

Connect Plus SKANSKA Balfour Beatty

M25 DBFO Major Improvement Scheme June 2012



Creating road networks that serve communities, improve traffic flow, raise safety levels and keep industry moving

The delivery of these three Major Improvement Schemes demonstrates the professionalism, dedication and ingenuity of all of our people. They should be justifiably proud of their achievements

Tim Jones, Chief Executive -Connect Plus

Contents . . .

Increasing capacity of the M25	4
Hatfield Tunnel refurbishment	6
The major widening works	8
Traffic management 1	0
Gantry installations 1	1
A culture of innovation 1	2
Materials and waste management 1	4
Caring for the local environment 1	6
Serving the community 1	8
Operations and maintenance 2	22

Increasing capacity of the M25



In May 2009, the Highways Agency awarded Connect Plus a 30-year DBFO contract to manage the M25 and its key arterial link roads. The contract included the widening of the M25 to four lanes between Junctions 16 and 23 and between Junctions 27 and 30, and the refurbishment of the Hatfield Tunnel on the A1(M). The contract also includes the operation and maintenance of the M25 and associated stretches of motorway and trunk roads and the Dartford Crossing for a 30 year period.

The widening work has been undertaken on behalf of Connect Plus by the Skanska Balfour Beatty Joint Venture (SBBJV) within the first three years of the DBFO contract. Skanska Balfour Beatty has been supported by designer Atkins, alongside the Hyder Halcrow Joint Venture who have acted as the client's representative.

The M25 is one of the busiest motorways in Europe, carrying more than 200,000 vehicles per day on some sections. The widening improvements between junctions 16 and 23 and junctions 27 and 30, will improve journey time reliability, reduce congestion, improve motorway safety and improve driver information.

Whilst some disruption during the construction has been unavoidable, our construction teams have worked hard to minimise the impact of our work on local communities, keeping delays to a minimum and protecting the environment, whilst prioritising the safety of our workforce and the public.

To date, all project milestones have been achieved on or ahead of schedule, in one instance almost six months early. The work has been phased to keep as many lanes open as possible through the use of contraflows and average 50mph speed limits for the safety of the travelling public and our workforce.



Health & Safety

An ethos of Zero Harm has united the project delivery partners behind the aspiration of achieving a completely injury free environment and a shared vision of what constitutes good safety practice. These principles have been used to meet the Highways Agency's 'Aiming for Zero' health and safety strategy.

The 24-month refurbishment of the Hatfield Tunnel was completed with no RIDDOR accidents, lost time injuries or dangerous occurrence, totalling almost 1 million man hours. The project team's vigilance and devotion to safe working has been commended with a Gold RoSPA Award in 2011 and shortlisting in the NCE International Tunnelling Award for industry leading achievements in safety. This zero accident return is a measure of how successful the initiative has been and how much it has been absorbed into on-site safety culture.

Key project achievements

- 38 miles of road has been widened over 35 months
- 125 gantries have been installed, including 44 super-span gantries
- A total volume of 2,168,092 m³ material has been excavated and recycled
- 58 miles of sheet piling has been used to retain the embankment
- 124 miles of drainage has been installed
- 360,000 m³ of concrete has been poured
- 500,000 tonnes of recycled road planings have been used
- A total of 11,872,000 man hours have been worked
- Two 0.75 mile bores at Hatfield Tunnel have been refurbished to EU standards
- 170 miles worth of cabling installed in the Hatfield Tunnel
- 56 jet fans installed in the Hatfield Tunnel



Hatfield Tunnel refurbishment



Scope of works

Located between junctions three and four on the A1(M), the refurbishment of the Hatfield Tunnel was the first of the three major improvement projects to be completed. Originally constructed in 1985, the mechanical and electrical systems within the 0.75 mile tunnel had reached the end of their design life, and refurbishment was necessary to:

- Improve safety
- Minimise future maintenance costs
- Upgrade the structure to comply with new European standards

New monitoring equipment has also been installed and linked to the new control systems in the Highways Agency's Regional Control Centre.

The work was completed on time in May 2011, and on budget. Major works on the tunnel have included:

- Upgrading and fully refurbishing the tunnel equipment in line with latest standards and legislation
- Full strip out and concrete repair
- Re-equipping the tunnel with new mechanical and electrical systems
- Additional operational safety measures and introduction of passive fire protection
- CCTV cameras to help traffic officers spot and clear up incidents in the tunnel more quickly were also installed.

Key challenges

The work required the closure of each bore of the tunnel for a 40-week period, during which time a contraflow system and a reduced speed limit operated in the open bore. As the safety of road workers was paramount an open safety culture was nurtured, empowering workers to share safety ideas and concerns. The reporting of 'near misses' was encouraged and regularly fed back into action reports, with working practices improved in response to suggestions.



