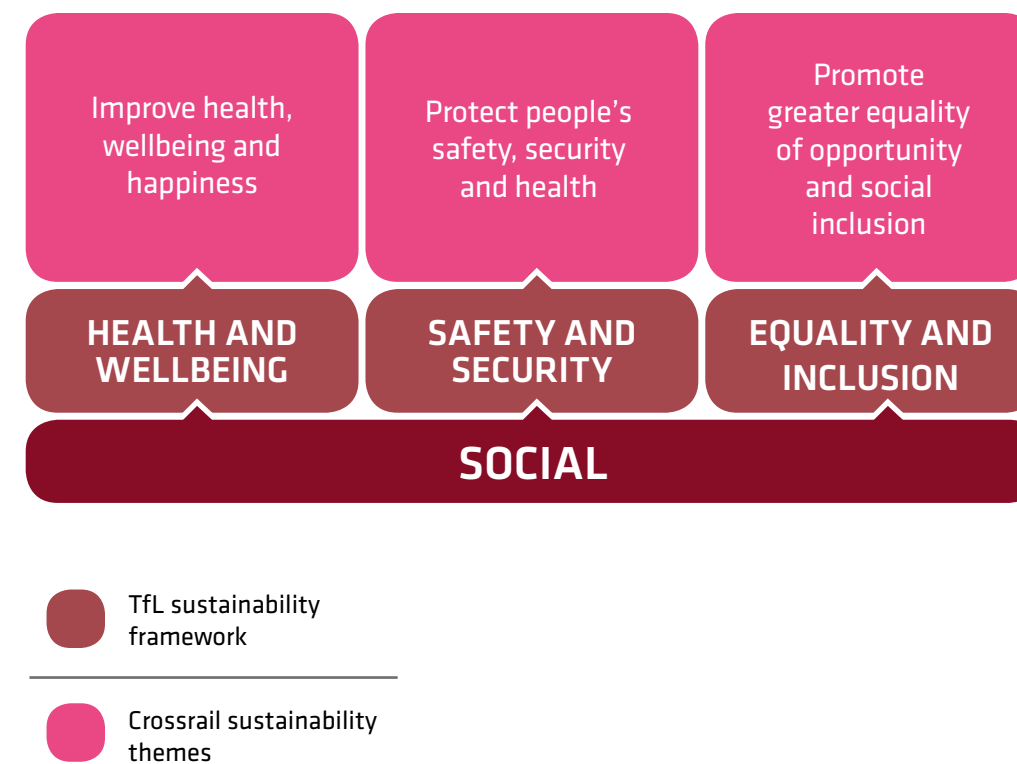
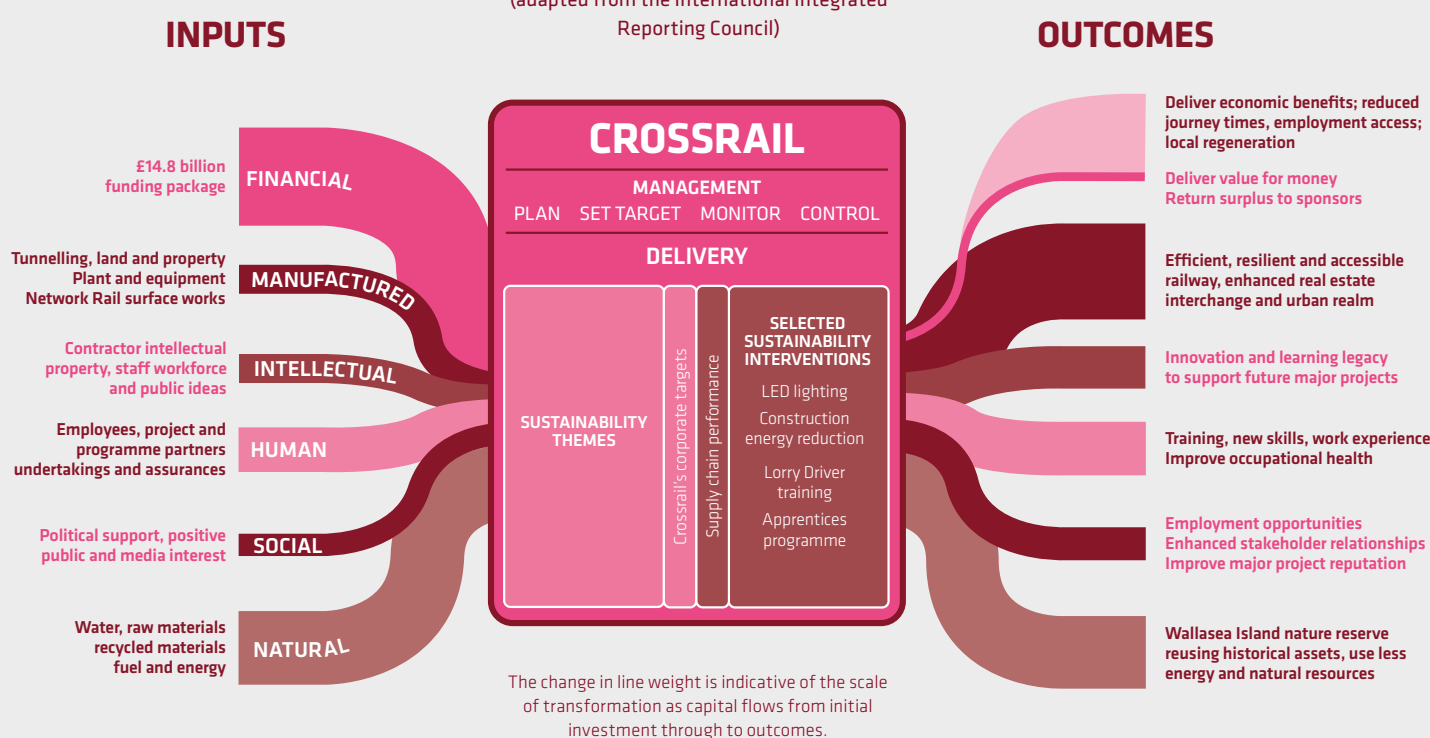
1. Location of businesses awarded Crossrail-related contracts
2. Delivery of whole life value
3. Number and size of businesses awarded Crossrail related contracts
4. Environmental assessment ratings
5. Recycled content by value
6. Recycling and reuse of waste material
7. Carbon footprint
8. Environmental complaints
9. Construction health and safety
10. Health and safety performance index
11. Diversity in Crossrail's workforce
12. London Living Wage
13. Strategic Labour Needs and Training compliance
14. Apprentices
15. Jobs Brokerage service and local employment
16. Volunteering
17. Work experience
18. Young Crossrail's audience reach

## Integrated reporting

The concept of integrated reporting has been developed by a coalition of regulators, investors, companies and non-governmental organisations who share a view that corporate reporting should also communicate value creation. The Integrated Reporting Framework below provides a foundation for this journey and will help Crossrail to build on the quality of reporting. Several examples of this form of reporting can be found throughout this document.

## THE FLOW OF CAPITAL

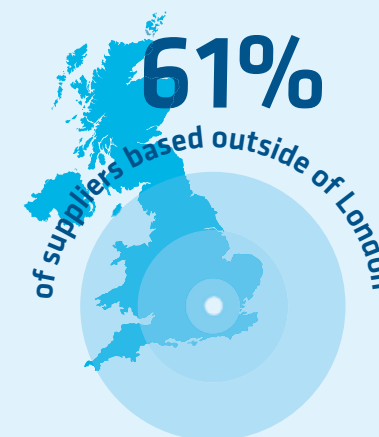
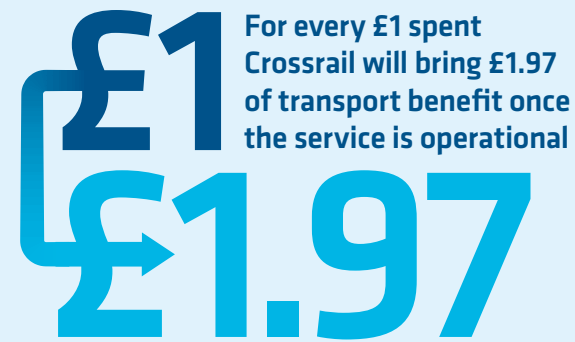
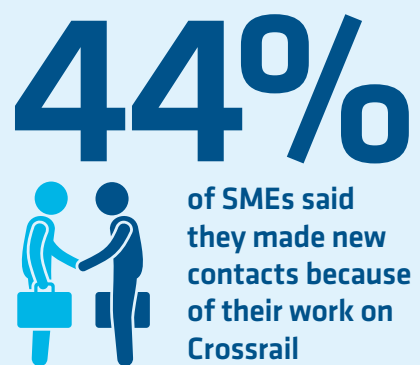
The value creation process on Crossrail (adapted from the International Integrated Reporting Council)



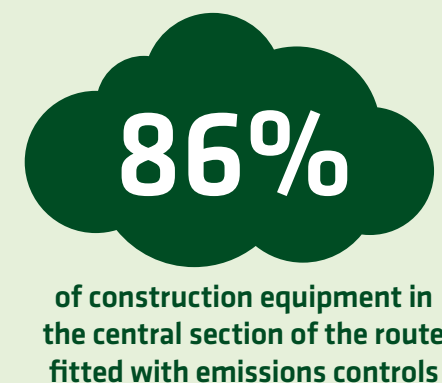
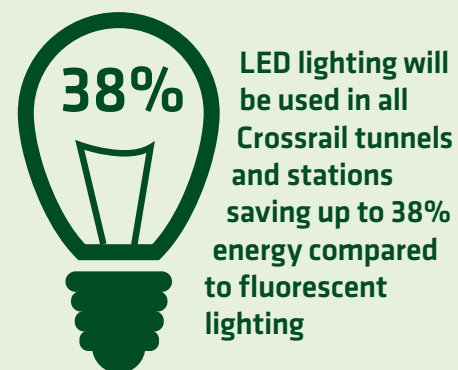


# SUSTAINABILITY HIGHLIGHTS

## ECONOMIC



## ENVIRONMENT



## SOCIAL





# LOOK AHEAD 2015-16

## Crossrail construction programme

The focus of the construction programme shifts to the huge task of fitting out the empty tunnels, stations, shafts and portals with the infrastructure, power and technology required to become a fully operational railway. At the same time, Crossrail will continue to work closely with its partners to deliver 30 station improvements, 12 above station developments and urban realm improvements across the entire route.

## Supply chain

The new specialist teams and skills required to deliver the new construction work stream will continue to present opportunities for UK companies through the supply chain.

## Air quality

Develop a Good Practice Guide as part of the health legacy and support the Chartered Society for Worker Health Protection (BOHS) Breathe Freely initiative and its workplace management standard.

## Energy efficiency

Continue the focus on driving down operational energy requirements by working with contractors in the detailed design phase of mechanical and electrical components and ongoing work with Bombardier to ensure delivery of efficient rolling stock.

## Construction waste

Work with contractors to explore further opportunities to reduce, reuse and recycle construction waste.

## Biodiversity

Biodiversity accounting work will be undertaken to assist in identifying ways to incorporate biodiversity enhancements post-construction.

## Archaeology

The discoveries from Liverpool Street will be analysed in detail to reveal important history. The research, which is being undertaken by the Museum of London Archaeology, is also expected to offer the first proper understanding of the demographic profile of 16th century London.

## Health and safety

Implementation of next phase of the Target Zero programme in April 2015 to coincide with the transition into the new organisational structure and construction work stream. The Health and Safety Performance Index will be enhanced with new metrics and designed to ensure that contractors maintain their proactive approach to health and safety.

## Occupational health management

Continuous improvement in health risk management, fitness for work and health performance objectives.

## Mental health and wellbeing programme

Undertake an employee survey to establish needs and implement targeted interventions to tackle fatigue.

## Tunnelling and Underground Construction Academy (TUCA)

Work with industry to consolidate the long term success of TUCA.

## Community investment Programme

A Community Investment Plan agreed for every site with support and engagement from contractors. Plans implemented and reviewed on a quarterly basis of impacts measured and reported.

## Reward performance

Recognise and reward the sustainability performance of Crossrail's supply chain through the Annual Sustainability Awards. 2015-16 will include an additional awards category to recognise the value of the volunteer programme.

## Learning Legacy

Begin collating lessons learned and best practice from the Crossrail project and start sharing with wider industry from early 2016 following the launch of a Learning Legacy portal. The portal will contain a library of resources, including case studies, to help inform future projects.

## Apprenticeships

Identify and share best practice in areas such as high retention rates, providing sustainable employment and opportunities for further development.





# CROSSRAIL CELEBRATES OVER 400 APPRENTICESHIPS

**In 2009 Crossrail committed to creating at least 400 apprenticeships over the lifetime of the project. At the start of 2015, just over halfway through the project, Crossrail celebrated its 400th apprenticeship.**

To celebrate this milestone, Patrick McLoughlin, Secretary of State for Transport, visited the Bond Street site to meet some of the apprentices helping build London's new railway. Speaking about the apprenticeship programme he said:

*"Crossrail is the biggest construction project in Europe and shows UK engineering at its best. I am delighted it has created so many opportunities for young people in civil engineering and construction."*

The 400th apprentice was Fatima Alghali, 23, from Denmark Hill in southeast London. Previously a sales negotiator at an estate agent in London, Fatima joined the Crossrail project working with contractor Balfour Beatty, Morgan Sindall and Vinci Joint Venture as a Commercial Apprentice at Whitechapel and Liverpool Street stations. Speaking about her experience as an apprentice, she said:

*"I can't recommend apprenticeships more highly. Working on Europe's largest construction project has given me an unforgettable introduction. No two days are the same and not only am I learning from some of the best engineers in the industry, I'll end up with a qualification that will give me a great start to a career. It's also a huge help that you earn a salary as I'll be debt free when I qualify."*

Having exceeded its apprenticeship target, Crossrail has started to focus more intently on identifying and recognising high-quality standards for apprenticeships throughout the supply chain. This has included revising the Social Sustainability Performance Assurance Framework to incorporate key criteria that will support continuous development and sustainable employment to apprentices beyond the project as well as initiatives to encourage apprenticeship standards within the supply chain.

Crossrail apprentices are trained in a range of professions from construction to accountancy, quantity surveying to business administration. New skills and experience will be gained by apprentices as the project transitions into new construction work streams. In partnership with its principal contractors, Crossrail has delivered the most significant injection of new skills into UK tunnelling and underground construction in a generation.



***" No two days are the same and not only am I learning from some of the best engineers in the industry, I'll end up with a qualification that will give me a great start to a career. "***

Fatima Alghali, Crossrail's 400th apprentice





# GIVING NEW LIFE TO 7 MILLION TONNES OF EXCAVATED MATERIAL

Over seven million tonnes of excavated material were mined during Crossrail's construction. Ninety-eight per cent of this has been reused to bring new life to nature reserves, recreational facilities, agricultural and industrial land in London and the South East.

Nearly 80 per cent of material transported to these sites was by rail and water, significantly reducing lorry journeys in the streets of London.



8

## WALLASEA ISLAND

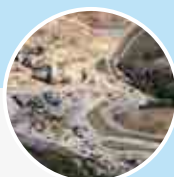
Over three million tonnes of excavated earth contributed to the creation of a landmark 1,500 acre wildlife habitat at Wallasea Island. A collaborative project between Crossrail and the RSPB, the island will provide a haven for an array of nationally and internationally important wildlife and a place for the local community and visitors to enjoy. Wallasea Island will be the largest and most important coastal habitat creation scheme in the UK. It is also one of the UK's most innovative flood defence systems, designed to help combat threats from coastal flooding.

## The 10 sites that have received the largest tonnage of excavated material from Crossrail

1

### CALVERT LANDFILL

Landfill restoration



2

### RAINHAM LANDFILL

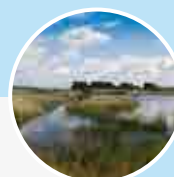
Landfill restoration



3

### FAIRLOP QUARRY

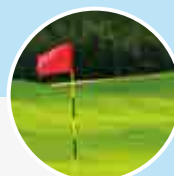
Agricultural use and nature conservation



4

### INGREBOURNE

Golf course



10

### OCKENDON

Landfill restoration prior to creating a wildlife reserve



9

### PITSEA LANDFILL

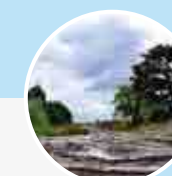
Supporting restoration of RSPB nature reserve



7

### KINGSNORTH

Raise land to allow for construction of a commercial park



6

### GOSHEMS FARM

Grazing pasture for livestock



5

### EAST TILBURY QUARRY

Supporting restoration to RSPB wetland nature reserve



©MAPS IN MINUTES™ 2013 Contains Ordnance Survey data ©Crown copyright and database right 2010



## AN ACCESSIBLE RAILWAY

It was important to ensure that Crossrail would be an accessible railway. Crossrail's new central stations were designed with accessibility features incorporated from the outset. Collaboration with project sponsors, Transport for London (TfL) and the Department for Transport (DfT) resulted in improvements to the remaining stations on the route so each station will be accessible once the service is fully operational.

TfL announced in October 2014 that it would fund step free access at Seven Kings, Maryland, Manor Park and Hanwell stations. Following this announcement, in November 2014, DfT put forward a further £14 million to deliver step free access to stations at Langley, Taplow and Iver. This final round of funding ensured that all 40 stations on the Crossrail route would be step free.

In addition to the improvements at stations, the new Crossrail train fleet will be built to the latest accessibility standards. This includes audio-visual information systems, dedicated priority seats and spaces for wheelchairs.

**“ A fully accessible transport network is a top priority for us, so we are pleased that when Crossrail is fully operational in late 2019 all forty stations it serves will be step free, transforming how disabled people can travel in and across the city. ”**

Mike Brown MVO  
Interim Commissioner of  
Transport for London



## UNCOVERING LONDON'S PAST AT LIVERPOOL STREET

Crossrail's archaeology team completed one of the most significant phases of excavation on the project at Liverpool Street. Over 3,000 people took up the opportunity to watch archaeologists carefully excavate layers of London history from a specially constructed public viewing platform.

Findings from the site - which will later become the Broadgate ticket hall for Liverpool Street station - include the foundations of old Broad Street railway station; 3,000 burials from the former Bedlam cemetery; Tudor period finds; Roman artefacts including jewellery and decorated pottery; and a medieval canalisation of the River Walbrook, one of London's lost rivers.

As the largest archaeological programme in the UK, over 10,000 items from 20 construction sites have been discovered to date.





## ECONOMIC SUSTAINABILITY

**E**conomic sustainability for Crossrail is built on the **ethos of contributing to a strong, stable economy that will help provide prosperity and opportunities for all. As well as providing London and the South East with a world-class, high capacity, affordable railway, Crossrail will generate significant economic benefits across the UK.**

During construction the project will support over 55,000 full-time equivalent jobs through direct and indirect employment opportunities and place an emphasis on local employment and long-term skills development. The majority of business on Crossrail has gone to UK companies with a high percentage of contracts being awarded to small and medium enterprises (SMEs) and businesses located outside of London.

Crossrail is a key part of London's future and in an economy that is inextricably linked to that of the whole country, it will be a catalyst for safeguarding the UK's economic future too.

With up to 24 trains running per hour once operational, Crossrail will bring an additional 1.5 million people within 45 minutes of London, ease congestion, improve connectivity and reduce journey times for passengers.

Minimising whole life costs of the project from design and procurement through construction to operation and maintenance has been essential in delivering a sustainable asset. Objectives are set to ensure good value for money, improved transport efficiency, improved service reliability and provide wider economic benefits.



**ECONOMIC SUSTAINABILITY** ▶



## ECONOMIC PROGRESS: MAXIMISE COMPETITIVENESS AND PRODUCTIVITY OF THE ECONOMY

### Indicator 1 – Location of businesses awarded Crossrail related contracts

At the end of the year, 95 per cent of the critical contracts awarded on the Crossrail project were to companies within the UK and of those, 61 per cent were to suppliers based outside of London. Crossrail continued to closely monitor its critical construction contracts throughout the supply chain.

The largest contracts awarded by Crossrail this year were for the fit-out of Woolwich Station (£70 million) and a £28 million contract awarded to Knorr-Bremse, a Wiltshire based company, for the delivery of platform screen doors in the new underground stations. This complex contract will deliver the screens and sliding doors that will enable passengers to safely board the trains and separate the platform and track side ventilation. For the first time in a UK rail project, these screens will utilise current technology to display live travel information.

In September 2014, Crossrail completed its programme of procurement for Tier 1 contractors, the companies with which Crossrail has direct contractual relationships. The Tier 1 contractors will however continue with procurement of subcontractors as the railway construction programme shifts to railway systems.

Promoting the opportunities available at Crossrail has been a core focus of the supply chain engagement strategy. To encourage UK suppliers to get involved, Crossrail and Tier 1 contractors visited regions in the UK such as the West Midlands, East Midlands, Yorkshire and North Wales. In addition to these visits, presentations were given to industry bodies such as the Rail Alliance and local businesses in the London boroughs. Online engagement opportunities via the Crossrail website continue through the suppliers section which now includes an additional interactive map which allows visitors to browse Crossrail's suppliers and make direct contact.

### Indicator 2 – Delivery of whole life value

Crossrail's whole life value has three principal elements: whole life cost, value for money and benefit realisation.

Where a change has a material impact on the operating cost of the railway, the impact is considered through

Crossrail's change management control procedure, ensuring whole life cost is assessed and value for money is achieved. Any change that impacts capital expenditure or future operating costs is assessed to demonstrate value for money aligned with government policy and guidance.

The 2011 revised business case for Crossrail demonstrated an improved case for the programme. The Department for Transport forecast that for every £1 spent Crossrail would bring £1.97 of transport benefit. When considering wider economic benefits, this benefit cost ratio increased to £3 for every £1 spent (3:1). An updated business case will be undertaken to reflect the extension of the railway to Reading and Twyford and the inclusion of Woolwich station.

Crossrail developed a theoretical framework (see overleaf) to further understand how additional whole life benefits derive from major projects and used this framework as a basis for a direct survey of the supply chain. The results summarise the significant positive impact that spending on infrastructure can have on economic growth through distributional effects (regionally and to SMEs) and productivity impacts (supply chain, skills and major project experience). 75 per cent of survey respondents were from SMEs.