Through training, inductions, question and answer sessions the project team adopted an inclusive attitude to safety, with the Project Director sharing the importance of safety on site with every new worker at each safety induction.

The major widening works

Scope of works

Junction 16-23

This section of works covers 22 miles of the northwest quadrant of the M25 between the M40 and the A1(M). In addition to the carriageway widening works, the project has involved widening to both sides of Berry Lane Viaduct, and replacing the existing Park Avenue Footbridge just south of Junction 18 at Chorleywood.

Junction 27-30

The northeast quadrant of the M25 has involved widening 17 miles of the motorway between the M11 and Thurrock. The last section of works required close interface with the Dartford Crossing to avoid elongated periods of delay for the travelling public; an enhanced vehicle recovery regime was implemented during this phase of the works.

Collectively the widening work has included:

- Widening the carriageway to four lanes in both directions, with hard shoulder
- Upgrading the central reservation
- Demolishing and reinstalling a footbridge
- Widening Berry Lane Viaduct, Chorleywood
- Providing new verge-side lighting
- Installing new and replacement noise fences where necessary
- Providing new gantries and variable message signs
- Improving drainage, including new balancing ponds
- Providing environmental enhancement measures
- Temporary traffic management measures



Key challenges

Three lanes have been kept open in each direction during peak times, with essential lane closures implemented at times of reduced traffic flow. Advance notice is routinely given for all lane and slip road closures, in agreement with local motorway police.

The fast paced programme required both day and night working; at peak the team was working 24 hours a day/7 days a week.

The widening construction works naturally required a stringent safety strategy due to the close proximately of road workers, plant and site vehicles to the live network and within the limited space of the hardshoulder. These risks were carefully managed through risk assessments and effective controls.

At its peak the project had over 2,000 staff on site every month. To successfully embed a sustainable safety culture amongst a workforce of high volume and turnover, team members received regular safety training throughout the project duration, in addition to inductions and toolbox talks. Back to work inductions and Project Director's communications supplemented these activities, helping to maintain a safe-working ethos across the project team and supply chain. Challenges associated with widening Berry Lane Viaduct

- A valley full of falsework
- RMD equipment coming in from Dubai
- 55,000 components
- Tandem 150 tonne cranes
- Achieved the installation of 3 beams in 45 minutes across the Metropolitan Line
- Started October 2008 completed April 2010





Traffic management

Gantry installations



126 gantries have been installed throughout the widening works, the majority of which have been superspan gantries which straddle the entire breadth of the motorway. This provides a cost effective solution as no piling or reinforcement works are required on the central reservation. In areas such as junction 21 the UK's longest super-span gantry was installed, measuring 69m over 10 lanes.

Each gantry installation is managed with precision and completed within an average of 15 minutes, avoiding unnecessary disruption to the travelling public. Gantries are fabricated off site, transported and rigged within the works space prior to installation. Rolling road blocks are then used to keep traffic stationary for approximately 15 minutes whilst a crane lifts the structure into its final resting place.

To help minimise unnecessary delay for the travelling public, a free vehicle recovery service was provided within the road works. Cameras were installed to enable the CCTV team to identify incidents promptly and notify vehicle recovery teams to assist stranded motorists. The average response time was nine minutes and 96% of all interventions were completed within 15 minutes.

In spite of the severity of some incidents, the average overall clean-up time was approximately 20 minutes. Motorists were delivered to safe and secure customer care areas at our project compounds from which they could make arrangements for continuing their journeys. General traffic management requirements included:

- The need to maintain three lanes in contraflow
- Overnight and/or slip road closures as necessary
- Temporary 50 mph running with average speed enforcement
- Regular liaison with local Police and highways maintenance stakeholders
- 24/7 free recovery available from the carriageway
- Customer Care Unit where motorists could wait in safety for their own recovery service. The Unit included kitchen area, vending machines, playhouse and toys for children, payphone, TV and toilets with baby changing facilities



Did you know?

- The M25 DBFO Major Improvement Scheme gantries used 350 miles of cabling
- The average weight of a super-span gantry is 40 tonnes and measures approximately 50 metres

A culture of innovation



Slipforming

Innovative slipform concrete processes were developed during the M25 DBFO Major Improvement Scheme. Ducting was incorporated into the central reserve concrete safety barrier during installation. This carried miles of cables required to connect the lighting columns which light the motorway.

A much higher slipformed concrete retaining wall was adopted as a preferred widening solution in the verges, with communications installed behind the wall. Walls up to 2.3m were constructed by this process which is believed to be the highest slipformed in Europe. The slipforming process was faster than other widening options available and the resulting narrower verge reduced excavation volumes and overall CO_2 emissions.