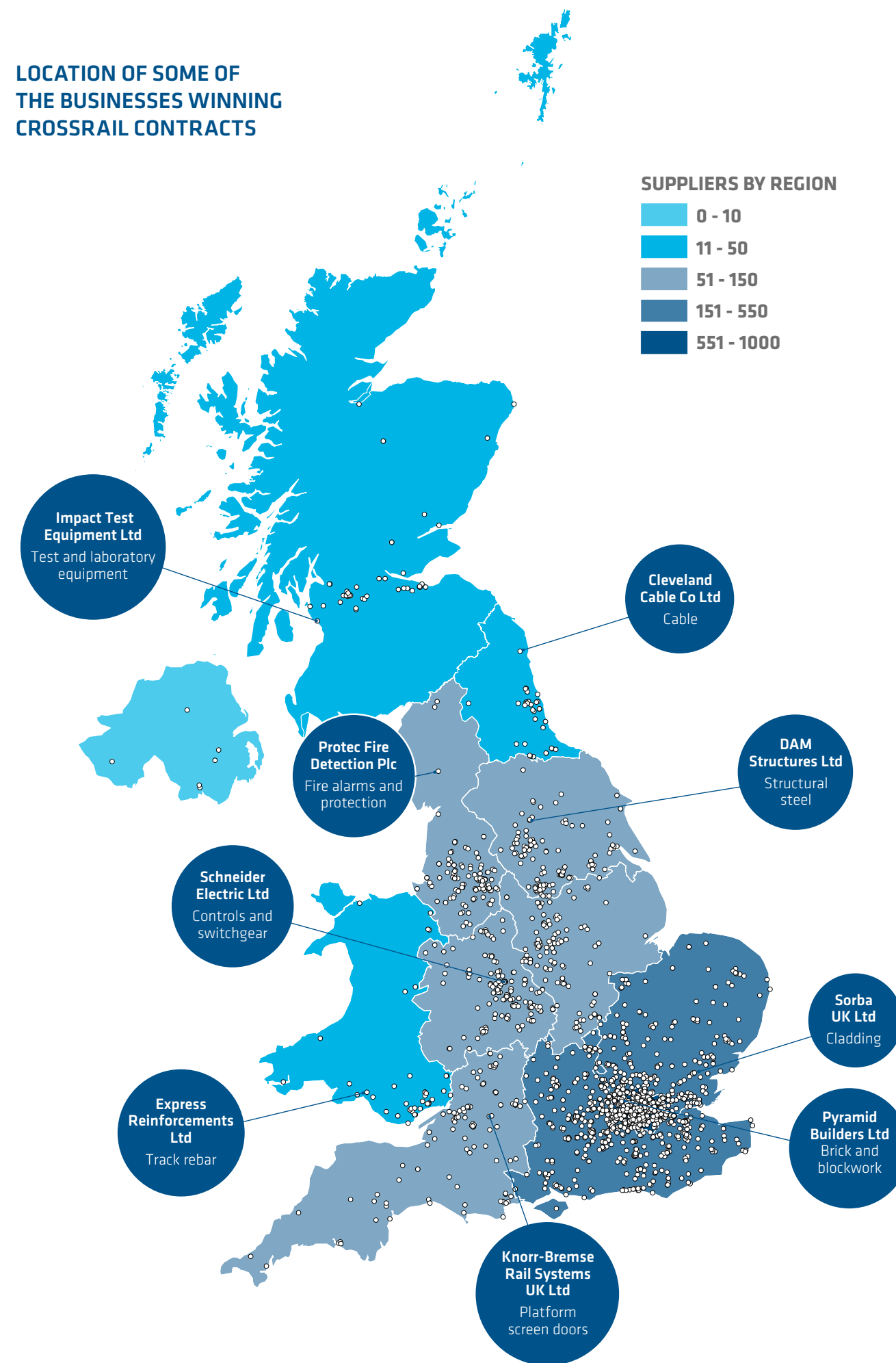
Highlights from the survey include:

- Of the firms that saw employment growth due to Crossrail, SMEs grew much faster than the larger companies
- Crossrail's impact on major project experience was seen to be strongly positive and this experience contributed to companies winning further work
- 44 per cent of SMEs had made new contacts
- 59 per cent of SMEs thought they were more likely to get work from large companies
- 37 per cent of Tier 1 suppliers were likely to use new SME partners as a result of contacts made through Crossrail
- 38 per cent of SMEs felt that Crossrail had helped them generate revenue elsewhere

Highlights specifically related to skills and training include:

- 60-70 per cent of respondents said that their business had benefited a fair amount or a great deal from training whilst working on Crossrail
- 90 per cent of respondents felt that there was at least a moderate long-term benefit from training with no respondent suggesting that the training had no long-term impact

### LOCATION OF SOME OF THE BUSINESSES WINNING CROSSRAIL CONTRACTS





### Indicator 3 – Number and size of businesses awarded Crossrail related contracts

Great emphasis has been placed on attracting a wide and diverse base of potential bidders for Crossrail work. This is to help ensure businesses in the UK, irrespective of size and location, are aware of the opportunities available on the project. All major contracts on the project are monitored to help keep track of the location and size of companies that bid for Crossrail work.

Overall, 95 per cent of work has been won by UK companies with 61 per cent of these companies based outside London.

Since the start of the Crossrail programme UK companies have been engaged on the programme with many winning multiple contracts. 61 per cent of suppliers are SMEs whereas at Tier 2 and below, this figure increases to 70 per cent.

As the programme transitions into the railway systems work stream it is likely that further increases in SMEs will be seen within the mechanical and electrical industries, as the Tier 1 contractors work to deliver the railway fit out, power, signalling and communication works.

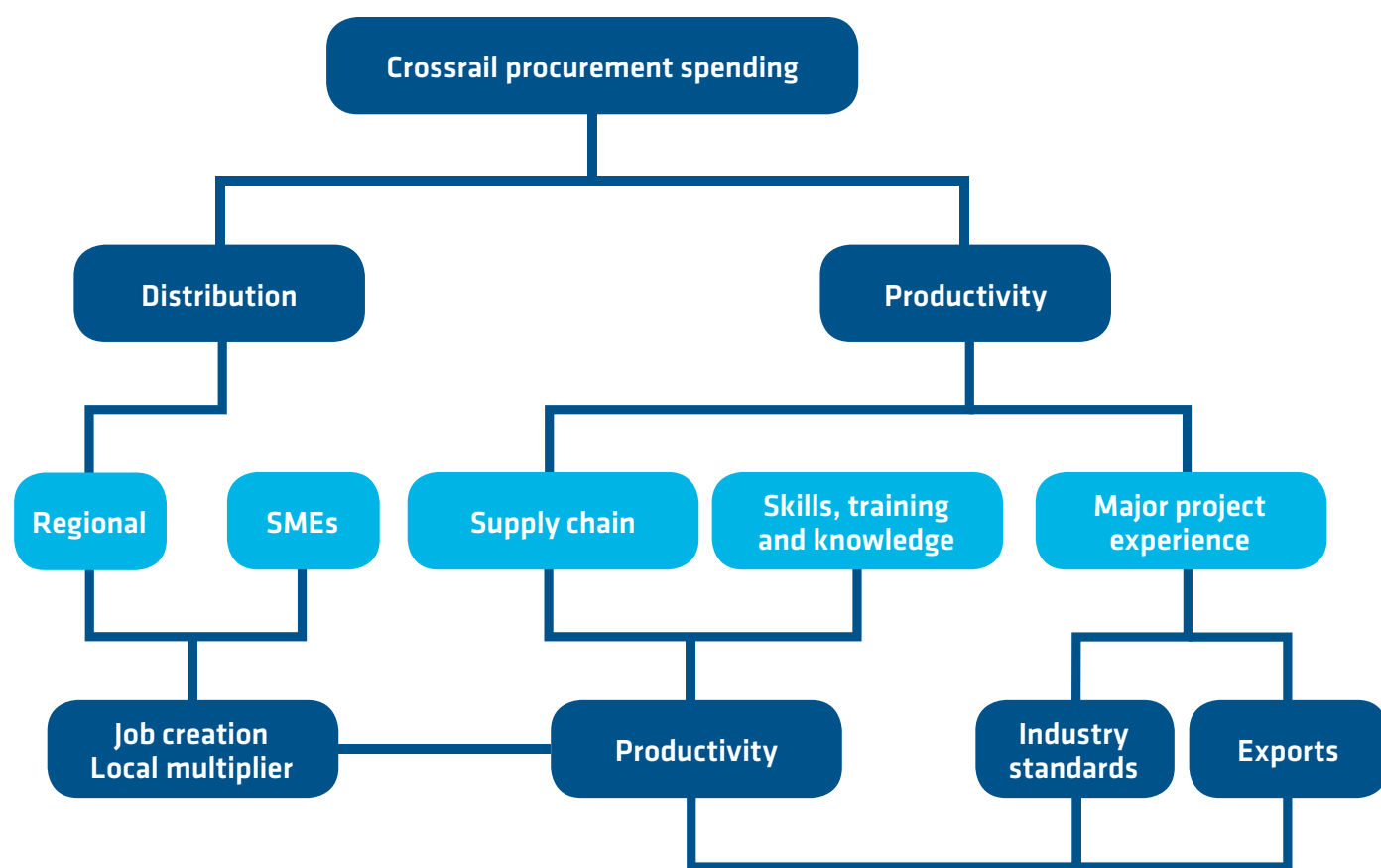
#### CompeteFor

CompeteFor is a free service that enables UK businesses to compete for contract opportunities linked to major public and private sector buying organisations.

Designed to be a fair and transparent procurement process it does not favour suppliers of any particular size and maximises the opportunities available to SME companies.

While procurement by Crossrail's supply chain nears completion, over three years of construction remains and will continue to present many opportunities for a diverse supply chain of businesses of all sizes. Crossrail will continue its commitment to encourage use of the CompeteFor service by its contractors.

### CROSSRAIL THEORETICAL FRAMEWORK



## HADEE ENGINEERING LTD

Formed in 1969, Hadee Engineering in Sheffield boasts a rich history. The firm specialises in fabricated metalwork, machining and welding. With an annual turnover of approximately £5 million Hadee employs 50 full-time staff that work across energy, quarrying, coal and rail industries.

The company won numerous contracts on Crossrail, including work at Pudding Mill Lane, Whitechapel, Victoria Dock portal and Limmo Peninsula totalling around £2 million. These contracts included the supply of tunnel eye rings, emergency stairs and tunnel boring machine launch frames, crucial for the successful start of several major tunnel drives.

Hadee cite the additional benefits gained from working on the project, in particular the enhanced reputation and profile boding well for future contracts. The use of CompeteFor proved hugely beneficial, enabling the company to identify and tender for suitable opportunities on Crossrail and Hadee has encouraged other companies to register as a result. Following its work on Crossrail, Hadee has gained approval to apply the CE\* mark to all the steelwork it produces.

\*Conformité Européenne – The CE mark certifies that a product has met EU health, safety, and environmental requirements, which ensure consumer safety.







### Oversite Development and Urban Realm

Crossrail is the first rail project in the UK to undertake the design of stations, public space and property developments along the route at the same time as construction. The profits from property developments form part of the core funding package – reducing costs for the taxpayer.

A total of three million square feet of high quality office, retail and residential space is planned at 12 key sites above or near the new Crossrail stations. In addition, £130 million of urban realm improvements will create more than one million square feet of improved public space surrounding all stations.

Crossrail is stimulating regeneration and economic growth. Independent research by property consultants concludes that Crossrail will unlock or accelerate the supply of some 57,000 homes and 3.25 million square meters of commercial space. This is expected to add £5.5 billion to property values in London.

#### Funding urban realm improvements

Crossrail aims to maximise the physical improvements and regeneration opportunities that will arise from the new railway. To achieve this, designs have been developed for urban realm master plans for sites surrounding the stations. Crossrail's urban realm initiative is delivered in partnership with TfL and local authorities who are contributing funding alongside Crossrail.

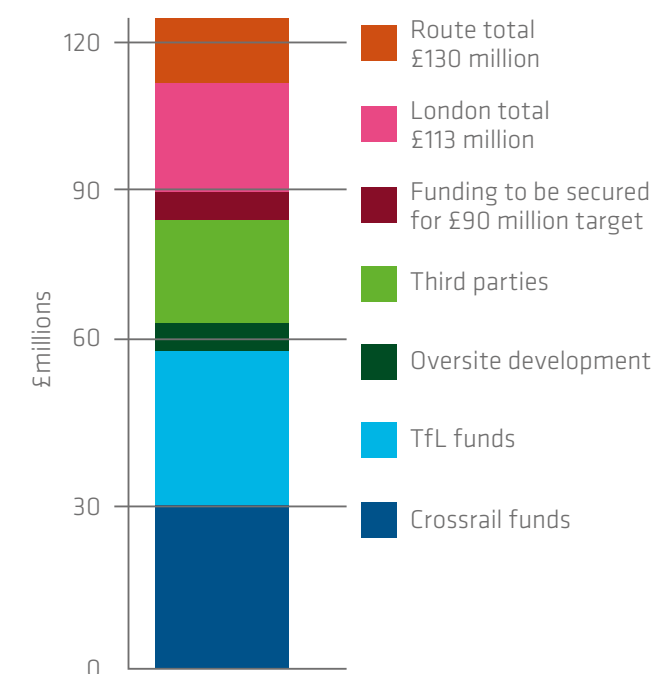
Over the last year, significant progress was made in raising funds. TfL confirmed the allocation of a £28.5 million Crossrail Complementary Measures Fund to six outer London boroughs. In addition, the boroughs allocated £11 million from their own funds (including developer contributions). Together with the improvements that Crossrail is funding, this brings the total funding to £85 million, towards the target of £90 million. This means there will be urban realm improvements outside every station along the route, enhancing the public experience.

#### The Crossrail Effect

In 2012 and 2014 Crossrail commissioned property experts Bilfinger GVA to research development trends around its stations. The reports highlight the positive effect of Crossrail on property values and the numbers of planning applications submitted compared to areas not served by Crossrail stations.

In 2015 two property agents independently produced reports with similar conclusions: Knight Frank concluded that once averaged over each station, residential values around Crossrail stations between 2008 and 2013 out-performed other areas by around five per cent; JLL forecasted that house price growth outperformance between 2014 and 2020 would reach an average of eight per cent and a maximum of 19 per cent concluding that, 'areas experiencing significant regeneration to combine with the Crossrail Effect will benefit the most'.

Funding for urban realm schemes (target of £90 million by December 2018)



#### Oversite developments

The buildings above or around Crossrail stations and associated urban realm schemes will deliver significant physical and visual improvements to surrounding areas and will impact existing local communities. For this reason great care and attention has been given to design, to ensure integration with the existing urban fabric. All designs have been undertaken by leading architects and urban designers and have been reviewed and approved by the Design Council and Commission for Architecture and the Built Environment. A number of the oversight developments have been evaluated as 'excellent' at the pre-assessment stage using the BREEAM rating scheme.

**Crossrail will accelerate the supply of some 57,000 homes and 3.25 million square metres of commercial space along the route**

The new oversight developments in the central section of the Crossrail route will deliver prime new commercial and residential space in some of the most sought-after and high-profile locations in London. In Woolwich and Limmo (Leamouth) Peninsula, the residential oversight developments will act as a major stimulus to regeneration in these locations and will contribute significantly to the housing targets in the borough.



# SUSTAINABLE CONSUMPTION AND PRODUCTION

## Indicator 4 - Environmental assessment ratings

### CEEQUAL

All tunnels, portals and shaft structures are assessed for overall environmental quality using the civil engineering environmental quality (CEEQUAL) assessment scheme. Additionally, specific rail infrastructure on the surface sections of Crossrail are also assessed under the scheme.

All central structures to date have achieved an 'excellent' rating at the design stage or are on course to do so. Three structures have been completed so far: Royal Oak portal, Paddington Integrated Project and Connaught Tunnel. Post construction ratings for these structures have achieved a rating of 'excellent'.

The Connaught Tunnel contract CEEQUAL assessment, completed in April 2015, performed particularly well in the management of water resources, protection of water receptors and local community and stakeholder management.

Continual improvement in energy performance for these three completed structures resulted in a new high score of 75 per cent.

CEEQUAL	Target rating	Client and interim design rating	Post construction rating
Running tunnels west	Excellent	Excellent	On target
Running tunnels east	Excellent	Excellent	On target
Thames tunnel	Excellent	Excellent	On target
Sprayed Concrete lining structures	Excellent	Excellent	On target
Paddington Integrated Project	Excellent	Excellent	Excellent achieved
Eleanor Street / Mile End shafts	Excellent	Excellent	On target
Victoria Dock portal	Excellent	Excellent	On target
Pudding Mill Lane	Excellent	Excellent	On target
Royal Oak portal	Excellent	Excellent	Excellent achieved
Connaught tunnel	Excellent	Excellent	Excellent achieved
Stockley Park viaduct	Excellent	Excellent	On target
Acton dive under	Excellent	Very Good	On target
Western outer track infrastructure	Excellent	Very Good	On target
Western inner track infrastructure	Excellent	Very Good	On target
Old Oak Common Paddington approaches	Excellent	Very Good	On target
West stations	Excellent	Very Good	On target
Northeast section	Excellent	Very Good	On target
Southeast section	Excellent	Very Good	On target

### BREEAM

The Building Research Establishment Environmental Assessment Methodology (BREEAM) is used for all central London stations and Abbey Wood station in Kent - the only completely new station to be delivered on the existing surface rail network.

This year the design stage assessments for Tottenham Court Road and Liverpool Street were completed and certified as 'very good'. Over the next year, ways of improving the overall performance will be explored, subject to engineering feasibility, cost and programme constraints.

Last year Crossrail reported that maintaining the 'excellent' rating received for Whitechapel station

following the formal design stage assessment would be a challenge. The original target rating for this station had been 'very good', consistent with other stations. However, the design team had been hopeful that additional credits could be achieved and had submitted the assessment on this basis. As the design was further developed by the contractor it became evident that this had been overly optimistic and that it would be required to scale back initial expectations. The current target is a 'very good' rating and the contractor will continue to seek ways in which to safeguard as many of the credits as possible to achieve a very good rating at the higher end of the rating band.

BREEAM	Target rating	Design stage rating	Post construction rating
Tunnelling and Underground Construction Academy	Very Good	Achieved	Excellent achieved
Paddington station	Very Good	Achieved	On target
Bond Street station	Very Good	On target	On target
Tottenham Court Road station	Very Good	Achieved	On target
Farringdon station	Very Good	On target	On target
Liverpool Street station	Very Good	Achieved	On target
Whitechapel station	Excellent	Achieved	Very Good expected
Custom House station	Very Good	Achieved	On target
Old Oak Common depot	Very Good	On target	On target
Abbey Wood station	Very Good	On target	On target
Woolwich station	Very Good	On target	On target





### Indicator 5 – Recycled content by value

Recycled content by value is the standard industry metric developed by the Waste Resources Action Programme as a measure for recycled content within construction products. Crossrail's target across the programme is 15 per cent, with a stretch target of 20 per cent. At the end of the year, Crossrail surpassed its own target by more than double at 34 per cent, an increase of two per cent from the previous year. This consistency reflects the early stage exercise undertaken by the contractors and the continuation of similar construction over the last year using similar materials – largely steel and concrete.

Crossrail contractors continue to assess opportunities to procure products with higher recycled content where they exist and where there are no commercial constraints.

Successes in this area include an increase in cement replacement in concrete where possible. This has the added benefit of reducing the embodied carbon in concrete.

Another opportunity has been with internal block work walls and collaborative work with contractors to identify products that meet stringent performance requirements, whilst offering higher recycled content.

As the construction transitions to include architectural finishes, cladding and flooring, this figure is likely to change, although remain significantly above the original 20 per cent stretch target.

### Indicator 6 – Recycling and reuse of waste material

This year, 1.5 million tonnes of material was excavated during the tunnelling and construction of underground

stations, bringing the overall programme total to 7.3 million tonnes since construction began in 2009.

During the year, 98 per cent of excavated material was beneficially reused to create new areas of agricultural or industrial land, nature reserves and recreational facilities.

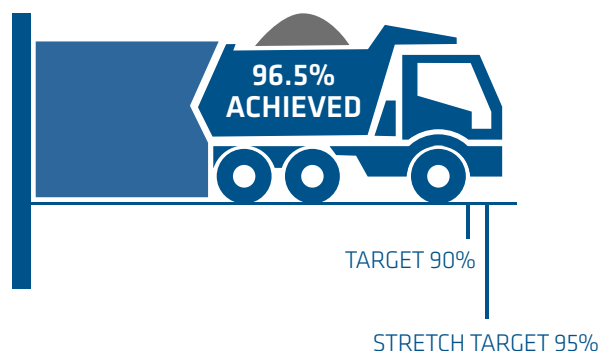
A large volume of contaminated material was excavated from sites at Pudding Mill Lane, Plumstead and Paddington New Yard. Although much of this material was consigned to specialist landfill, soil washing techniques were used for the New Yard material which resulted in diversion from landfill to beneficial use elsewhere.

**80% of excavated material has been transported by rail or water significantly reducing lorry journeys in the streets of London**

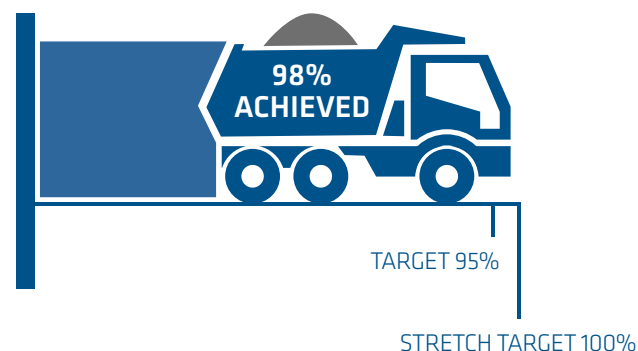
Crossrail generated 80,721 tonnes of construction and demolition waste during 2014-15 and over 96% of this waste was reused or recycled.

Diversion of excavated material from landfill has been one of the key successes of the construction programme. The partnership with the RSPB to help create Wallasea Island has been a key element of this success. Early partnership with the RSPB as part of holistic planning and collaboration enabled greater use of rail and water transportation to the site, helping remove lorries from London's roads.

#### Construction and demolition waste



#### Excavated material



## THE GREEN LINE

**Crossrail recognises that improving environmental performance means helping everyone involved to understand what needs to be done and providing the motivation to do it. The Green Line Recognition Scheme aims to recognise and reward contracts that engage with and support their teams to promote better environmental behaviour. It also aims to promote continual improvement by maintaining the performance and sharing successes.**

At the start of the financial year, 12 of 22 active contracts had achieved recognition under the scheme and a new contract was awarded during the year. Three further contracts are working towards recognition under the scheme. Contractors that continue to promote great environmental behaviour following receipt of Green Line recognition go on to receive commendation. Two contracts achieved a commendation during the year; Hochtief Murphy Joint Venture (Thames Tunnel contract), for their work in encouraging operatives to become involved in environmental inspections (see below); and Costain Skanska Joint Venture for their work in encouraging subcontractors working on the Mile End and Eleanor Street shafts to carry out environmental inspections and complete environmental observation cards.

### C310 Commendation

A Green Idea Tree was developed and displayed at all three Hochtief Murphy sites (Plumstead portal, North Woolwich portal and Woolwich station box) in June 2014. All teams were encouraged to share environmental improvement ideas by writing these down on supplied paper leaves and affixing them to the tree. Following a selection process the best ideas would then be implemented.

Sharmjit Singh, a concrete operative from the North Woolwich portal site, had the winning idea of an environmental inspection checklist that could be carried out by different staff each week. A Workforce Environmental Inspection checklist was created and has been in use since July 2014. Site supervisors coordinate weekly inspections on a rotating roster with different staff to help improve environmental knowledge across the team and improve the environmental standards on site.

These inspections have improved environmental engagement and site standards as best practice has become second nature.



CASE STUDY



## ENVIRONMENTAL SUSTAINABILITY

**B**uilding new infrastructure requires the use of significant natural resources and will always impact the people and areas surrounding it. Minimising these impacts is a responsibility that Crossrail takes seriously. Crossrail strives to achieve this balance in the delivery of the project. This means looking at how goods and services are produced, the impacts of products and materials across their whole life cycle and raising awareness of social and environmental concerns.

As a long term infrastructure asset, the design of Crossrail has taken into consideration the likely impacts of climate change over its 120 year design life. Future flexibility has been factored into the design where possible, particularly with regard to water level, flood risk and higher ambient temperature.

Minimising energy consumption during the construction and operational life of Crossrail has also been a key focus area for the project. The project has seen the evolving design of lighting, lifts, escalators, cooling, ventilation systems and energy use on the trains to help meet set project targets.

Protection of the physical environment is another core component of Crossrail's sustainability strategy. Protecting the natural resources; carefully excavating and archiving archaeological artefacts uncovered during tunnelling; minimising the impact of noise, vibration and disruption to traffic; and transport remain a high priority. To ensure impacts are kept to a minimum and the license to construct is maintained, the project adheres to mitigation plans and a strict code of conduct set within the Environmental Minimum Requirements.

# ENVIRONMENTAL SUSTAINABILITY





# PHYSICAL ENVIRONMENT AND NATURAL RESOURCE PROTECTION

## Air Quality

Crossrail is committed to reducing particulate emissions from construction machinery as part of its Environmental Minimum Requirements. The use of diesel particulate filters or cleaner Euro Stage IIIB engines on construction plant and equipment are helping contribute to better air quality in London, especially for communities around Crossrail sites.

Following the introduction of cleaner engines requirement in 2010, concerns about equipment reliability and maintenance have been overcome and

Crossrail has achieved a year on year increase in cleaner construction equipment.

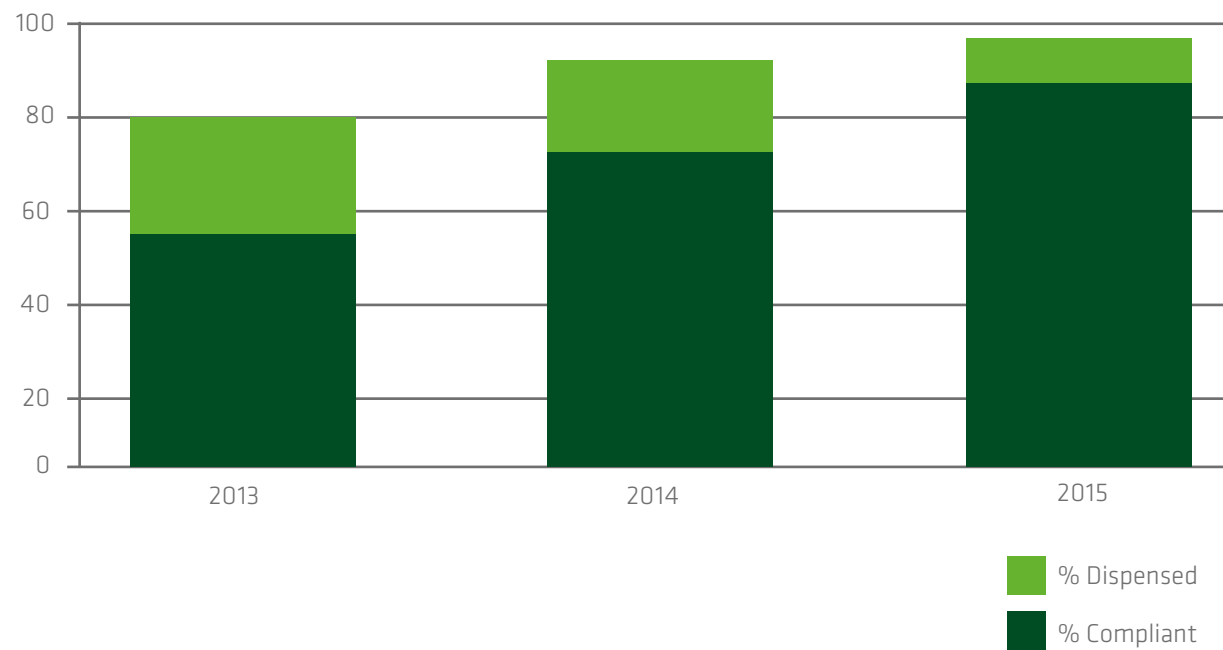
86 per cent of equipment used in the central section of the route was fitted with emissions controls. A further 12 per cent of equipment was awarded a dispensation where it was not deemed practicable to fit these controls. The progress on air emissions control has been shared with Network Rail and a review in July 2014 showed that 72 per cent of equipment on the surface section of the route was fitted with emissions control.

Crossrail received a Green Apple Environment Award (industry award) for its work around pollution management and is now advising the Greater London Authority on the implementation of London's Ultra Low Emission Zone for construction machinery.

# 86%

of equipment used in the central section of the route was fitted with emissions controls

Construction machinery emissions control performance





# NO NET LOSS: CROSSRAIL WEST OUTER ELECTRIFICATION

**On the western section of the route between the Heathrow Spur and Reading, Network Rail has been using a mitigation hierarchy to ensure biodiversity habitats are not lost. The approach aims to avoid or reduce negative biodiversity impacts or compensate where it is unavoidable.**

To date, project teams have avoided vegetation clearances in 12 locations and at 20 locations where avoidance was not possible, vegetation removal was minimised through collaboration with the design and construction teams. For example, by changing the location of infrastructure to avoid areas of vegetation; and by altering the design of a new footpath to retain mature trees, protect their root systems and maintain a green corridor at the site. The next steps are to begin engaging local authorities and potential offset providers to find locations for compensation planting on other sites.

Integration will help create bigger, better habitats that link with existing biodiversity areas and align with local biodiversity action plan priority habitats. In June 2015 Crossrail project teams will begin engaging local authorities and potential offset providers which will lead into actual compensation planting in September 2015.

The mitigation register will be updated to record the cost per biodiversity unit saved: a cost that will be based on de-vegetation and restoration costs. The aim is to provide project and commercial managers with cost data to support the avoidance of de-vegetation rather than removal and compensation.

## Water Use

Crossrail is committed to protecting water resources from pollution. Work was undertaken at the Pudding Mill Lane portal site to remove existing contamination and protect the water environment. The ground was heavily contaminated with metals, asbestos and hydrocarbons from previous historical land uses. To avoid pollution of the groundwater 14,640 tonnes of contaminated material was removed and replaced with 20,220 tonnes of clean material.

Water usage during construction is carefully monitored. Over 275,000 cubic metres of water was used on the project this year. The most water intensive construction processes were bored tunnelling and sprayed concrete lining. Contractors have been encouraged to save water where possible. Examples of contractors who have taken proactive water-saving measures include: Costain Skanska Joint Venture who installed smart meters at the Paddington site to enable them to review and benchmark water use from creation of the station walls that extend 30 metres into the ground; and Balfour Beatty who measured their water usage to develop benchmarks and identify reduction opportunities.

## Biodiversity

The final shipment of excavated material from Crossrail was shipped to Wallasea Island in March 2015.

Over three million tonnes of excavated material has been used to create the landmark 1,500 acre wildlife habitat – a collaborative project between Crossrail and the RSPB.

Later in 2015, the sea walls will be breached to allow sea water to flood in and help create the new wetland habitat.

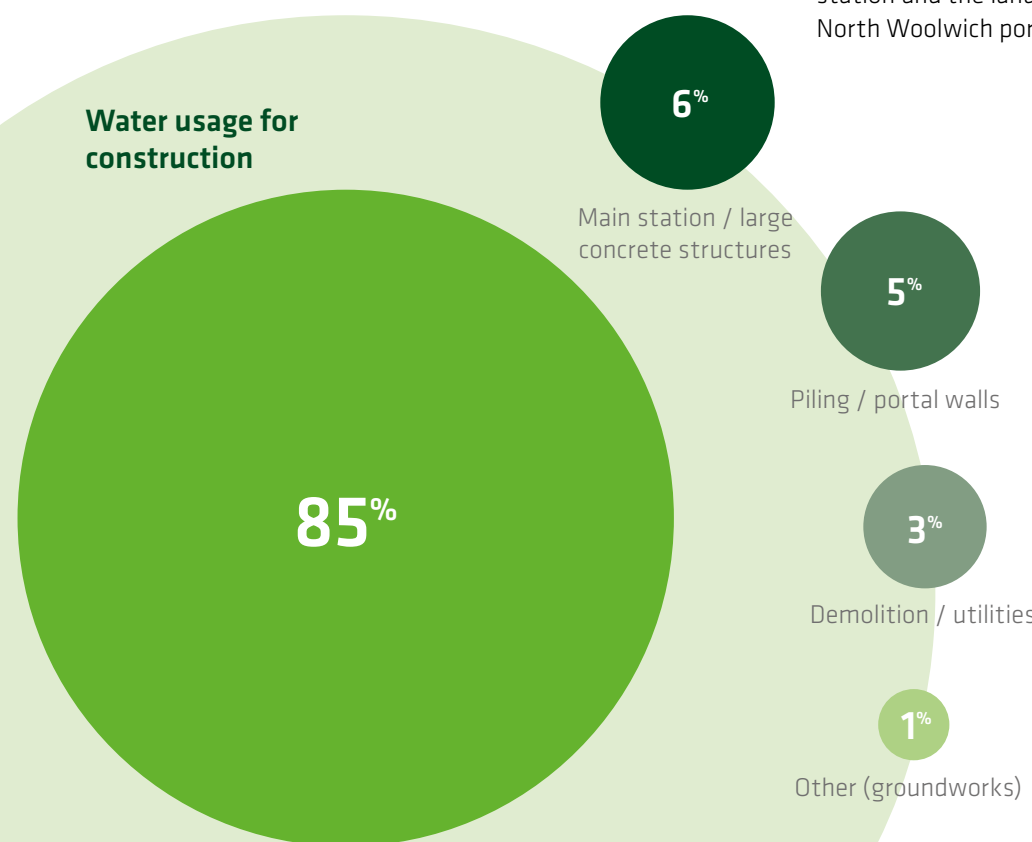
In the last year, follow up surveys were undertaken on the water voles that had to be rehomed due to the works on site. The surveys confirmed the water vole population at Wallasea Island remains at a favourable conservation status and that no long term impacts had occurred as a result of the Crossrail project.

In central London, where construction sites are surrounded by dense urban infrastructure, green and sedum roofs have been integrated into the designs at Whitechapel station and the Paddington Integrated Project. Where areas of land are suitable for restoration, carefully selected flora species will be used. An example of this is at Westbourne Park, where a wildflower species is to be planted adjacent to the railway.

The surface sections of the route, being delivered by Network Rail, offer a greater opportunity for biodiversity along the rail corridor. Network Rail has a target for no net loss of biodiversity. In November, the southeast section of the route, east London to Abbey Wood, received a Green Apple Environment Award for tree planting to support its target.

Crossrail and Network Rail are using DEFRA's biodiversity accounting methodology to determine the value of habitats lost and created. This study will identify opportunities for increasing biodiversity value at locations where restoration has yet to be designed. This includes the area around the new emergency evacuation and ventilation shaft at Stepney Green station and the land around the Connaught Tunnel and North Woolwich portal.

## Water usage for construction



Sprayed concrete lining and tunnel boring machine tunnels



## Archaeology

Crossrail construction is resulting in one of the most extensive archaeological programmes ever undertaken in the UK, unearthing archaeological finds from almost every important period of London's history.

Since Crossrail construction began in 2009, over 100 archaeologists have uncovered more than 10,000 items, spanning 55 million years of London's history and pre-history, at over 20 construction sites.

### Archaeology Fieldwork Programme

Archaeological fieldwork continued this year with many important discoveries made that will help reveal more of London's history.

The team at Liverpool Street Station – one of the most significant Crossrail archaeological sites – uncovered more than 3,000 skeletons from the Bedlam burial ground (1569 to 1730). In the year ahead, these discoveries will be subject to detailed analysis that will aim to reveal the demographic profile of London's very first city-wide cemetery. Fieldwork on the medieval and Roman layers at Liverpool Street is due to commence in the later part of 2015.

At Paddington New Yard, remains of structures dating back to the 1850s were unearthed, built by world famous engineer Isambard Kingdom Brunel for his Great Western Railway. Found below the current rail level, the foundations of a 200 metre long engine shed, a workshop and two turntables were discovered. The remains were documented using a 3D laser scanner to help create a detailed record of the UK's important rail heritage.

Archaeological investigations also commenced at the site of the new Ilford rail depot, at the same site where a large collection of ice age mammal fossils were discovered over 100 years ago. All finds uncovered here will be professionally identified and recovered for the Natural History Museum.

Along the surface route to the west of London, the important historic railway structures and buildings due to be altered or demolished as part of the programme were recorded to ensure an accurate record of them can be submitted to the historic archives.

### Post-excavation dissemination and publication

Analysis of Crossrail archaeology finds is underway. In the year ahead, a series of reports documenting the findings and analysis will be released. These will include detailed information about the historic buildings and range of railway heritage recorded across the project; the discovery of a Tudor Manor house at Stepney Green; and the Thames Ironworks and Shipbuilding Company, one of London's most important industrial archaeology sites at Canning Town.

### Reuse of historic assets

Crossrail has reused historic railway assets as part of the construction programme where possible.

#### The rebirth of Connaught Tunnel

The Connaught Tunnel, a disused rail tunnel built in 1878, has been brought back to life as part of the Crossrail project. The 550 metre long tunnel which runs below the Royal Docks next to the ExCeL Exhibition Centre, close to London City Airport, has not been in use since December 2006. The tunnel originally served the Royal Docks when they formed the world's largest enclosed docks in the 19th century. It survived bombing during World War II and is the only existing tunnel being reused for Crossrail.

Last summer, 13 million litres of water was drained from the dock above the tunnel to allow workers to access the structure. Extensive work was undertaken to deepen, strengthen and widen the structure and to remove 135 years of coal and soot left behind by the steam trains that originally used the tracks.

#### Paddington New Yard

A large number of Brunel-era rail engineering bricks, recovered from Paddington New Yard was donated to the Gloucestershire Warwickshire Steam Railway charity. The bricks will be used to help reconstruct the charity railway's Broadway Station in Worcestershire.

#### Pudding Mill Lane

Two Victorian parish boundary markers found abandoned in excavations at Pudding Mill Lane are planned to be relocated as close as possible to their original positions.

#### Industry publications

During the year the archaeology team contributed technical papers and articles for professional conferences, journals and wider public audiences. A highlight was the inclusion of an article for the 2014 the International Conference for Cultural Heritage and New Technologies in Vienna.

#### Community information and resources

Significant time was invested to supporting a broad range of media production to help engage people with London's history.

Channel 4's Secrets of the Black Death documentary was inspired by the excavations at Charterhouse Square. The BCC, Discovery Channel and other Channel 4 documentaries also featured references to other Crossrail archaeological finds.

Crossrail's media strategy secured wide press coverage locally and internationally, supporting this community education objective through the provision of diverse resources and content. Supporting the range of TV, radio, print and online resources that were made available, Crossrail produced a number of informative videos which were shared online.

**“ As well as delivering a brand new railway for the capital, the construction of Crossrail is resulting in one of the most fascinating and extensive archaeological programmes in the UK. ”**

Isabel Dedring, Deputy Mayor for Transport

## COMMUNITY INVOLVEMENT IN THE HISTORIC ENVIRONMENT

**Volunteers and local archaeologists took part in the Charterhouse Community Dig, held as part of the 2014 UK Festival of Archaeology.**

The event aimed to engage stakeholders with the discovery of London's 14th century black death burial ground. More than 90 local volunteers worked alongside experienced archaeologists and uncovered Roman pottery and what is believed to be the courtyard to a 15th century chapel or meat kitchen.

The archaeology team also held a learning session at Christ Church Primary School in Ilford as part of its Young Crossrail programme.

#### Liverpool Street Dig

A volunteer research project was undertaken, designed to identify the names of individuals buried in the Bedlam Burial Ground from burial records across London.

The names and backgrounds of over 5,000 Londoners dating to the 16th and 17th centuries were identified. Among the common causes of death were the plague, consumption, small pox and even the flu. Records show that child mortality in that period was very high and some buried here met a violent end through fights and executions.



# ADDRESS CLIMATE CHANGE AND ENERGY

## Indicator 7 – Carbon footprint

### Construction carbon emissions

Crossrail's target for the reduction of construction related carbon emissions is eight per cent. With over 60 per cent of construction completed and many of the energy intensive activities reducing, Crossrail has achieved a reduction of close to 11 per cent against the baseline. This equates to a saving of about 52,000 tonnes of CO<sub>2</sub> emissions. This is a slight reduction from 2013-14 but remains close to Crossrail's stretch target.

Crossrail is evaluating the application of the new Greenhouse Gas (GHG) Protocol for the treatment of carbon reductions for green tariff electricity. Electrical energy (known as Scope 2) has been treated inconsistently by the industry and the Protocol, (Greenhouse Gas Protocol, Scope 2 Guidance, The World Resources Institute) finally provides a common accounting methodology.

Energy consumption of the tunnel boring machines was considerably lower than the original estimates made in 2010. Work will be undertaken to quantify and confirm that reporting of carbon savings is against a robust baseline.

### Embodied carbon

Work was undertaken to reduce the embodied carbon in construction materials. The biggest opportunities in this area are the reduction of material quantities in construction and the reduction of cement used in concrete.

Cement production is carbon intensive as the conversion of calcium carbonate to calcium oxide, one of the key components of Ordinary Portland Cement, releases carbon dioxide. In addition, the heat required for cement kilns is derived from hydrocarbon based fuels. Any reduction in cement will achieve a reduction in the inherent carbon in concrete.

Crossrail's concrete specification requires a minimum of 50 per cent cement replacement but replacement of up to as much as 72 per cent has been achieved in instances where cement performance requirements and curing time has allowed this change.

Collaboration with the supply chain to identify opportunities to increase cement replacement will continue.

### Lighting technology

Detailed research into LED lighting technology was completed and will help ensure the delivery of reliable, low maintenance and low energy solutions. The new underground tunnels and stations in the central section will be lit with LED lighting – a design solution that was achieved in the last year as a result of collaboration with the lighting manufacturers, designers and future asset operators. This lighting solution will be extended to tunnel maintenance and emergency access lighting,

### Rolling stock and depot

The development and review phase of the Class 345 Rolling Stock programme, Crossrail's new trains, commenced in 2014 and is due to be completed before construction of the trains begins in autumn 2015. The review process indicates that the trains will meet Crossrail's energy usage commitments.

Train mass and aerodynamics – the principal determinants of energy consumption on moving trains – remain within specification and the smart on-board control systems that curb waste on heating and cooling have begun to take shape. The aspiration to use LED lighting inside the trains has been met. Areas to be explored in the year ahead include the approach to validate energy performance and the ways to ensure operational practice, such as energy efficient timetabling, use of the driver advisory speed guidance systems and the optimisation of Automatic Train Operation, maximise energy efficient design.

In addition to the new trains, Bombardier, the supplier awarded the contract to deliver Crossrail's new rolling stock, is required to develop the design for the maintenance depot at Old Oak Common and to ensure an energy efficient and low carbon design solution. A number of energy efficient design features were confirmed in the last year. These include roof mounted solar thermal photovoltaic panels, energy piles and a gas fired combined heat and power system. Whilst the primary purpose of piles are to support the building structure, this design incorporates water filled pipework loops that allow heat extraction from the ground to be used to heat the depot.

Other indirect carbon savings will derive from rain water harvesting, which will capture water required to wash the trains. This reduces the need to use mains water.

The use of these combined technologies for the depot is expected to reduce operational carbon emissions by up to 35 per cent. If achieved, this will surpass Crossrail's current target reduction rate of 20 per cent.

### Other carbon reduction measures

Given the nature of underground stations and the tight physical constraints of Crossrail sites, it has not been possible to harness renewable energy on any scale. However, it was recognised early on that the construction of Crossrail would provide a unique opportunity to future-proof the oversite developments (commercial developments above train stations) by incorporating technology designed to extract ground heat from around the station structure.

Crossrail stations have a design life of a minimum of 120 years (they are expected to last considerably longer). A typical commercial development in central London, however, would not be expected to last this long and is likely to be replaced at least twice during the lifetime of the station. If the station does not have the provision for the capture of this ground heat, then the opportunity is lost forever. This technology has therefore been installed and work is being undertaken with prospective developers of Crossrail sites to ensure that the capability to capture both heating and cooling from this provision is utilised when the first developments are built.

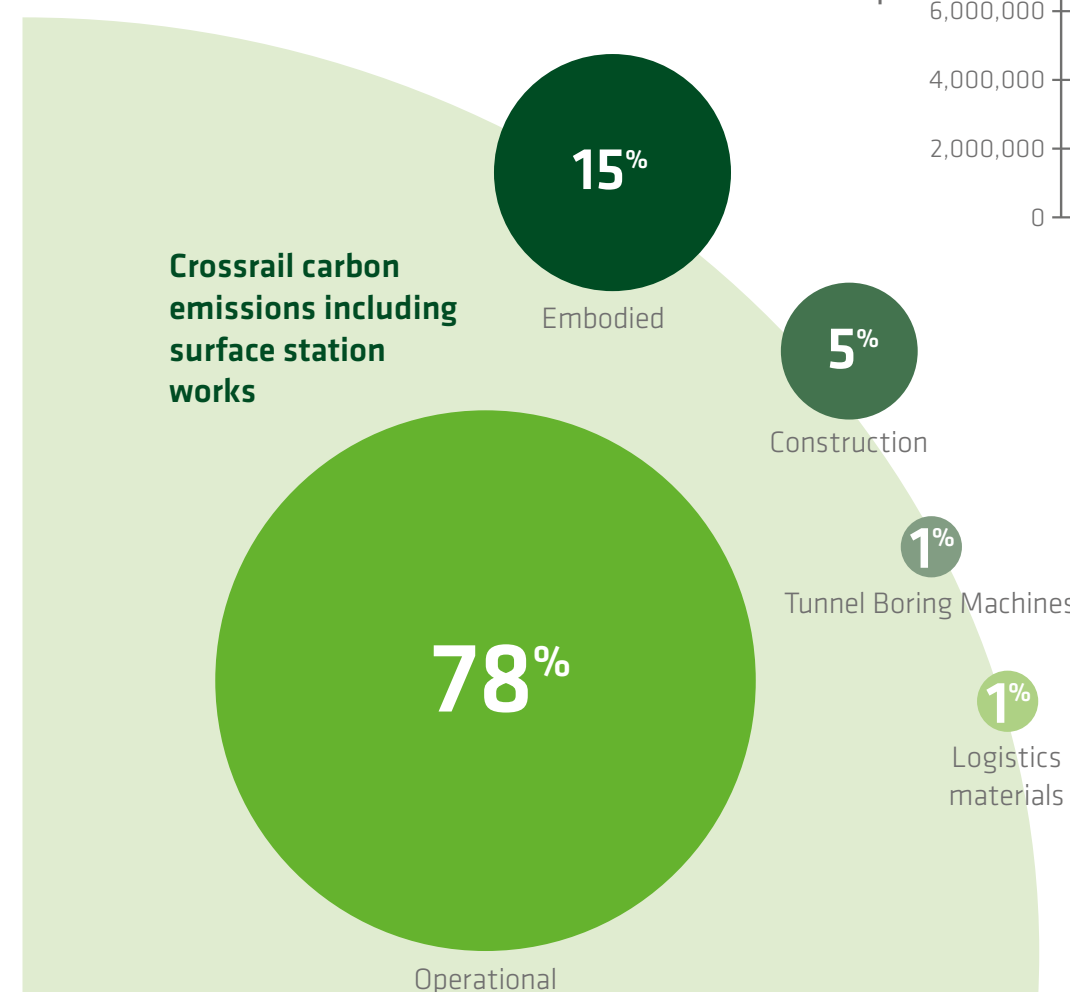
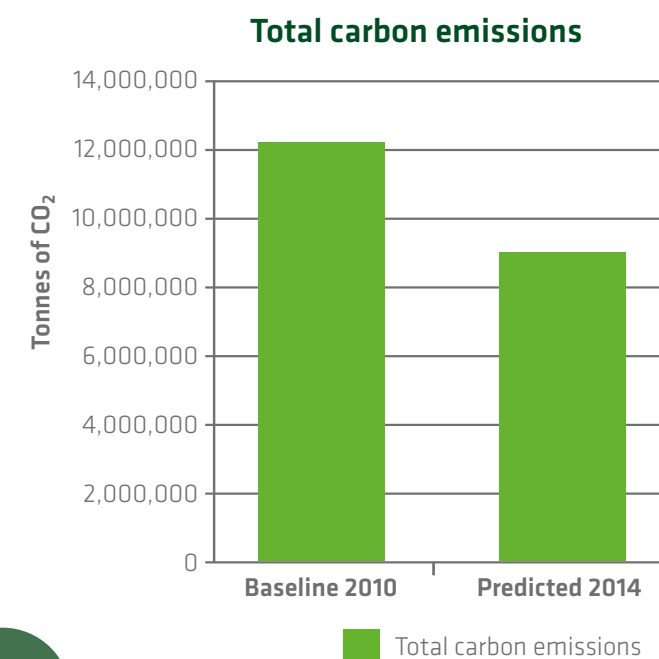
Whitechapel station has provided the only opportunity for a solar photovoltaic array that can provide a viable proportion of the station's energy requirements. This will be included as part of the final design.

It was reported last year that the lifts and escalators that will be used in the new stations are significantly

more energy efficient than those currently used on the underground system. Procurement for these commenced this year. All new stations will also have sophisticated lighting controls and electricity sub-meters installed. This will be integrated into a sophisticated building management system that will allow for optimisation of station energy performance.

It is forecasted that 2.5 million tonnes of carbon savings will be achieved by Crossrail from the start of the construction programme through to operation for the next 120 years. This is close to a 20 per cent increase on Crossrail's baseline figure.

It is important to manage the operational energy over the lifetime of the project as it equates to 78 per cent of the railway's total carbon footprint. The focus on keeping train weight to a minimum and ensuring an uninterrupted service with minimal signal failures will help to minimise operational carbon emissions.





### Indicator 8: Environmental complaints

Limiting the impact on people living and working near Crossrail sites, especially those in densely populated areas, has been a high priority.

In 2014-15, 785 environmental complaints were received by the Crossrail Helpdesk.

A number of requirements are in place to help minimise the impact on local communities:

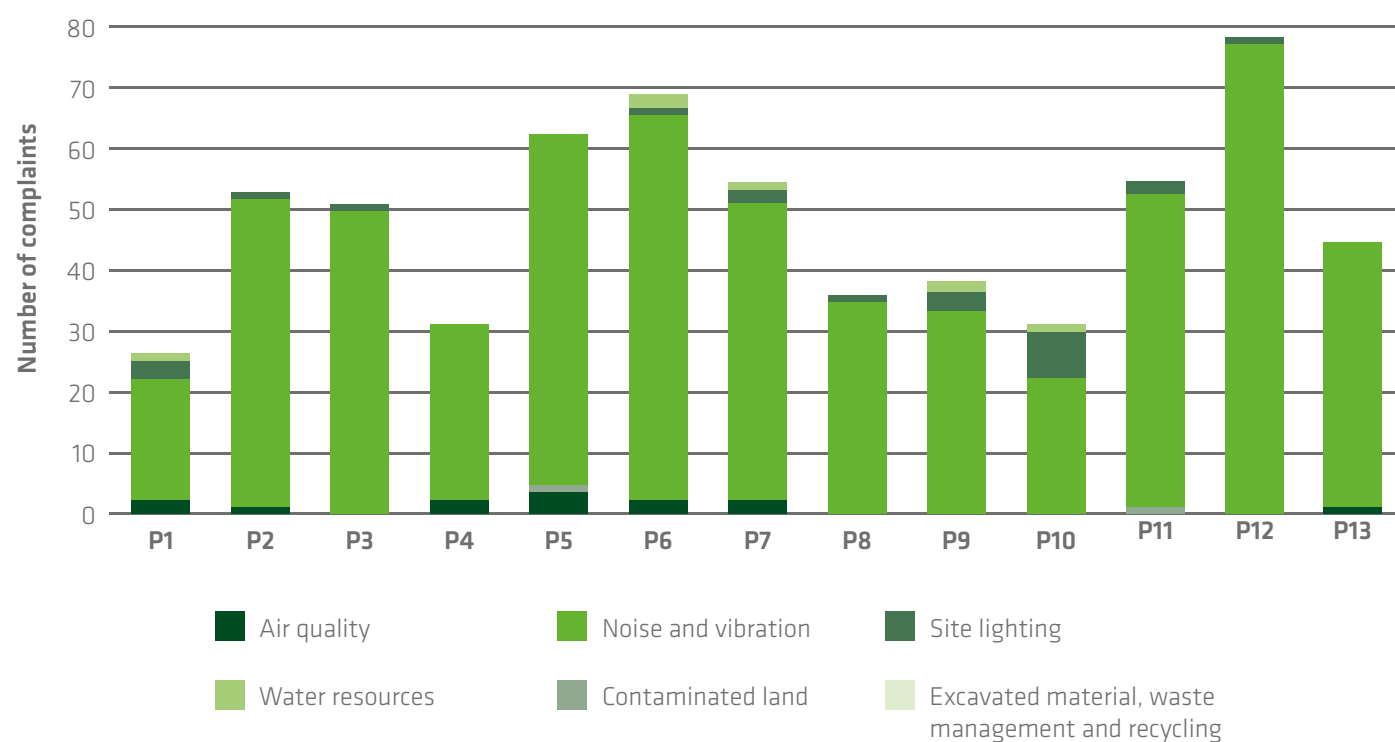
- All contractors must use industry best practice to minimise inconvenience
- Local authority approval must be received authorising the working methods proposed which considers disturbance as part of the process
- A 24 hour helpline allows people to seek advice or to register a complaint

The majority of the complaints (618) received this year were from the central section of the route. The remaining 167 complaints were received from the surface sections from areas such as Maidenhead, Acton, Abbey Wood and Stockley.

90 per cent of all the environmental complaints related to noise and vibration, particularly for works during the night. Complaints were primarily from people in close proximity to the works, such as Whitechapel and Bond Street.

Where the level and duration of noise reaches certain criteria, residents are offered secondary glazing as noise insulation or in more severe cases, temporary rehousing. A majority of complaints were directly related to the activity associated with the sprayed concrete lining work in the tunnels. Where possible, this impact was mitigated using alternative construction methods.

Total number of environmental complaints (breakdown by category)



## NOISE MITIGATION

Crossrail worked with contractors to develop construction related noise and vibration improvement plans to ensure performance reflected industry best practice or beyond.

Three contractors achieved world-class status for their exemplary work managing construction noise and vibration:

- Costain Skanska Joint Venture, Paddington site
- Bam Nuttal Kier Joint Venture, Moorgate site
- Laing O' Rourke, Custom House site

World class performance comprises:

- Strong culture of effective management
- Innovation
- Community engagement
- Compliance
- Integrated team
- Effective planning
- Quality of consent applications

Exemplary performance was demonstrated through examples such as embedding noise management throughout the organisation, from the appointment of noise champions, to procurement of plant and equipment. A strong focus was placed on integrating community engagement to improve how feedback was received from residents to increase understanding of the impact of noise and vibration.

Innovative noise reduction methods implemented at these sites included quiet methods of reducing concrete, removing piles and increasing offsite pre-fabrication.

Building on existing successes, contractors will continue to work towards achieving a world-class status in 2015-16.

*“ A very educational experience which gave an informative glimpse into the Crossrail project. I very much appreciated the opportunity to visit the sites and to get an understanding of the project. ”*

Visitor survey response  
Open Doors, March 2015

CASE STUDY

## BEHIND THE HOARDINGS

Local residents often hear the noise generated at construction sites but rarely get the opportunity to see the work taking place behind the hoardings. Understanding the source of noise and why it is generated can lead to the reduction of annoyance felt by residents.

During the year, a number of Crossrail sites hosted open days to give local communities the opportunity to experience construction work behind the hoardings.

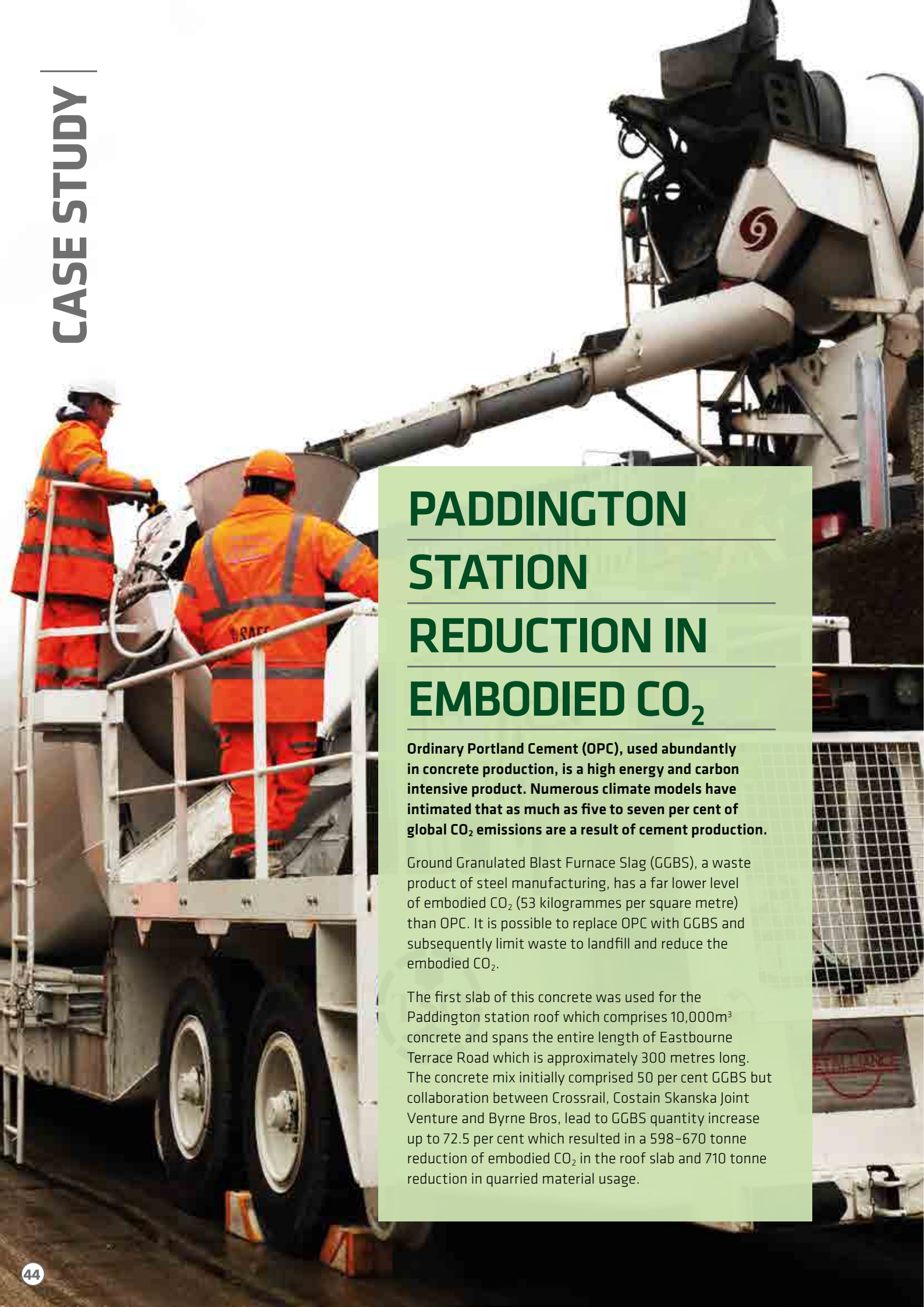
At Victoria Dock and North Woolwich portals, 139 residents attended site-based events to see the dismantling of two tunnel boring machines and hear about the construction activity directly from those working at the site.

At Bond Street station, groups of local residents who were being impacted by underground construction activity, were offered a tour of the station box and tunnels to see the works taking place underneath their feet.

Crossrail extended the open day experience even further by participating in the London-wide Open House and Open Doors events. On 20 September 2014, four sites (Canary Wharf, Connaught Tunnel, Farringdon and Moorgate) hosted a total of 6,103 visitors. Over the first weekend of March 2015, nine Crossrail worksites welcomed 402 people through their doors to help them learn about the project and construction on site.

The responses to all of these events were overwhelmingly positive, with many visitors expressing excitement at the opportunity to experience and see construction work first hand.





## PADDINGTON STATION REDUCTION IN EMBODIED CO<sub>2</sub>

Ordinary Portland Cement (OPC), used abundantly in concrete production, is a high energy and carbon intensive product. Numerous climate models have intimated that as much as five to seven per cent of global CO<sub>2</sub> emissions are a result of cement production.

Ground Granulated Blast Furnace Slag (GGBS), a waste product of steel manufacturing, has a far lower level of embodied CO<sub>2</sub> (53 kilogrammes per square metre) than OPC. It is possible to replace OPC with GGBS and subsequently limit waste to landfill and reduce the embodied CO<sub>2</sub>.

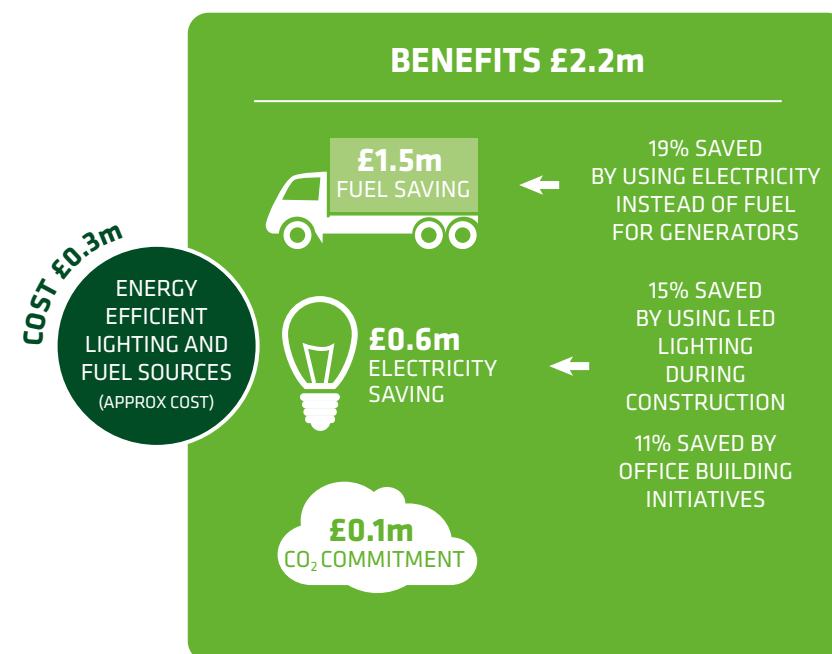
The first slab of this concrete was used for the Paddington station roof which comprises 10,000m<sup>3</sup> concrete and spans the entire length of Eastbourne Terrace Road which is approximately 300 metres long. The concrete mix initially comprised 50 per cent GGBS but collaboration between Crossrail, Costain Skanska Joint Venture and Byrne Bros, led to GGBS quantity increase up to 72.5 per cent which resulted in a 598–670 tonne reduction of embodied CO<sub>2</sub> in the roof slab and 710 tonne reduction in quarried material usage.

### Integrated reporting

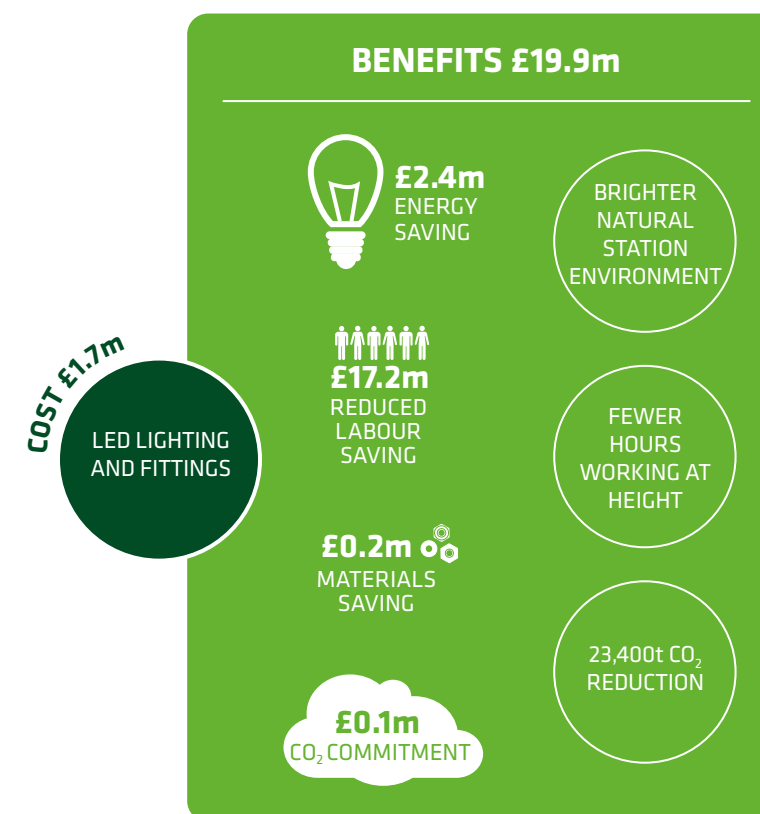
#### Energy savings in construction

Construction by its nature is energy intensive. Many initiatives have been implemented to reduce the fuel and electricity costs and associated carbon.

These initiatives are forecast to reduce the fuel and electricity required to complete the project by eight per cent against industry norms. As a consequence, there are financial benefits of about £2 million to the project as well as a positive environmental impact from lower CO<sub>2</sub> emissions. Greater awareness of energy savings activities has been seen on both construction and office sites with many of the changes requiring little or no cost to establish.



#### BENEFITS £19.9m



#### LED lighting whole life benefits

The decision to move from conventional to LED lighting in stations will result in a significant whole life cost and carbon savings.

The switch to LED lighting has a positive environmental and financial impact through enhanced energy efficiency, greater longevity of bulbs and reduced maintenance requirements. The reduced operating and maintenance costs do more than offset the initial implementation costs reinforcing it as a viable alternative to conventional lighting. LED lights also bring health and safety benefits to workers and commuters.



## SOCIAL SUSTAINABILITY

**D**uring construction Crossrail is a major employer and offers a significant opportunity to develop a highly skilled workforce with people and businesses along the route. Significant investment in training and education continues to be a priority to help maintain the high standards required to deliver the project. This investment in developing a skilled workforce will extend beyond Crossrail to future projects in the UK.

Crossrail has the aspiration for zero accidents across the project in recognition that safety, security and health is paramount. Systems are in place to identify hazards and to reduce risk as much as possible for all those involved in the construction programme.

Increasing the proportion of the workforce that live locally to construction sites and ensuring local businesses understand the procurement routes and maximise their chances of winning work within the supply chain remains a priority. Crossrail and its Tier 1 contractors continue to support communities by contributing to local projects and initiatives that consider the wider impacts of responsible procurement.

Crossrail's bespoke innovation programme, Innovate18, continues its promotion of new thinking and fostering new ideas, particularly in the field of sustainability. Several trials of innovative ideas were undertaken over the year.

Through its art programme, the Culture Line, Crossrail is working with sponsors and artists to deliver a visionary art strategy that will leave a legacy of public art in central London. This unique programme is part of a wider focus to regenerate areas within and around stations and enhance the passenger experience.

There are significant social benefits from a healthier and happier population. Good public transport makes a valuable contribution by allowing people to get around in reasonable comfort, minimising delays and improving the wellbeing of the population. Crossrail will improve the quality of the travelling experience in London by reducing congestion, shortening journey times, increasing London's accessibility and improving links to international travel.

# SUSTAINABILITY

# SOCIAL





# IMPROVE HEALTH WELLBEING AND HAPPINESS

## Occupational health and wellbeing

Crossrail recognises that health and wellbeing of its employees are intrinsically linked to sustainable performance and a good work life balance. For this reason each Crossrail site is supported to help minimise health risks and promote health and wellbeing.

Crossrail's occupational health and wellbeing improvement plan is designed to increase understanding, allow informed decision making and encourage delivery partners and contractors to promote a philosophy of optimal health to staff. Research has been undertaken to gain greater understanding of health risks, recognising the importance of focusing not just on reported health incidents but on protection from longer-term health risks such as cancer.

In 2014 the Crossrail team continued to build on the Occupational Health and Wellbeing Strategy and

established the four-cornerstone model for occupational health management. This model forms the basis for the wellbeing improvement plan until the end of the project.

### Healthy company – commitment to the health of our workforce

The occupational health and safety commitment for those working on the Crossrail project is implemented through the Occupational Health Standard. This sets out the requirement for good health management and forms the basis of Crossrail's contractual requirements. To ensure effective delivery and continuous improvement, a rolling audit of local arrangements is delivered in collaboration with teams on site.

The audits have focused on:

- Pre-placement health assessments for all employees
- Providing access to occupational health service providers who support the sites to identify health needs and deliver appropriate services as needed
- Managing key health risks
- Maintaining an effective drug and alcohol testing programme
- Promoting health education for everyone working on site
- Ensuring clear accountability and responsibility for health management on site

The external commitment has been realised through the participation and support of a number of UK and industry-wide health initiatives including:

- The Public Health Responsibility Deal – annual update following health campaigns
- The Institution of Occupational Health and Safety's 'No Time to Lose' campaign
- Safe Effective Quality Occupational Health Services – with more occupational health service providers attaining accreditation
- Constructing Better Health – establishing a user forum for all Crossrail principal contractors and their Occupational Health service providers

### Health risk management – protecting people from inherent risks and ensuring zero harm

During 2014, a series of health hazard management campaigns were delivered with particular emphasis on protecting people from exposure to air borne contaminants, some of which are carcinogens such as diesel engine exhaust emissions and silica. To increase understanding of these hazards and how exposure can be managed an occupational hygiene monitoring research project was commissioned.

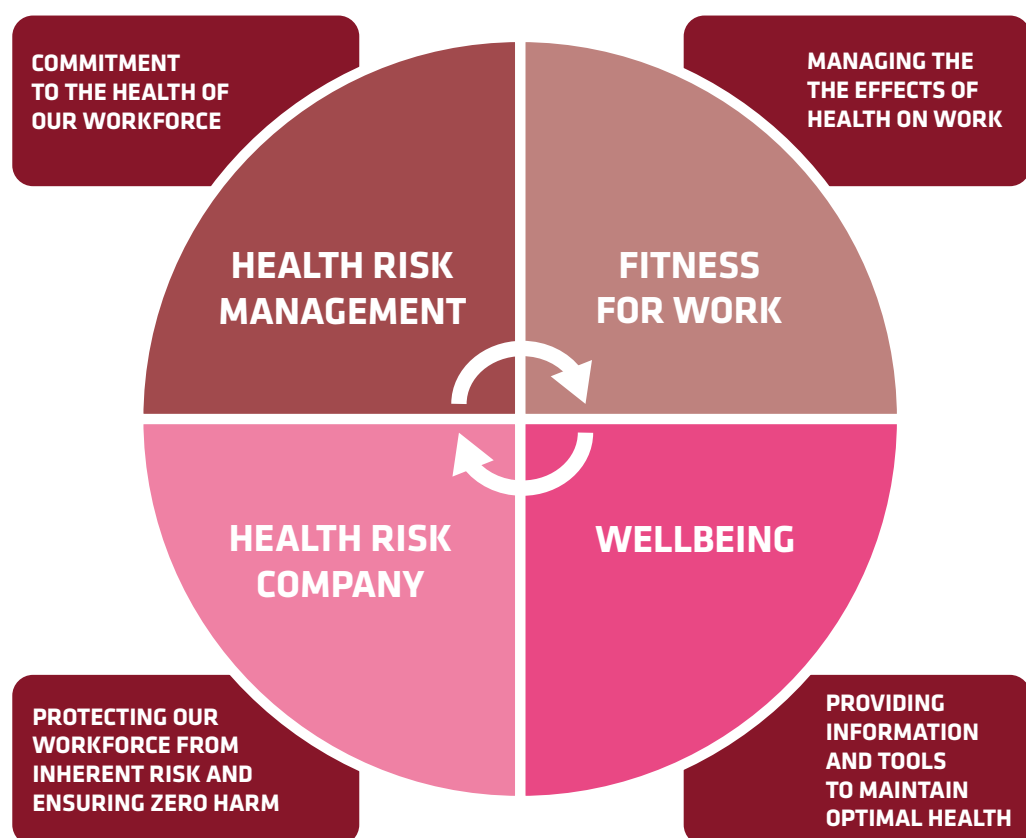
A second area of research was undertaken and focussed on fatigue, which can have a significant impact on safety, performance and health. The outcome of this research resulted in changes to some shift patterns and the commissioning of additional research which will help further understand the underlying causes of fatigue.

### Fitness for work – managing the effects of health on work

A review of occupational health practice in Crossrail was conducted in 2014 and procedures updated. This included a targeted pre-placement medical assessment process, communication of the management referral process and improving the reporting of adverse results from drug and alcohol testing.

### Wellbeing – providing information and tools to maintain optimal health

The wellbeing programme is driven at a local level, with monthly toolbox talks and events that cover fatigue, coronary heart disease, respiratory health, sun awareness, hypertension and back care.





# PROTECT PEOPLE'S SAFETY SECURITY AND HEALTH

## Indicator 9: Construction health and safety

Crossrail has a good health and safety record and sets the most stringent contractor requirements in the industry. Health and safety has always been, and continues to be, the number one value for Crossrail and is critical to the delivery of the project.

The number of hours worked on the Crossrail project in the year again increased. A total of 18.8 million hours were worked this year, compared to 18.2 million in 2013-14. Crossrail monitored performance closely, adapting its approach to promoting health and safety among contractors, to account for this increasing workload and ongoing changes to the type of activity being undertaken on the project.

The Target Zero aspiration remains at the core of Crossrail's approach to promoting excellence in health and safety. The three founding principles continue to form the foundation of that approach:

- We all have the right to go home unharmed every day
- We believe that all harm is preventable
- We must all work together to achieve this

Until the end of 2014-15, these principles were supported by seven Golden Rules that related to the safe management of driving, lifting, working at height, sprayed concrete works, electrics, confined spaces and breaking ground.

As the Crossrail railway construction programme transitions from the tunnelling work and station build to station fit-out and railway systems installation works, new people will commence employment with Crossrail. A review was undertaken to ensure the messaging of Target Zero remains fresh and relevant. This was undertaken in collaboration with Tier 1 contractors and their supervisors, who provided input into the review.

As a result of this review, five new behavioural-based Golden Rules were identified that are intended to be applicable to all situations and all employees, regardless of their trade or the task being undertaken.



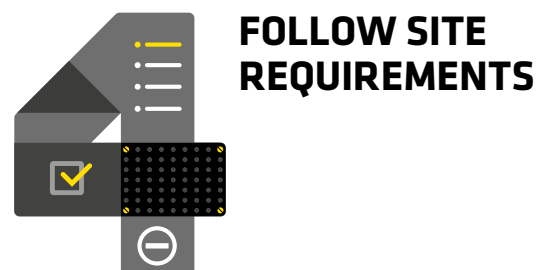
**RESPECT THE BASICS**



**ASSESS THE RISKS**



**CHECK THE SITE**



**FOLLOW SITE REQUIREMENTS**



**SUPPORT EACH OTHER**



Supported by the Golden Rules, a number of high risk activities were also identified. These high risk activities are those that will be present during the remaining phases of the project.

The updated Target Zero messaging and communication will take effect from April 2015 to coincide with the move to the new organisational structure that reflects the transition to the new construction work streams.

Despite Crossrail's stringent contractor safety requirements, a fatality occurred in March 2014 involving experienced nozzleman, Rene Tkacik, at the Fisher Street site. The inquest into the incident concluded in March 2015. The Jury determined Mr Tkacik's death was accidental. Everyone who works on Crossrail continues to be affected by this terrible incident. Crossrail's thoughts and sympathies remain with Rene's family, friends and colleagues.

Following the incident, Crossrail together with its tunnelling contractors jointly produced guidance on exclusion zones which has been shared with the wider tunnelling industry. To support contractors in complying with their obligation to provide briefings in relevant languages where there are non-English speakers, Crossrail will introduce additional assurance checks to verify and confirm the necessary communication of important information in the appropriate language or languages for the team.

### Crossrail's three health and safety goals for 2014-15 were:

**GOAL 1: Strive for excellence in industry health and safety performance through continued focus on Health and Safety Performance Index (HSPI) and Gateway awards**

### Indicator 10 - HSPI Performance

The HSPI metric is used to provide a leading indicator of Crossrail contractors' health and safety performance and their commitment to continuous improvement. HSPI was enhanced at the start of this year to include metrics, specified by each contractor and based on factors considered a priority to improve health and safety performance. These metrics were combined with measures specified by Crossrail and applied to all contractors.

Gateway, Crossrail's health and safety assessment scheme, encourages good practice and innovation on site as well as the opportunity to share ideas and learning. The output from Gateway assessments, which are taken twice a year, contributes to 50 per cent of HSPI. This year, improvement was observed on all contracts and the project's first contract, Paddington station (C405), achieved an overall status of 'Inspiration', the highest award available within the scheme.

An HSPI score of 1.0 signifies contractual compliance. A score above 1.0 signifies good practice and the maximum score is 3.0. At year end Crossrail achieved an overall HSPI



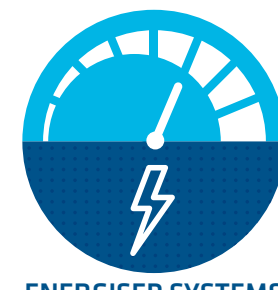
**CONFINED SPACES**



**BREAKING GROUND**



**FIRE/HOT WORK**



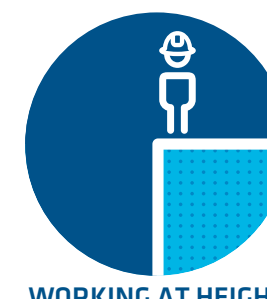
**ENERGISED SYSTEMS**



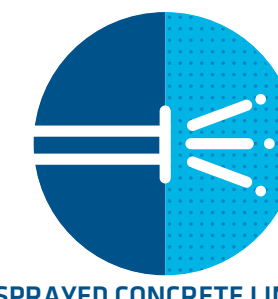
**PEOPLE & PLANT**



**LIFTING OPERATIONS**



**WORKING AT HEIGHT**



**SPRAYED CONCRETE LINING**



**RAILWAY OPERATIONS**



score of 2.35 an improvement from the previous year's score of 2.09. This was achieved against the new, more challenging measures and 94 per cent of all Crossrail contracts scored 2.00 or above by the end of the year, exceeding the corporate objective of '85% of contractors above or equal to 2.00'.

HSPI will be further enhanced in 2015-16 with new metrics, designed to further increase the challenge and ensure contractors' proactive approach to health and safety is maintained.

**GOAL 2: Continue to drive the Frontline Leadership Programme (FLP)**

An objective was set to progress a further 100 supervisors through the Crossrail FLP this year. FLP provides training for contractors' supervisors to improve leadership skills, including competencies to help them exhibit the right behaviours in terms of health and safety. This objective was exceeded, with a total of 120 supervisors enrolled in the programme. Combined with previous years, more than 250 supervisors have been engaged in the FLP programme.

**GOAL 3: Drive down accident rates**

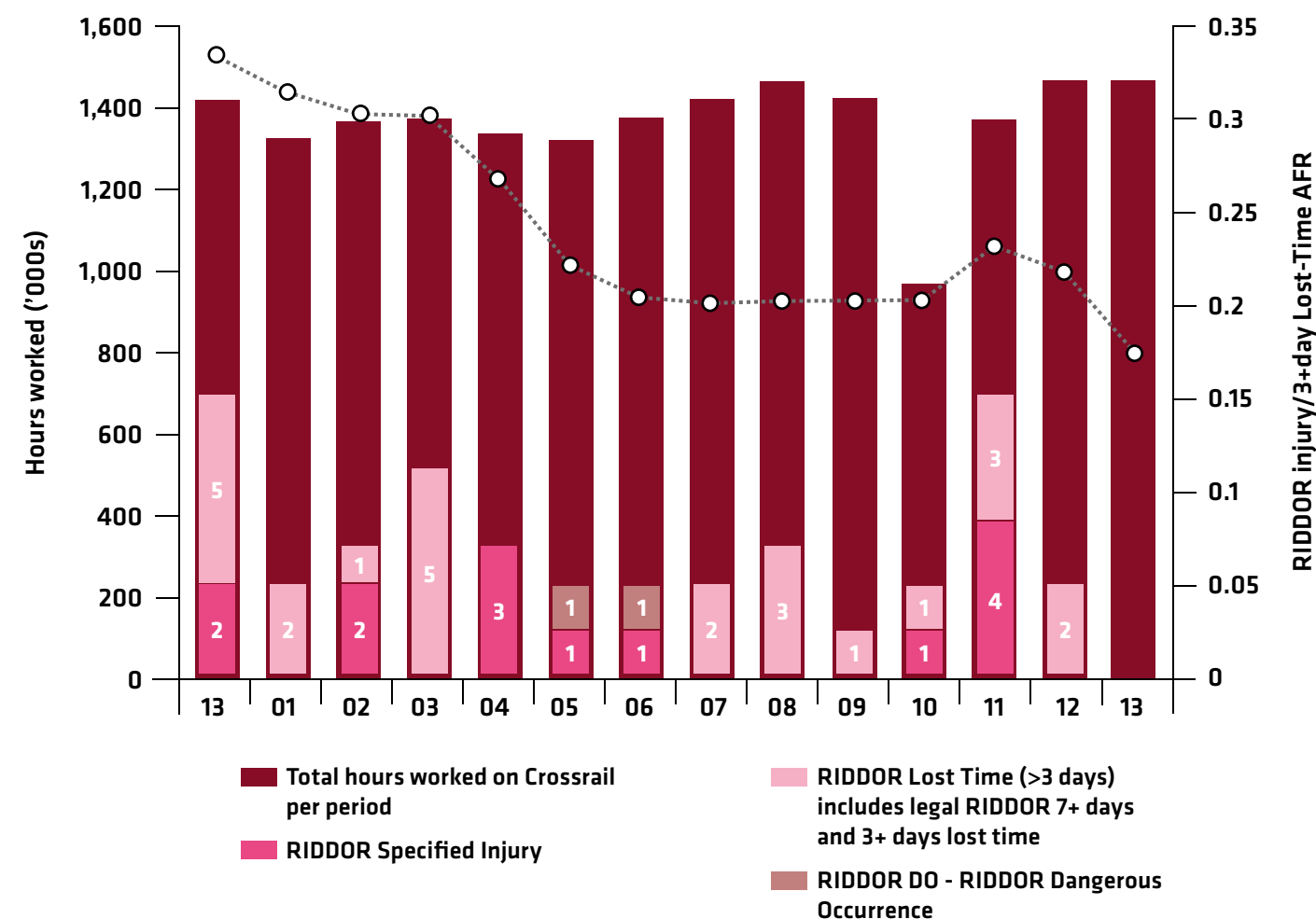
Crossrail set the objective to reduce the Accident Frequency Rates (AFR) – measured per 100,000 hours worked – by 40 per cent this year.

The RIDDOR AFR (including injuries resulting in more than three days lost time) exceeded this target, reducing from 0.33 to 0.18, a reduction of 45 per cent. The Lost Time Case (accidents resulting in one or more days absence) AFR narrowly missed meeting the target but still showed a 33 per cent improvement, reducing from 0.48 to 0.32.

The reductions in AFR are a welcome success and exceed the improvements made last year. This ongoing improvement supports the approach taken to promote and develop health and safety excellence across the whole programme. This year has seen further development of that approach, with ongoing improvement to initiatives, many of which are now regular features of the annual calendar at Crossrail.

- Have Your Say – This annual health and safety climate survey was completed by over 4,300 respondents, with a strong health and safety culture evident across the programme
- Two more Stepping Up weeks were held this year, with activities at all sites designed to improve engagement in health and safety

- A Best Practice Guide covering 'Sprayed Concrete Lining (SCL) Exclusion Zone Management', was created collaboratively with Crossrail contractors to specify suitable standards to safely manage SCL activity. Best practice guides are planned for release in 2015-16 to cover lifting operations, fire safety and air quality management in tunnel environments
- This year, 48 health and safety alerts and 17 good practice bulletins were created and distributed across the project, ensuring consistent and shared knowledge among all Crossrail contractors
- Behaviour Influences Behaviour (BiB) – helps develop internal Crossrail leaders to ensure they exhibit the right behaviours and understand how they influence the behaviour of others. To further advance this programme, Crossrail will expand on previous work, with a drama-based, interactive programme under development to be rolled out in 2015-16
- A risk based approach to assurance was implemented this year, with the agreed audit programme delivered fully and supplemented with ad-hoc assurance assessments undertaken on topical health and safety issues





## STEPPING UP WEEK

**Stepping Up Week is a bi-annual, health and safety engagement and focus week that has proved enormously successful at Crossrail. It provides Crossrail and its contractors an opportunity to reflect on performance and drive forward targeted improvements.**

For each week, Crossrail and its contractors developed their own events, relevant to their own workforce and targeted at the health and safety risks specific to them. A leadership message to open and close the week was delivered at each contract site by both Crossrail and contractor leadership teams. Crossrail's Board members were also engaged with activities during each week.

Activities included:

- Guest speakers sharing their experience of incurring personal injuries while at work and the impact this had on their own and others' lives
- Mock rescue activities from cranes, mobile elevated work platforms and waterways
- Health seminars and fitness challenges
- Hazard spotting, tailored to specific locations and tasks
- Spill response and clear up exercises
- Trading places exercises involving plant operators and 'on foot' operatives

Feedback from these activities was consistently positive, with contractors sharing the view that they were beneficial in developing a health and safety culture and encouraging continual improvement. Following each Stepping Up Week, a notable increase in the number of near misses, observations and good practices has been reported. Analysis of the incident data confirms that increased reporting of these 'none harm' incidents correlates with a decrease in injury rates.

### Construction logistics leadership

Crossrail continues to set high standards and demonstrate leadership in developing and implementing safer construction logistics working practices and procedures. The Construction Logistics for Cycle Safety (CLOCS) initiative, founded on the best practice implemented by Crossrail, continues to gather pace and is now supported by leading industry bodies, contractors, regulators, vehicle manufacturers, logistics operators and clients. As a CLOCS champion Crossrail played a key role in helping shape this initiative by sharing lessons learned through working groups managed by TfL's CLOCS team. Crossrail also continues to pass on best practice to other infrastructure projects and to local authorities.

Crossrail's leadership efforts to improve road safety for vulnerable road users and encourage the construction industry to follow best practice will continue relentlessly.

The Project Manager responsible for Crossrail's road safety initiatives, Michael J Heduan, was awarded the MBE by Her Majesty the Queen in December 2014 in recognition for 'Services to Road Safety in London'.

### Making construction vehicles safer

By introducing stringent standards for all vehicles involved in building Crossrail, over 40,000 heavy goods vehicles (HGV) and more than 14,000 vans have been made safer.

**40,000+**  
heavy goods vehicles and  
**14,000+**  
vans used on Crossrail  
have been made safer

The fitting of a standard set of safety equipment to all lorries working on the project, along with rigorous compliance checking procedures applied each time a vehicle visits a Crossrail worksite, has set high standards in the construction industry for vehicle safety. Nearly 600 principal contractor staff across 53 worksites, including lorry holding areas, are trained and qualified to undertake systematic vehicle safety checks every time

a vehicle visits site. Each check is recorded on handheld computers and reported monthly to monitor and track the compliance levels of each principal contractor.

At the end of March 2015 the principal contractor level of vehicle safety compliance across the project was running at 99.4 per cent. This is a testament to the ongoing commitment of Crossrail's supply chain to meet their contractual requirements and to make London safer for vulnerable road users.

### Lorry driver training

Since November 2009 the award winning lorry driver training programme has delivered 561 courses and continues to go from strength to strength with a total of 8,039 drivers attending the one day course up to 31 March 2015. The course remains focussed on 'Sharing London's Roads with Vulnerable Road Users' but is overlaid by key project information covering Crossrail health and safety policies, approved lorry routes and contract requirements covering vehicle safety requirements. Crossrail continued to host observers from stakeholder organisations and safety managers and company directors from the supply chain.

The two main performance indicators are consistently high in that 91 per cent of drivers agree with the statement: "This course has significantly raised my awareness of sharing London's Roads," and 93 per cent of drivers agree with the statement: "This course will definitely make me a safer driver". This year's figures mirror last year's record high results for the training.

Crossrail is exploring the introduction of a van driver training course and is collaborating with TfL on the design, development and implementation of it. As Crossrail transitions into a new construction work stream, fewer HGVs will be seen as higher numbers of light vans up to 3.5 tonnes will be used.



## Road safety in the community

### Exchanging Places

Crossrail's Exchanging Places efforts have reached over 3,600 cyclists directly to raise their awareness of sharing London's roads with HGVs.

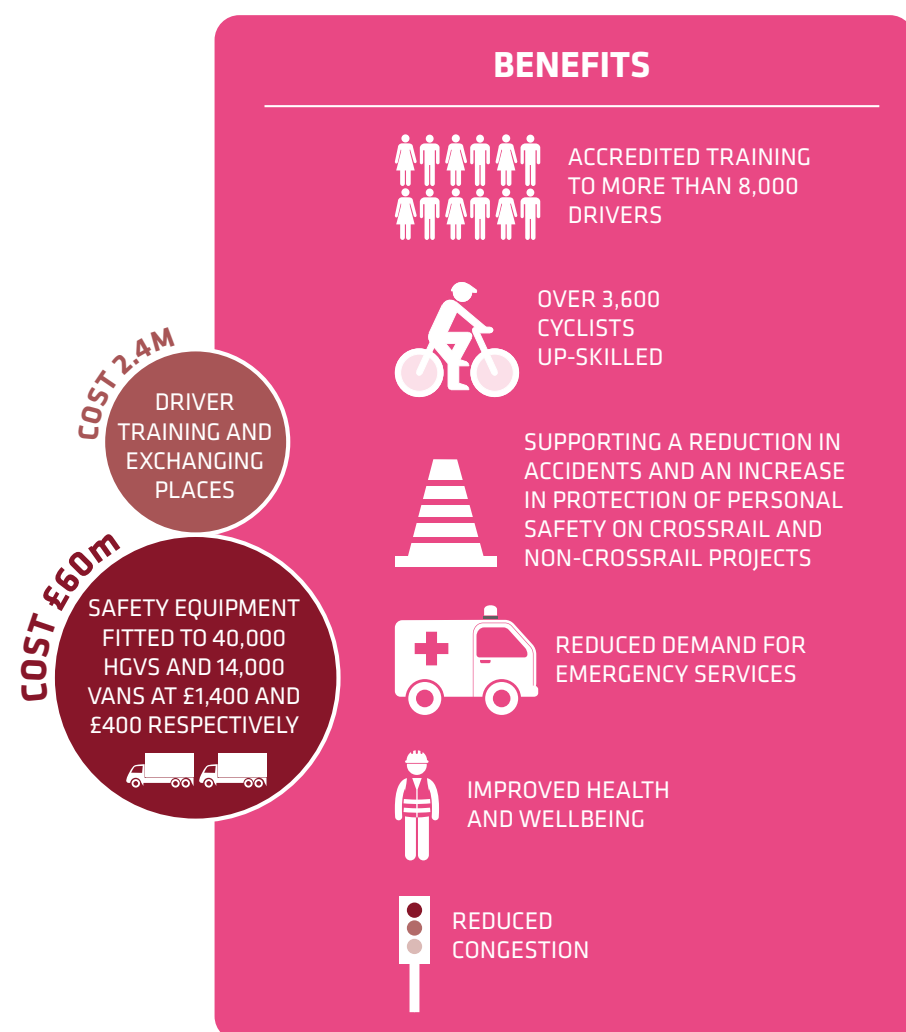
Since early 2012 Crossrail, together with the Metropolitan Police and the City of London Police, have delivered local Exchanging Places events around Crossrail worksites and also featured at the London Bike Show. Crossrail also took the lead role in organising CLOCS champions to support the 2015 Bike Show safety event at which 1,176 cycling enthusiasts underwent a safety briefing on cycling close to HGVs.

### Newham junior citizens event – cycle safety

Young Crossrail works with the Metropolitan Police as part of a three-week Junior Citizens Scheme for primary school students in Newham. The event runs

during January and June. Young Crossrail ambassadors present a ten-minute cycle safety scenario alongside safety scenarios from other organisations including the Metropolitan Police, London Fire Brigade and the Youth Offending Team. Crossrail's 'Be Safe, Be Seen' interactive session encouraged children to wear helmets, reflective clothing and bike lights at night and informed them of the dangers of blind spots through the use of a mock-up HGV lorry, webcam and video.

Crossrail continues to pioneer the protection of vulnerable road users through the continued mandating of vehicle safety equipment. Despite these efforts, during the year covered by this report, a fatal collision occurred involving a lorry operated by a Crossrail contractor leading to the tragic death of a female cyclist. Crossrail's thoughts remain with her family, friends and colleagues.



## Integrated reporting

### Lorry safety

Crossrail has been proactive in improving the safety and wellbeing of road users. Lorry safety has been prioritised through a number of key initiatives that target four key elements: drivers, vehicles, hauliers and cyclists. The mandating of standard safety equipment to be fitted to all lorries and vans working on Crossrail triggered an investment of about £60 million from the industry. In combination with specialist driver training and the Exchanging Places scheme, it has helped improvements in safety and drivers' awareness of vulnerable road users.

In addition, a proactive approach to route and congestion management has compounded the positive impact of this initiative. A ripple effect is already visible across other clients and projects which will help lead to long term improvements in road safety across London.

# PROMOTE GREATER QUALITY OF OPPORTUNITY AND SOCIAL INCLUSION

## Ethical sourcing section

Crossrail continues its proactive approach to addressing the issues of ethical sourcing. Through the Ethical Supply Chains in Construction Working Group, procurement specialists from Tier 1 contractors have been engaged in a collaborative manner to share best practice and ensure a consistent and rigorous approach to ethical procurement.

As procurement moves to more complex mechanical and electrical components, the ethical risks increase. Crossrail has engaged with the Building Research Establishment (BRE) to work with their group responsible for sourcing mechanical and electrical products and has also contributed to the BRE's resilient resourcing across the value chain.

Crossrail promoted the importance of ethical procurement on public sector projects at industry events such as the Action Programme for Responsible Procurement, an Engineering and Physical Sciences Research Council funded programme led by Loughborough University.

An industry webinar was presented at the Lighting Solutions Conference and Awards which offered a different perspective on the provenance of components used in the lighting industry and issues associated with conflict minerals and other unethical work practices.

Whilst the complexity of supply chains in the construction industry continues to be a challenge, Crossrail continues to receive recognition for its commitment to this often forgotten area of responsible procurement. Industry collaboration is essential for progress to be made and it is hoped the learning legacy will help future major projects.

*"Crossrail made ethical sourcing of construction materials a central part of the procurement process. By doing so it made fundamental changes to the way reinforced steel was procured for a national infrastructure project so that sustainable procurement was an integral part of the procurement processes."*

Lee Brankley, General Manager, UKCARES

## Performance assurance

Crossrail uses a performance assurance framework as one of its principal tools for encouraging contractors to perform above and beyond minimum contractual requirements. It has proved to be successful in encouraging contractors to meet or exceed their targets, especially those relating to strategic labour needs and training.

Changes were made to reflect the new challenges and opportunities expected to arise as a result of the transition in Crossrail's construction programme. In particular, contractors are encouraged to engage proactively with the more complex supply chain typically associated with this phase of the project to maximise opportunities and minimise risks. The changes are also designed to help contractors develop their longer term capacity to deliver similar outcomes on future projects.

Specific areas of focus in the revised performance assurance framework include sustainable employment, high-quality apprenticeships, robust monitoring and implementation of the London Living Wage and promoting equality and inclusion.

## Indicator 11 – Diversity in Crossrail's workforce

Crossrail and its contractors are committed to promoting diversity, valuing talent and respecting each other and the communities they impact.

The table overleaf shows the diversity of Crossrail's Integrated Team and its contractors' workforces, measured against the UK Contractors' Group (UKCG) industry data.

An encouraging picture of diversity is seen in specific work-related programmes, such as, higher levels of Black, Asian and Minority Ethnic (BAME) and female representation in work experience, work placements and apprenticeships.

The percentage of women in Crossrail's Integrated Team (30%) represents a small (1%) increase from last year, whilst the percentage of people from BAME groups (24%) remains the same. The proportion of people who



identify as having a disability has remained broadly the same at around one per cent.

To address workforce gender diversity, Crossrail is supporting the Women into Construction initiative and has made changes to its Contractor Performance Assurance Framework to encourage improvements to contractors' performance in this area.

Women make up just 11 per cent of the construction workforce in the UK. Most of these jobs are office based,

with only two per cent working in manual jobs. The Women in Construction project aims to place women in all areas of construction from manual trades to graduate construction professions. The project also offers women various short construction courses, Construction Skills Certification Scheme training/testing and apprenticeship opportunities on sites across London.

Crossrail's first Women into Construction event took place in January 2015 at the Pudding Mill Lane site and was hosted by contractor Morgan Sindall. It resulted in work placement offers in Morgan Sindall's engineering, health and safety and commercial teams. Further work placements have since been secured with other Crossrail contractors, Dragados-Sisk and Alstom-TSO-Costain.

Women into Construction is a Construction Industry Training Board funded initiative, originally created in 2008 for the Olympic Park project. Now an independent community interest company, Women into Construction is working closely with Crossrail and its contractors to maximise opportunities for women on the project.

### Equality and talent strategy

Crossrail has made progress in achieving the actions set out in its Equality and Talent Strategy, published last year. This progress includes:

- Head-office staff and 20 sites taking part in 274 activities during Crossrail's first Respect Week
- Confirming gender parity in pay through a programme of equal pay audits
- Over 1,000 employees attending diversity and inclusion training over the past year
- Promoting disability awareness, particularly with regard to mental health
- Establishing a targeted skills and employment initiative in partnership with Women into Construction

### Indicator 12 - London Living Wage

Crossrail contractors and their supply chains are expected to pay workers on the project's London sites the London Living Wage. This is the hourly rate of pay set by the Greater London Authority, based on the cost of living in London. In recent years, annual increases in the London Living Wage have begun to outstrip prevailing market rates for lower-paid construction occupations, meaning that some civil engineering and building operatives workers are now potentially at risk, in addition to traditionally high-risk groups such as cleaners, catering workers and security guards.

In order to mitigate these risks, Crossrail has continued to work closely with its contractors to establish robust processes for monitoring and enforcing London Living

Wage compliance. This has included asking individuals working on site whether they are receiving the London Living Wage or better. Contractors are also expected to undertake regular payroll audits of their subcontractors, prioritising those considered to be high risk.

Over the past year, two contractors working on Crossrail (Dragados UK and Canary Wharf Group) have sought and obtained accredited employer status with the Living Wage Foundation, a Citizens UK initiative that recognises and celebrates the leadership shown by Living Wage Employers across the country.

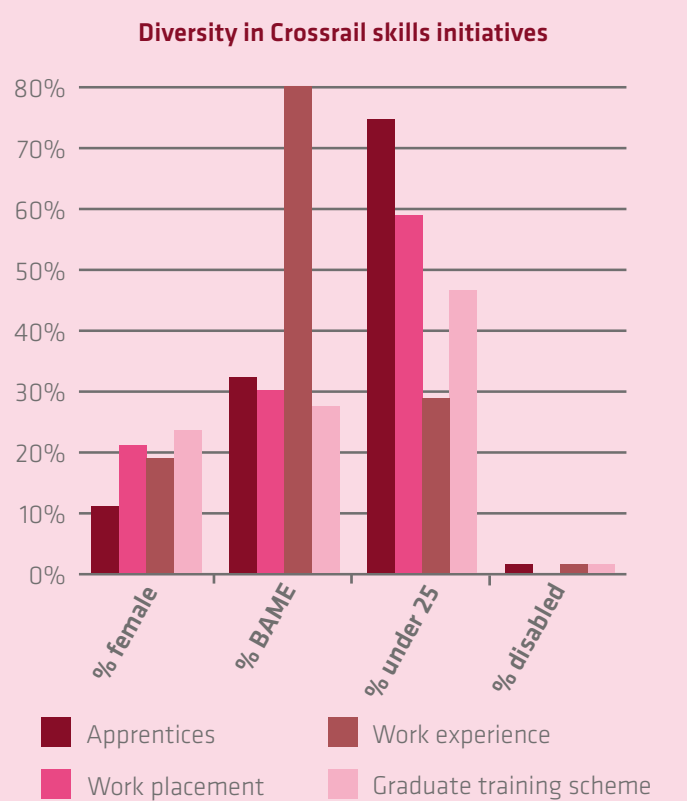
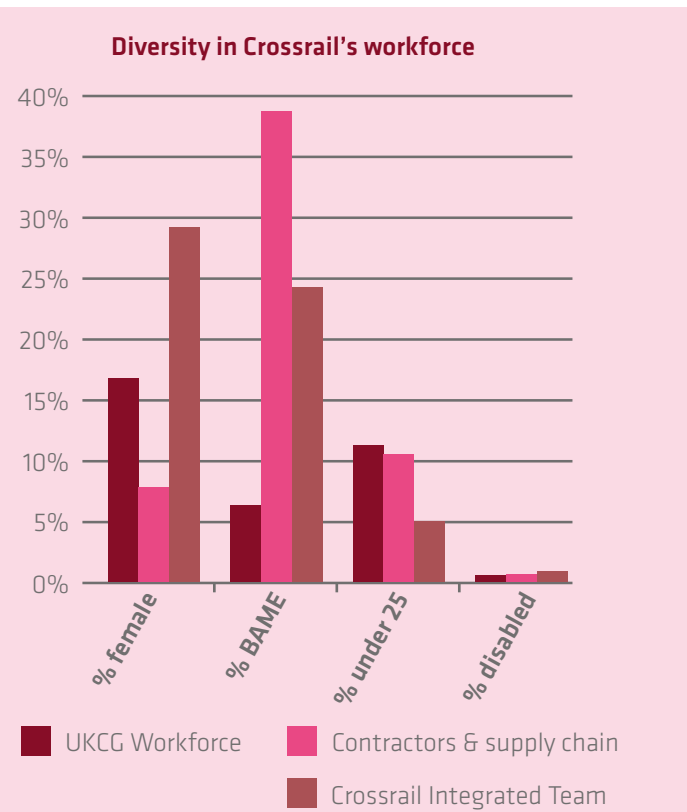
### Strategic Labour Needs and Training (SLNT)

Crossrail requires each of its contractors to deliver specific skills and employment outcomes proportionate to the value of their contract. These are known as SLNT targets and include apprenticeships, local or unemployed job starts, up-skilling, work placements, work experience and graduate training schemes.

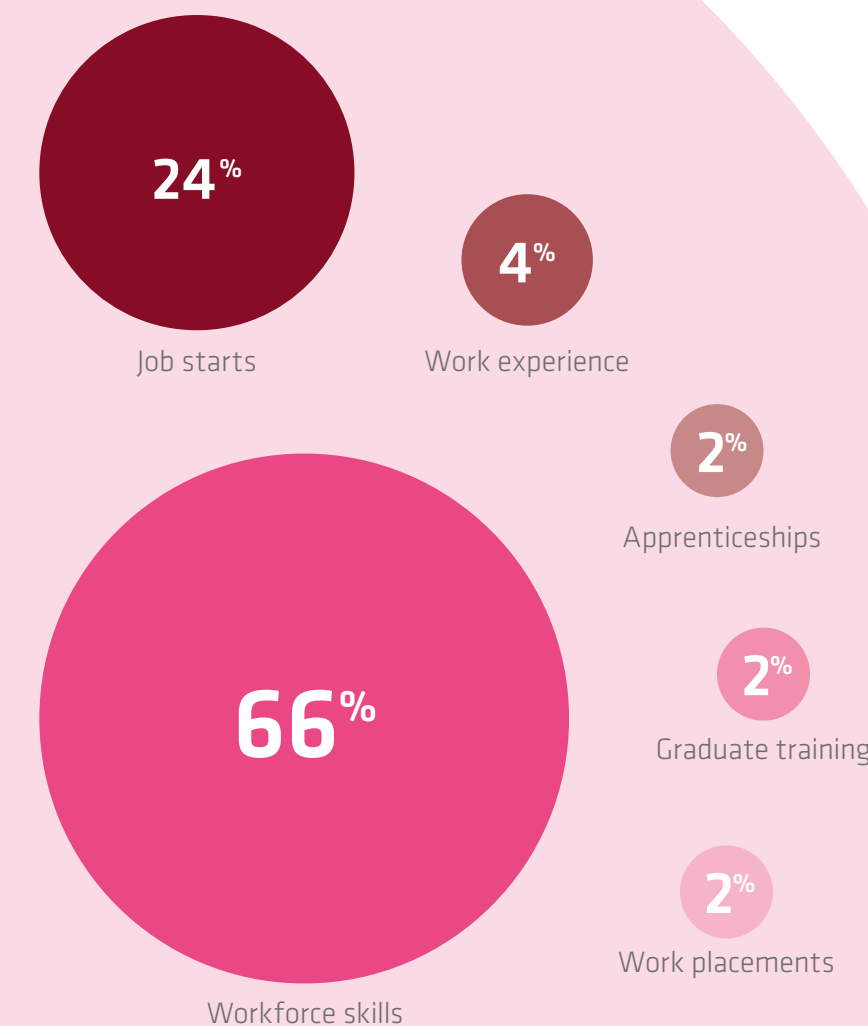
### Indicator 13 - SLNT compliance

Crossrail reviews the SLNT progress of its contractors every quarter and provides support to optimise the opportunities provided. When last assessed, 100 per cent of Tier 1 contractors were on track to meet or exceed the commitments set out in their SLNT plans. All but one active contract was on track or ahead of schedule in delivery of apprenticeship targets and most are exceeding their other SLNT targets, including work experience opportunities, work placements and graduate opportunities.

The chart below shows the proportion of people benefiting from the various types of SLNT intervention since the start of the project.



### Breakdown of SLNT beneficiaries by type





### Indicator 14 – Apprentices

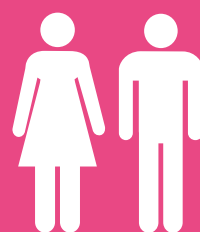
In 2014, Crossrail passed its target of creating 400 apprenticeships over the lifetime of the project – three years ahead of project completion. By the end of the year, a cumulative total of 426 apprentices had been recruited on the project: an increase of 143 from the figure reported at the end of 2013-14.

Practices which contributed to this significant achievement included contractors identifying and embedding opportunities during subcontract

procurement and working closely with their supply chains to identify additional opportunities during the delivery phase. The best performing contractors have also been characterised by the championing of apprenticeships at senior leadership level.

Crossrail remains committed to promoting further apprenticeship opportunities on the project over the next three years. These efforts will be complemented by initiatives to ensure apprenticeship quality.

#### BENEFITS £16m



£15m GROSS VALUE ADDED  
£0.8m GOVERNMENT BENEFIT

426

APPRENTICES RECRUITED



£117,000 GVA GENERATED PER APPRENTICE

ONE THIRD EMPLOYED AS A RESULT OF THE PROJECT

IMPROVED HEALTH AND WELLBEING

LASTING SKILLS LEGACY

GREATER SOCIAL INCLUSION

#### Integrated reporting Apprenticeships Programme

Support of apprenticeships on Crossrail provides a wide range of benefits to apprentices, Crossrail, the construction industry and the local and national economy.

Apprentices receive income from employment which is consequently distributed in the local economy. Employment leads to increased health and wellbeing as well as greater social inclusion. The government also benefits from increased tax contributions and less need to draw on Job Seeker's Allowance.

## CROSSRAIL'S OUTSTANDING APPRENTICES

Crossrail's annual apprenticeship awards recognise the outstanding apprentices helping to deliver the project. This year, over 60 nominations were received for apprentices working across all parts of the project.

The Crossrail Apprentice of the Year award went to 24 year old Freddy Denny, a second year civil engineering apprentice. Originally from Petersfield, Hampshire, Freddy was half way through his third year at university studying computer sciences when he switched to take up an apprenticeship at Crossrail's Farringdon site as an Infrastructure Apprentice with BAM Ferrovial Kier. He won the award after being described by his co-workers as having a 'passion for construction' and being a mentor to younger members of his team.

#### Annual apprenticeship awards

- Crossrail Apprentice of the Year, Freddy Denny. Freddy also picked up the Infrastructure Apprentice of the Year (Advanced) award.
- Apprenticeship Employer of the Year, Laing O'Rourke. The team responsible for Crossrail's Liverpool Street station was hailed for their commitment to apprenticeships and commended for the scale, range and quality of apprenticeship places.
- Infrastructure Apprentice of the Year (Intermediate Level), Nico Parmer. Nico, an Apprentice Carpenter working on Custom House station for Lang O'Rourke, was nominated for his unwavering enthusiasm and energy, embracing innovative ways of working and commitment to safety.
- Business Apprentice of the Year, Lauren Kennet. Lauren works for the Dragados Sisk Joint Venture at Crossrail's eastern tunnels. She is described as the perfect HR manager, with her mature and respectful approach.
- Advocate of the Year, Colin Edwards. Colin from Morgan Sindall was recognised for his hard work mentoring students on the Pudding Mill Lane site.

CASE STUDY



COST £0.9m

APPRENTICESHIP PROGRAMME



### Indicator 15 – Jobs Brokerage service and local employment

Crossrail has a dedicated Jobs Brokerage service which is delivered in partnership with JobCentre Plus. The service works closely with the Tunnelling and Underground Construction Academy (TUCA), stakeholder boroughs, further education colleges and a wide range of other referral organisations across London. This helps ensure that details of jobs and apprenticeship opportunities on Crossrail reach the widest possible audience. Potential applicants are provided with information, advice and guidance while contractors are supported in their commitment to recruiting local people.

**4,115 jobs were created for local or previously unemployed people by the end of the year**

By the end of the year, a cumulative total of 4,115 jobs had been created on the project for local and/or previously unemployed people: an increase of just over one thousand from the figure reported in last year's report. The chart below shows the breakdown of job starts by the top 10 boroughs.

Over the past year, the Brokerage further extended its service by launching three targeted initiatives, designed to offer routes into employment for particular groups. These include:

- Former armed-services personnel – in partnership with the Construction Youth Trust's Buildforce initiative
- Women – in partnership with Women into Construction
- Unemployed young construction workers – in partnership with Green Skills Partnership, Carshalton College and TUCA

### Other work opportunities

Equipping its workforce with key competencies and workforce skills remains a high priority for Crossrail.

Since the start of the Crossrail project, 957 young people have taken part in work experience both on site and at head office. 340 of these were for long work placements of between 11 and 100 days.

This year contractors took on more than 150 additional graduates on a training scheme, bringing the total graduate intake on the project, including Crossrail's own graduate scheme, to 411.

**411 graduates worked on Crossrail**

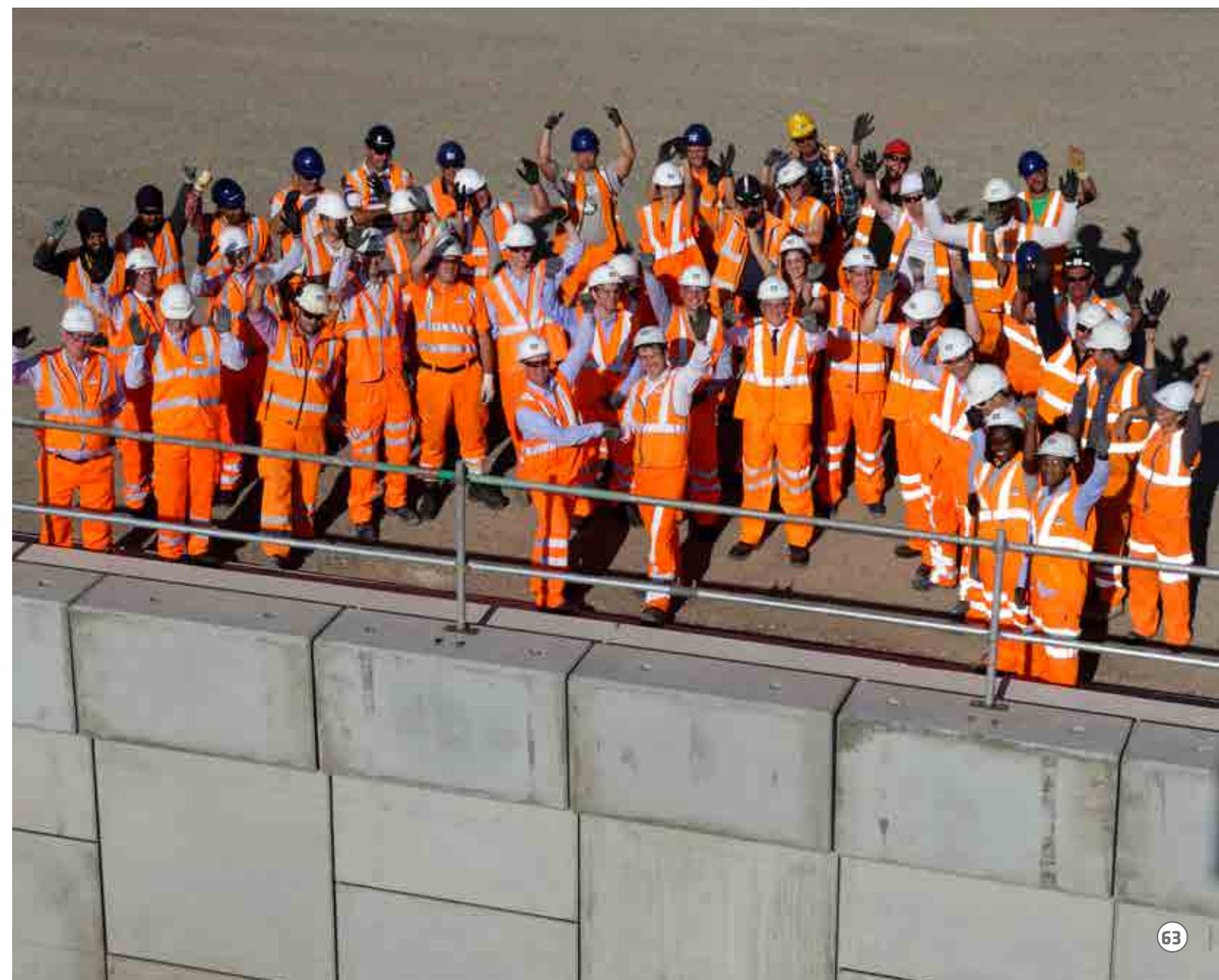
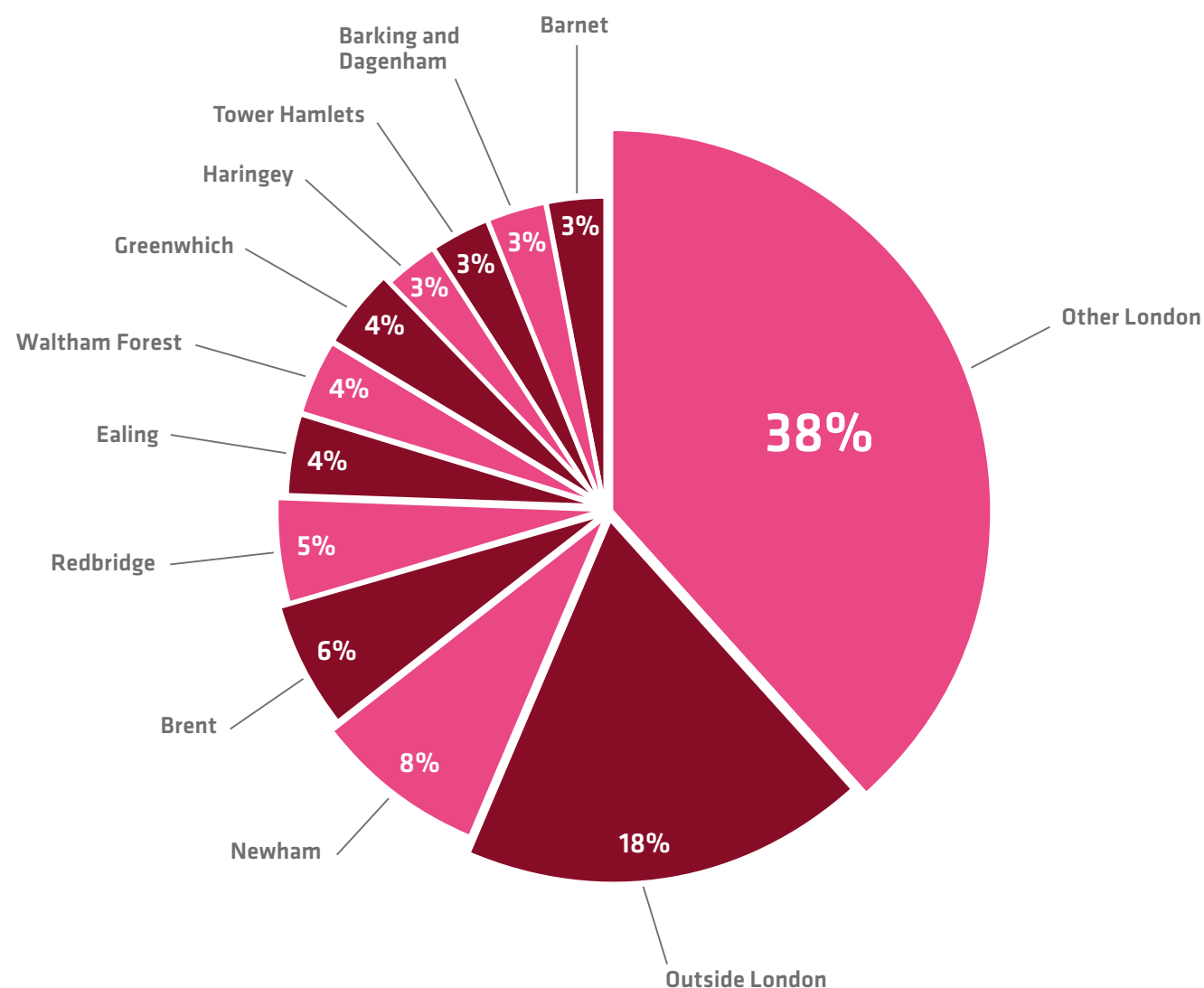
The roles offered cover many disciplines and each graduate will have spent a minimum of six months

working either directly with Crossrail, one of its Tier 1 contractors or a member of the supply chain.

Network Rail, in partnership with Crossrail, developed an objective during the year to create Crossrail apprenticeships focussed on developing project management skills and to provide opportunities to local candidates from disadvantaged groups. This was launched as the London Major Programmes Apprenticeship scheme and six apprentice placements started in March 2015 with Taylor Woodrow, Balfour Beatty and Network Rail. A two year learning programme has been put in place with apprentices achieving an Association of Project Management (APM) diploma and an Institute of Leadership and Management (ILM) qualification on completion of the course. Two more apprentices are expected to join the others in June 2015.

The scheme will be expanded for the second cohort in September 2015 engaging more of the supply chain in the apprenticeship programme.

### New job starters by borough





### Indicator 16 – Volunteering

The number of Young Crossrail ambassadors grew from 171 to 250 over the year. This number includes 72 Young Crossrail STEM (science, technology, engineering and maths) ambassadors who are allied to the STEMNET programme. The volunteers logged over 1,250 volunteer hours over the year, an increase of 150 hours compared to the previous year.

Ambassadors played a key part in a number of successful initiatives rolled out through the programme. Some highlights include mentors working with student teams for project work and a debating competition, assisting at the Skills London and Skills Show careers exhibitions, delivering cycle safety workshops to primary school students and supporting a number of corporate work experience students from partner schools.

### Indicator 17 – Work experience

In 2014-15, Crossrail provided 97 work experience placements across the project, including 25 placements as part of the corporate work experience programme. Feedback from the programme was positive with students rating the experience as 4.7 out of 5 on average. Students and hosts stated they were very happy with the information, programme and support from Young Crossrail.

**97 student work placements were offered on Crossrail. The average rating for the experience was 4.7 out of 5**

In 2015-16, students who undertook placements will be asked to complete a post-work experience evaluation form three months after the placement end date. This will help the Young Crossrail team enhance their understanding of how placements affect student choices around career aspirations and working within STEM industries.

### Indicator 18 – Young Crossrail audience reach

The Young Crossrail programme works with schools and young people, particularly those closest to the route. Through the activities in schools, work place visits and other events, volunteer Young Crossrail ambassadors aim to change perceptions of the engineering industry and encourage more young people, and particularly girls, to consider engineering and construction-related careers.

Young Crossrail aligns with other programmes aimed at supporting young people into work and apprenticeships. Young Crossrail will help develop a pipeline of engineering and construction workers beyond the lifetime of the Crossrail project leaving a skills legacy for the future industry.

Over 13,000 students, teachers and parents across 70 schools were engaged over the year.

A significant amount of the Young Crossrail programme is focused on working closely with students from its six partner schools: Royal Greenwich University Technical College (UTC) in Greenwich, Rokeby School in Newham, Swanlea School in Tower Hamlets, Elizabeth Garrett Anderson in Islington, Maria Fidelis School in Camden and Westminster Academy.

Young Crossrail started work to extend its partnerships, forming links with two new schools St Paul's Way Trust School, Tower Hamlets and Oasis Academy, Newham in 2014-15. In the year ahead, the team will work on establishing links with four more schools.

Activities with partner schools included supporting teams for the Go4Set 'Stations of the Future' project and the First LEGO League robotics competition. Events delivered to mark National Women in Engineering Day and Tomorrow's Engineers Week were also supported.

### Respect Week

Crossrail's first organisation-wide Respect Week was launched on 19 May 2014 and culminated in a conference, attended by 160 people from across the project and over 200 other events across all sites. The conference featured a debate between two Crossrail project managers, Linda Miller and Nisrine Chartouny, on the topic of positive action to increase gender diversity within the construction industry.

The other 273 events included:

- Seminars and workshops on gender diversity, unconscious bias, difficult conversations and positive body language
- Guidance on the benefits of inclusive language for health and safety
- 'Getting to know your colleagues' events, including sharing food, speed networking and job shadowing

## YOUNG CROSSRAIL HOSTS DEBATE AT HOUSES OF PARLIAMENT

Young Crossrail hosted its first House of Commons debate between three partner schools Westminster Academy, Royal Greenwich UTC and Elizabeth Garrett Anderson School. Chaired by Terry Morgan, Crossrail's Chairman, the debate saw the schools competing against each other on topics including apprenticeship versus graduate routes into employment and positive discrimination within the engineering industry.

Each team was supported by a Young Crossrail ambassador who acted as a mentor and helped the teams formulate their arguments.

Elizabeth Garrett Anderson and Westminster Academy made it through to the final round where they debated the topic: The UK has become too London-centric and more money should be invested in the rest of the country – agree/disagree.

Both teams put forward excellent arguments to the judging panel who comprised Terry Morgan, Mary Macleod MP, Mike Gapes MP and Elizabeth Gillbe, Head of Financial Control at Crossrail.

The debate was won by the Elizabeth Garrett Anderson team who received a trophy for the school and a tour of the Houses of Parliament.





# LONDON MAJOR PROGRAMMES APPRENTICESHIP SCHEME

This is the first scheme of its kind in London, formed with six companies: Crossrail, Balfour Beatty, HS2, Network Rail, Thameslink and Vinci.

Recruitment occurred via Young London Working, the Jobs Brokerage and JobCentre Plus. Following two assessment days, 15 apprentices started their apprenticeships in March 2015. Six of these apprentices will work on Crossrail through placements with Network Rail and the broader Crossrail supply chain.

Apprentice snapshot:

- 13 aged between 19 – 24
- 8 unemployed at the time of application
- 2 female
- 11 BAME

The apprentices will follow a two year programme and will gain an APM diploma and ILM qualification upon successful completion. They will spend up to three days per month with the learning provider to cover course work. Site-based placements, guest lectures and contextual visits will further reinforce what is learned through coursework.

## READY, STEADY, GO4SET...

Students from four Crossrail partner schools took part in a 10-week 'Stations of the Future' project which ended at the Crossrail offices in Canary Wharf in March 2015.

The students were tasked with developing ideas for how stations of the future could be designed to be more environmentally friendly.

The students from Royal Greenwich UTC, Elizabeth Garrett Anderson School, Rokey School and Westminster Academy were supported by Young Crossrail ambassadors who helped develop ideas that later fed into the project report, presentation and display stand.

Andrew Wolstenholme, CEO Crossrail, gave a presentation about his experience on the Crossrail project and also offered an opportunity to discuss future career aspirations for students. Encouragingly, about half of the students said that they wanted to be engineers.

The winning school was Royal Greenwich UTC with Westminster Academy winning a prize for Best Display Stand and Elizabeth Garrett Anderson School winning an award for Best Project report.

## Tunnelling and Underground Construction Academy (TUCA)

Crossrail's state-of-the-art training facility and Europe's only specialist soft-ground tunnelling training facility, TUCA provides training for the key skills required to work in tunnel excavation, underground construction and infrastructure.

Since opening in September 2011, over 10,000 people have been trained with skills and safety training required to operate effectively and safely in the tunnel network.

TUCA is expected to become a sector-led centre of excellence, delivering world-class skills and sustainable career opportunities, not just for Crossrail, but future infrastructure projects. The specialist skills and life-changing experience offered at TUCA will enable individuals to develop sustainable careers, with opportunities for future progression.

In 2014/15, the team at TUCA trained more than 3,100 people, across three key strands: pre-employment, workforce development and apprenticeships.

## Over 3,000 people trained at TUCA this year

TUCA's clientele is varied. It provides training and support to those looking for their first step in a new career through to those looking to build upon their existing skilled roles.

TUCA engages with employers across the entire tunnelling industry, ranging from large multi-nationals, through to SMEs within the supply chain.

2014-15 highlights include:

- 120 new supervisors and mentors participated in the innovative Frontline Leadership Programme
- 1,102 learners gained Tunnel Safety Cards
- 400 learners undertook the Tunnel Entry and Emergency Procedures courses
- 247 learners undertook the pre-employment courses

TUCA was successful in obtaining funding under the Employer Ownership of Skills (EOS) pilot, with plans to develop training programmes that are employer and sector driven. The ambition of EOS is to put more ownership of the skills agenda in the hands of employers. TUCA's pilot will inform the government's policy of skills funding, making it more demand-led, rather than driven by the learning providers that deliver training and workforce development programmes. By placing the funding with employers and driving up their own contributions, the quality and relevance of the training will be increased, resulting in more effective learning and better value from tax payers' money.

The industry panel providing advice for the pilot will determine the skills required and in some cases, support the development of new courses that better fit the sector's needs. Although in its early stages, the pilot project is proving to be very popular with its industry partners – a testament to the effectiveness and ambition that embodies TUCA. The ultimate ambition of the project is to commission over 4,800 learning activities, directly through the investment of the employer partnership.





### Community Investment Programme

Crossrail remains committed to investing in local communities along the route through opportunities that arise from the construction programme. Community investment takes the form of a donation of skills, time, money and expertise to help bring lasting benefits to the local communities where Crossrail contractors work.

Each contractor working on Crossrail is required to provide a community investment plan customised to each specific community and their local stakeholders. Particular focus areas are education, renovation and refurbishment, social welfare, economic development and jobs.

In addition to contractor community investment programmes, Crossrail has its own programme targeted at local primary school children and their parents, through the Young Crossrail programme.

A key piece of work this year has been the development of a community investment toolkit. This has been in

response to an observation that community investment has most benefit when it identifies and contributes to the main concerns and needs of the community that it is trying to help and support. There is also a need to provide consistency in the approach to identifying these needs and quantifying their value. It is expected that the toolkit will be used to inform future investment in local communities and it will be an important part of Crossrail's learning legacy for future projects.

Community investment is not just limited to the London boroughs. Crossrail delivery partner, Network Rail, has a range of volunteer activities. A total of 970 hours were donated through initiatives such as the Budding Brunels programme, the corporate community involvement service run by the Paddington Partnership. Network Rail plans to re-launch its volunteer programme to support the key future focus areas. Each project area will have a community investment plan with a focus on employee and contractor volunteering.

## BUDDING BRUNELS

In 2014 Network Rail partnered with the Construction Youth Trust to deliver the Budding Brunels rail training programme to encourage young people along the Crossrail route to consider a career in construction and engineering.

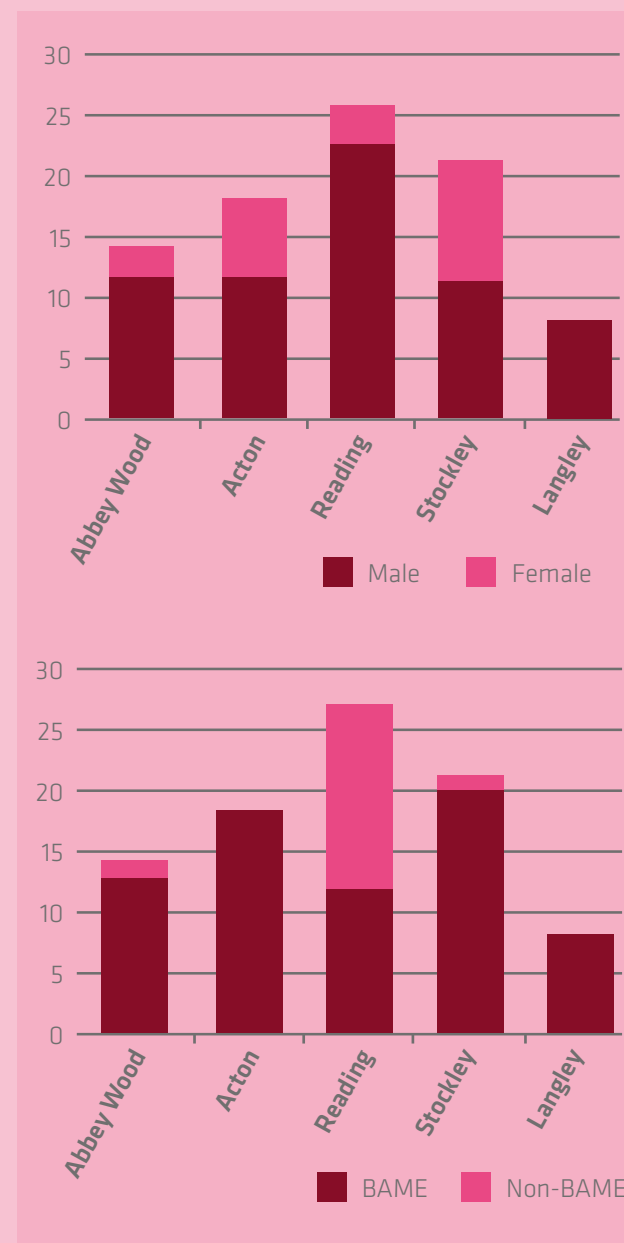
Five courses were delivered to 84 young people from 14 schools in Acton, Abbey Wood, Stockley, Langley and Reading and 17 work placements completed.

In addition, a number of workshops have been completed with 84 students from 14 schools attending. Presentations at these schools engaged with more than 200 pupils.

Before and after each course, students were asked about their views on construction and their key learnings from the course. Results from this survey demonstrate that students were inspired by the programme with an increased interest in careers in construction and apprenticeships. 86 per cent of students changed their view of the construction industry and 53 per cent said they would consider a career in construction.

Initial research to measure the impact of the Budding Brunels programme by undertaking a social return on investment analysis identified that for each £1 invested, the social return was £5.43.

Budding Brunels will be expanded to engage a wider age group of students and will include opportunities for curriculum talks and engagement with younger pupils within the partner schools.



CASE STUDY





## A NEW SENSORY GARDEN FOR CHILDREN

Haven House Children's Hospice cares for children and young people from birth to age 19 who have life-limiting and life-threatening conditions and who are unlikely to reach adulthood. They provide care for children and families living in North or East London, West Essex or East Hertfordshire.

The hospice itself is an important place for these children. It provides a tranquil haven, a home away from home where children can feel safe and have fun, whilst their families can relax in the certainty that their children are receiving care.

Laing O'Rourke, through the Crossrail community investment programme, developed a project that involved planning and building a new sensory garden for the children. The area identified for the new garden was previously inadequate for this kind of project and needed a major overhaul to turn it into an interactive and engaging space.

A small group of volunteers from the contract team were brought together to plan and deliver the project. Following the first site visit, the team spent time developing the plan, sourcing materials and equipment and obtaining all of the necessary agreements to enable the project to start.

The garden took several weeks to construct. Three Laing O'Rourke employees put in place the hard landscaping (clearing and levelling the site, paving, repairing the wall, building planters). Sixteen volunteers from Laing O'Rourke and Crossrail then assisted with other softer elements including painting the garden wall, planting and general garden duties. Materials from Crossrail's Liverpool Street station site were also donated and formed part of the garden.

The garden was then formally opened by Haven House patron and actress Vicki Michelle MBE on 2 February 2015.

**“ Our children and families have a wonderful outdoor resource to enjoy over the coming years ”**

Jan Cunningham, development officer, Haven House



## COMMUNITY PLANTING DAY

The Royal Docks Learning and Activity Centre (RDLAC), Albert Road Green and St John's Community Garden were donated over 100 small trees from the Woodland Trust so they decided to hold a community tree planting event to bring the community together and help improve the local area.

Crossrail contractor Hochtief Murphy Joint Venture who has been working closely with the RDLAC and St John's Community Garden to deliver several community initiatives while working on the Thames tunnel construction thought this opportunity would be ideal to introduce the next contractors at the sites, Balfour Beatty and Alstom TSO Costain.

All contractors worked collaboratively to support the local community. Eighteen volunteers helped with digging and gardening, helping children sow seeds, painting the meeting rooms and preparing lunch.

**“ We couldn't be happier with the turnout today! Everyone has worked really hard putting this amazing event together and we are delighted that the local community came out to support it ”**

Joy-Caron Canter, Director, RDLAC



## THE CULTURE LINE

2014 showed a solid year of progress in Crossrail's drive to deliver The Culture Line: a series of large-scale art commissions at Crossrail's new central London stations, curated in partnership with some of London's leading art galleries.

Artworks have been selected for Tottenham Court Road and Canary Wharf and are currently in development with the artists and station teams.

In partnership with PACE gallery, at Canary Wharf, Israeli artist Michal Rovner was selected for her initial proposal to install a



video installation inside the 250 metre long station, which will depict streams of human figures. The work will be co-funded by Canary Wharf Group and the City of London Corporation.

At Tottenham Court Road, two Turner-prize winning artists represented by Gagosian Gallery were selected to develop their art proposals which will be funded by property group Almacantar, City of London Corporation and Derwent London.

Scottish artist Douglas Gordon will look to install artwork in the station's western ticket hall in Dean Street, Soho, and British artist Richard Wright will see a design on the ceiling above the eastern ticket hall, next to the existing Tottenham Court Road London Underground station.

The Culture Line falls outside Crossrail's £14.8 billion core funding and is funded through private sponsorship. The City of London Corporation is match funding art at central London stations. Crossrail is working to secure the additional 50 per cent of funding.

## ARTIST IN RESIDENCE

Crossrail's artist in residence, Julie Leonard, was appointed in 2014 to create a pictorial diary of Crossrail, to capture the many personalities and construction scenes across the project with the use of an application on her smartphone that helps her create digital and animated drawings. During the year she made over 20 visits to a variety of Crossrail worksites and led the first of a series of workshops teaching local budding artists to create construction-inspired artworks.

The three day workshop saw a group of 8-15 year-old children from Tower Hamlets invited

to Crossrail's Liverpool Street site office and taught to use iPads to create digital artworks based on views of the Liverpool Street construction sites. The project was delivered in partnership with arts charity, Arts for All, and funded by Laing O'Rourke.





Crossrail's award-winning innovation programme provides an opportunity to capture and explore unique and pioneering ideas from all of those involved in the Crossrail project. It supports ideas that have the potential to raise the capability and standards of UK construction. The techniques, products and methods used on Crossrail aim to help set benchmarks for other major construction projects.

Innovate18 has four key themes to guide innovators and help generate ideas: health and safety; delivering efficiencies through the life cycle; digital-physical integration; and sustainable solutions. By supporting the development and delivery of sustainable innovation projects, Innovate18 provides a mechanism for Crossrail to go beyond compliance.

Innovation highlights over the year include:

- Trialling a digitised red-line drawing application called Basestone
- Developing a light-weight aggregate from London clay

- Trialling the use of a low carbon concrete (CemFree)
- Investigating options for re-purposing grout shafts and associated grouting networks (temporary structures that allow stabilisation of ground if required during tunnelling activities)
- An assessment of the time savings associated with the use of projectors to deliver task briefings on site

Innovations at Crossrail are funded by Tier 1 supplier members of Innovate18 with match-funding provided by Crossrail.

To date Innovate18 has received approximately 800 ideas, published over 330 innovations and invested approximately £360,000 on developing 28 ideas. There are 126 examples where innovative solutions used on Crossrail have been shared across Crossrail contractors and their supply chains.

As Innovate18 continues to evolve a legacy that inspires and motivates innovation in future major infrastructure projects is envisaged.



## THERMAL IMAGING FOR MONITORING CONCRETE

### Scope

Investigate the use of thermal heat camera technology to understand curing characteristics of sprayed concrete lining (SCL) works to review advancement rates and mitigate the risk of falling concrete from understrength concrete.

### Progress

Cameras were procured by BAM, Ferrovial, Kier Joint Venture and trials conducted on behalf of Crossrail's chief engineer's group. Trials demonstrated that the cameras could be effective in monitoring concrete behaviour while curing. In July 2014 a report on the first trial was released and shared with SCL contractors via the Innovate18 portal. Further trials will be undertaken with a more compact product that attaches to mobile phones. The second report is due to be released at the end of 2015, following the second set of trials.

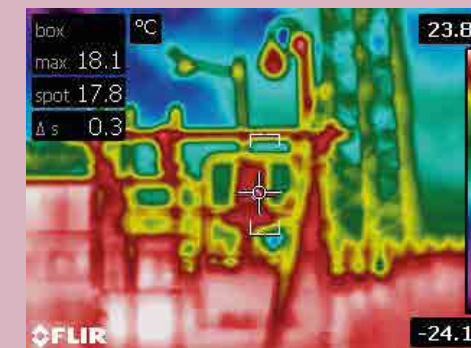
## PICO PROJECTORS

### Scope

Investigate the potential of using hand held projectors to display visual content on site to increase efficient delivery of task briefings.

### Progress

The initial trials were completed in April 2015. 'Six Sigma' (process improvement) analysis for the initial trial suggested 200 per cent efficiency was achieved when compared to the standard process, although further trials will be required to provide a more robust assessment of savings.



## FIELD TRIAL OF DIGITAL REDLINE REVIEW APP

### Scope

A field trial was undertaken of the BaseStone application, which digitalises works review processes using cloud based technology. The trial compared performance of the digitised system against the manual process and then reported on compliance with the Crossrail works information and quantifiable benefits of the system to the project team.

### Progress

Field trials were completed demonstrating an estimated saving of over 60 per cent against the standard process. Works will continue to progress further trials by other contractors and to develop a more thorough Six Sigma analysis of benefits. An Automatic Protocol Interface with eB (Crossrail's document store) for the upload and download of reports and red-lined PDF drawings is being developed to enable wide scale roll-out on Crossrail. This is expected to be developed in Spring 2015.





# AWARDS

## EXTERNAL AWARDS

### British Construction Industry Awards Programme Management

Crossrail won the prize for Programme Management at the prestigious British Construction Industry Awards. The judges said that Crossrail was “genuinely world-class in terms of scale and complexity”. Other nominated projects in this category came from Anglian Water, the Olympic Park and Heathrow Airport Terminal 2.

### Project of the Year

#### Specialist BIM Award

Crossrail won Project of the Year for its use of 4D BIM (building information modelling), combining 3D CAD (computer aided design) with the construction schedule to create animations that show what will be built and when. This project was recognised for the superior control of the 4D process, ability to implement 4D on the most complex elements and innovative use of their software. Crossrail's 4D designer, Dominic Wind, was also a finalist in the 4D planner of the year category

Congratulations to all the Crossrail contracts that were nominated for BCI awards:

- Costain Skanska Joint Venture, nominated for four awards for their work on Paddington and Bond Street stations
- Balfour Beatty, Morgan Sindall and VINCI Joint Venture, nominated for their work on Whitechapel station
- BAM Nuttall Kier Joint Venture, nominated for their work on Liverpool Street station
- Taylor Woodrow – were highly commended for their work on Connaught Tunnel

### Investors in People Awards

#### Excellence in the Public Sector

The Excellence in the Public Sector category recognises best practice, innovative techniques and strong strategic skills. Crossrail won this award beating competition from City of Edinburgh Council and the DVLA amongst others. This awards programme received over 500 entries from all over the UK and celebrates the best people management practices across all industries and sectors.

### Institution of Civil Engineers (ICE) Awards

Crossrail was commended for its excellently executed projects at the annual ICE Awards.

The London Infrastructure Award, which recognises excellence in the design and construction of projects, was shared between three Crossrail entries – Connaught Tunnel, Bond Street and Canary Wharf stations. Crossrail also took home the People's Choice Award, in which 3,600 readers of the Evening Standard voted for the Capital's favourite engineering project.

### Public Service People Managers' Association Awards

#### Excellence in employee engagement

Crossrail was voted as joint-winner of the prize with Barking and Dagenham Council, beating off strong competition from Birmingham, Nottingham and Chelmsford City Councils. This is the second top award Crossrail won for employee engagement this year following the Chartered Institute for Public Relations award in February 2015.

### Green Apple Awards for Environmental Best Practice

Green Apple Awards were received for Ecological Mitigation works at Wallasea (Crossrail central section); driving a step change in emissions control for non-road mobile machinery (Crossrail central section); biodiversity no net loss, Royal Borough of Greenwich (Network Rail South-East section works).

### Business Finance Awards

#### Public Sector and Voluntary Finance Team of the Year

The award recognises the entire finance team who were judged against four criteria: generation of improvements and innovations; a proven ability to work well as a team; benefit to the business; and benefit to the customer.

### Considerate Constructors Scheme

The Considerate Constructors' Scheme (CCS) is a national initiative established by the construction industry to improve its image by improving standards of neighbourliness. Sites registered with the scheme are independently assessed against a code of considerate practice, designed to encourage higher standards of conduct. All sites on the central section of Crossrail construction are required to register.

Crossrail contractors have again broken their record for awards received in the annual CCS National Site Awards. These recognise the best construction sites in the UK for excellent standards of consideration towards their neighbours, workforce and the environment. They are based on assessments made during 2014.

More than 9,000 sites across the UK were assessed for the scheme, with just two of these awarded the National Most Considerate Site runner up. The top one per cent receive Gold awards with others receiving Silver and Bronze awards

After four awards in 2012 and 11 in 2013, some 20 Crossrail sites received awards in 2014. In 2015 that total rose to 24.

The average score for Crossrail sites is 43 from a maximum of 50, compared with the industry average of 35. The overall performance of Crossrail sites is recognised by the level of award bestowed on them.

### 2015 Considerate Constructors Scheme Award recipients:

#### Most considerate site runner up award

BFK Bond Street and Tottenham Court Road  
Taylor Woodrow Connaught Tunnel

#### Gold

BBMV Joint Venture, Whitechapel main station works  
BFK Crossrail, Fisher Street shaft  
Costain, Paddington New Yard  
Costain Skanska Joint Venture, Mile End  
Costain Skanska Joint Venture, Eleanor Street  
Costain Skanska Joint Venture, Hanover Square  
Costain Skanska Joint Venture, Paddington Station

#### Silver

Bam Ferrovial Kier Joint Venture, Farringdon station  
Dragados Sisk Joint Venture, Crossrail Eastern running tunnels project  
Hochtief Murphy Joint Venture Plumstead portal  
Hochtief Murphy Joint Venture North Woolwich portal  
Kier BAM Joint Venture, Liverpool Street Station / Moorgate Shaft  
Laing O'Rourke Infrastructure, Custom House  
Laing O'Rourke Infrastructure, Liverpool Street Station  
Taylor Woodrow, Victoria Dock portal

#### Bronze

BAM Nuttall Ltd, Wallasea Island  
BAM Nuttall Ltd, Docklands Transfer Station  
Canary Wharf Contractors Ltd Canary Wharf Station  
Kier BAM Joint Venture, Liverpool Street Station / Moorgate Shaft  
Laing O'Rourke, Infrastructure Tottenham Court Road

Morgan Sindall Plc, Pudding Mill Lane  
Volker Fitzpatrick Ltd, Ilford Stabling Depot

## CROSSRAIL AWARDS

### Annual Apprenticeship Awards

#### Infrastructure apprentice of the year (intermediate):

Winner: Nico Parmar  
Highly Commended: Samir Abarak

#### Infrastructure apprentice of the year (advanced):

Winner: Freddy Denny  
Highly Commended: Luc Williams

#### Business apprentice of the year:

Winner: Lauren Kennett

#### Apprenticeship advocate of the year:

Winner: Colin Edwards  
Highly Commended: Lee Piper and George McClurg

#### Employer outstanding contract:

Winner: Laing O'Rourke, C502 Liverpool Street Station  
Highly Commended: BBMV JV, C510 Whitechapel and Liverpool Street Station Tunnels; and Morgan Sindall C350 Pudding Mill Lane.

### Annual Sustainability Awards

#### Environmental Engagement:

Crossrail team (C412) at Bond Street station for the Green Aider initiative

#### Innovation and Environmental Performance:

Joint winners, Hochtief Murphy Joint Venture (C310) at Thames Tunnel for reusing ground water for TBM processes and Costain Skanska Joint Venture (C405) at Paddington station for the largest plunge wire sawing project undertaken in Europe.

#### Young Crossrail and Community Investment:

Vinci Construction (C340) at Victoria Dock Portal for their Book Buddies initiative

#### Work Placements and Jobs Brokerage:

BBMV Joint Venture (C510) Liverpool Street and Whitechapel station tunnels.

#### Use of CompeteFor:

Laing O'Rourke

#### Fair Payments:

Costain Skanska Joint Venture (C405)

#### Sustainability Champion:

Paul Williams, Plant Administrator for Hochtief Murphy (C310) on Thames Tunnel



# PUBLIC INFORMATION

## Construction activities

Crossrail is committed to providing information about construction works taking place throughout the route to ensure local communities are aware of construction works that may affect them and the measures being taken to lessen impacts. Crossrail also works to keep stakeholders informed about the benefits that the Crossrail service will deliver, current progress and milestones achieved.

Crossrail Ltd is an organisation established solely to build the new railway linking Reading and Heathrow, to the west of London, with Shenfield and Abbey Wood, to the east, including a new central underground section that will link east to west through London.

Crossrail Ltd acts as a client and project management organisation, with the construction work delivered through a number of contractors and their supply chains. Crossrail Ltd imposes a number of requirements on its contractors in order to ensure that the works are undertaken in accordance with the Crossrail Act 2008 and its associated performance requirements.

Through the Crossrail website ([www.crossrail.co.uk](http://www.crossrail.co.uk)), we have developed the 'Near You' mapping tool to explain local works in each area.

To receive email notifications about planned works, sign up to our mailing lists online or contact our helpdesk team. Additionally, specific works are notified to residents and the wider stakeholder community through information leaflets that are distributed in the local area. Communications material can also be translated into other languages upon request.

## Crossrail helpdesk

The Crossrail Public Helpdesk is available to answer any questions about the project and help with any problems which may arise from construction of the railway. The helpdesk operates 24 hours a day, seven days a week. The team is contactable by email [helpdesk@crossrail.co.uk](mailto:helpdesk@crossrail.co.uk) or telephone 0345 602 3813. Details are advertised on the Crossrail website, on all our communications material and at construction site locations throughout London.

Crossrail aims to close all complaints within 10 working days, with an initial response made within 24 hours. Passing complaints to contractors is immediate and the response rate is generally much faster than this.

The Secretary of State for Transport has appointed an independent Crossrail Complaints Commissioner. Any

member of the public who feels that they have not received information from Crossrail, and has been unable to resolve an issue in communication with Crossrail, may ask the Complaints Commissioner to adjudicate. The application must be submitted in writing and the Complaints Commissioner must respond within 28 days, unless a further time limit is agreed.

The Crossrail Complaints Commissioner will:

- Act as a mediator in unresolved disputes between the project and members of the public
- Make recommendations to the Nominated Undertaker (Crossrail or London Underground) where action might be taken to satisfactorily address complaints, resolve disputes, or mitigate against the future occurrence of complaints or disputes
- Act as Registrar of the Small Claims Scheme – if a claim for loss or damages has been turned down by the Administrator of the Small Claims Scheme, the applicant can request the Complaints Commissioner to adjudicate. The Complaints Commissioner will be able to make financial recommendations if the applicant has suffered a loss or damages of up to £5,000
- Advise members of the public who are unhappy with any aspect of Crossrail's construction on how to lodge a complaint

The Complaints Commissioner will not act before Crossrail, London Underground or its contractor have attempted to address a case, and will not get involved in issues such as property, matters already considered by Parliament in approving the Crossrail Act, or issues which are not part of the Crossrail project.

Our contractors work in accordance with their contractual requirements which have been developed from Parliamentary commitments. They all have dedicated community relations representatives whose role it is to work with communities and address issues of concern. If breaches of agreed work parameters occur, the methods of working are re-evaluated and communication of agreements re-assessed to prevent recurrence.

## Stakeholders

The Crossrail project conforms to a series of undertakings and assurances agreed with various parties under the Crossrail Act 2008.

Continued community liaison forms a central part of Crossrail's duties, especially in ensuring construction work causes the least disturbance possible. Crossrail works within the constraints imposed to minimise noise and vibration, dust and road traffic. Crossrail works with contractors to make sure all community concerns are addressed.

Crossrail's stakeholders also include its contractors and we work with them as both client and project manager. They are crucial to Crossrail's success. Contractors provide and develop many of the innovative solutions required to complete safely a project as complex as Crossrail, with the least disruption.

Contractors communicate with Crossrail senior management through many routes, notably the safety, health and environment leadership team and a regular forum for project directors. This allows for open discussion on performance, identifying what Crossrail needs to do to improve its leadership and identifying areas where our contractors can achieve more.

Engagement with the workforce has improved significantly through the commitment to Investors in People. Its recognised framework provides the means for employees to express their concerns in a structured way and helps us address issues and make workplace improvements.

Above all Crossrail Ltd is responsible to the public and to private sector partners for project funding. There is a strict financial governance process to which Crossrail must adhere, with full accountability to the two project sponsors, TfL and DfT.

## Reporting requirements

This report covers our sustainability performance for the financial year 2014-15. As part of governance and accountability, Crossrail is already subject to a rigorous reporting regime as defined by our sponsors: TfL and DfT. Reports are required to cover health and safety, security, environment and cost performance. Additional reports cover management and assurance, consents, compliance and change control.

This annual sustainability report is a voluntary publication. By producing it Crossrail aims to provide a single source of sustainability performance information, which may otherwise prove difficult to gain and would involve extracting details from several different sources.

## Organisation profile

Crossrail Limited is registered in England and Wales No. 4212657. Registered Office: 25 Canada Square, Canary Wharf, London, E14 5LQ.

The purpose of the Crossrail project is to build a new railway under central London, linking Reading and Heathrow in the west with Shenfield and Abbey Wood in the east.

Crossrail Ltd was established in 2001 to promote and develop the project. In 2008, the project gained Parliamentary approval when the Crossrail Act received Royal Assent.

Crossrail is jointly sponsored by Transport for London (TfL) and the Department for Transport (DfT). Crossrail Ltd is a wholly owned subsidiary of TfL and is a company controlled by a local authority within the meaning of Part V of the Local Government and Housing Act 1989. The controlling authority is TfL. The Crossrail organisation comprises employees from several companies, and at March 2015 had 1,328 full-time equivalent staff. Of these, 886 are direct Crossrail employees; the rest are drawn from various partner organisations with consultancy and project management expertise.

## Operational structure and governance of Crossrail 2014-15

The Crossrail Board comprises:

Terry Morgan CBE, Chairman  
 Andrew Wolstenholme OBE, CEO  
 Terry Hill CBE  
 Michael Cassidy CBE  
 Jayne McGivern  
 Robert Jennings CBE  
 Phil Gaffney  
 Daniel Moylan  
 David Allen, Finance Director  
 Simon Wright OBE, Programme Director  
 Andy Mitchell, Programme Director \*  
 Heather Rabbatts CBE, Non-Executive Director\*  
 Ian Brown CBE, Non-Executive Director\*

Below the main Board is the Executive Committee, comprising the following:

Andrew Wolstenholme, CEO  
 Simon Wright, Programme Director  
 Chris Sexton, Technical Director  
 David Allen, Finance Director  
 Mark Fell, Legal Services Director  
 Martin Buck, Transition and Strategy Director  
 Steve Hails, Health and Safety Director  
 Howard Smith, Operations Director  
 Valerie Todd, Talent and Resources Director  
 Will Parkes, External Affairs Director  
 Andy Mitchell, Programme Director\*

Crossrail has a sustainability sub-committee. This sub-committee is responsible for setting strategy and providing organisational oversight. Members are:

Andrew Wolstenholme, Crossrail CEO and Chairman of the sub-committee  
 Bill Tucker, Central Section Director  
 Simon Wright, Programme Director  
 Chris Sexton, Technical Director  
 Valerie Todd, Talent and Resources Director  
 Kevin Lloyd-Davies, Head of Procurement  
 Will Parkes, External Affairs Director  
 David Allen, Finance Director

\*Current for the reporting period but no longer with Crossrail.









[www.crossrail.co.uk](http://www.crossrail.co.uk)

**MOVING LONDON FORWARD**