This technique has also been used for:

- Slot drains
- Surface water channels
- Pavement widening

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Building Information Modelling: Laser scanning

Laser scanning techniques have been used to improve worker safety, as well as deliver cost, programme and CO_2 emission savings on the M25 DBFO Major Improvement Scheme.

Survey data from laser scans were utilised to redesign the carriageway over Ockendon Railway Bridge, located between junctions 29 and 30. This enabled the railway network to remain operational whilst the work was carried out.

In the first instance, laser scan data was used by the engineering team to investigate the design and sequencing of widening works across the bridge. This saved repeat journeys to the site and associated traffic management requirements for lane closures and railway possessions.

As the scan was completed from a place of safety away from the live carriageway and railway boundary, 18 weeks from the programme were gained as the need to book a three night railway possession was negated.

In the second instance, the same laser scanning data was used to identify a temporary works clash with the existing structure. A true as constructed model was generated of the existing structure and compared to the second drawings which allowed early identification of discrepancies and allowed the design to be adapted prior to construction avoiding delay, duplication of work, re-ordering of materials and loss of man hours.

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Materials and waste management

A bespoke Materials and Waste Strategy was designed to maximise the use of recycled, secondary and manufactured aggregates in preference to primary aggregates. This approach has diverted significant quantities of material from landfill, reducing traffic impacts on the local network.

In total 2.3 million tonnes have been used, including 1.2 million tonnes of material processed on site from inert construction and demolition waste, imported from other projects in the South East. This represents 92% recycled content for bulk materials and a saving 35,000 tonnes of embodied carbon. Where use of primary aggregate was unavoidable, responsible procurement was under taken in line with BES 6001.

This is supplemented with an Earthworks Strategy to retain 100% of inert material on site. Over 1.8 million tonnes of surplus inert soil was diverted from landfill and reused to create 8 environmental bunds at locations where environmental benefits could be provided.

The environmental bunds provide visual and noise screening to nearby residential areas with up to 5dB reduction in traffic noise. The bunds were designed to enable the slope facing away from the motorway to be returned to agriculture.

King Sheet Piling

A 33% reduction in steel and the elimination of 45,000 tonnes of embodied carbon has been delivered using an innovative King Sheet Pile (KSP) system.

The patent pending KSP innovation was created in response to the need for a cost effective solution for the construction of hard retaining walls on the scheme, driven by programme requirements to widen a mile a month.

In recognition that many sheet pile walls are sized for driveability and therefore use heavier sections than structurally required, KSP eliminates the structural excess by replacing alternative pairs of full length Z piles with lighter, thinner and shorter piling sections spanning horizontally between the remaining full length sheet piles.

The 15 miles of KSP wall installed on the M25 has saved up to 33% of steel used in traditional walls. A four-fold increase in productivity was achieved in the chalky earth between junctions 16 to 23 of the M25 and the overall linear installation speed doubled.

The sheet piles were sourced from 100% scrap steel using a highly efficient electric arc furnace, reducing the embodied carbon by 75%. Safety benefits included a reduction in working from height.

Materials fact file

- 2,200,000 tonnes of high quality aggregates were produced on site, achieving 98% recycled content
- 250,000 tonnes of glass sand was used for drainage and backfill, saving virgin aggregates
- 100% of timber was procured under responsible sourcing schemes from sustainable forests
- More than 3,000,000 tonnes of excavated fill was used to landscape bunds, saving disposal to landfill
- 320,000 tonnes of asphalt, equating to 15,000 tonnes of embodied carbon, has been saved by using value engineering during pavement design







Caring for the local environment



The M25 DBFO Major Improvement Scheme has been committed to working in the most environmentally responsible manner possible. Before starting work, the project team has carried out a full environmental impact assessment including ecological and archaeological surveys. Our comprehensive environmental management plan took into account:

- Ecological works to protect plants and wildlife
- Consultation with regulatory and advisory bodies
- Moving species and habitats that might be adversely impacted
- Assessment of ecological information to inform the detailed design of the work

The following measures have helped to minimise disruption caused by construction work:

- Use of modern plant and machinery, that complies with permissible noise levels
- Use of the quietest possible plant and construction methods
- Controlling dust by covering vehicles carrying dry, dusty materials and mechanically sweeping hard surfaces and exits onto public roads
- Use of low noise surfacing
- Noise and visual protection through the provision of earth mounding, bunds, environmental screen fencing and screen planting.

Local environmental enhancements

- 125,670 trees planted
- 28,079 shrubs planted
- 31,747 marginal plants planted at ponds
- 24 balancing ponds
- 474,682m² highways grassland planted
- 406,164m² species rich grassland planted
- 400 bird boxes
- 76 bat boxes
- 2 otter holts
- 175 log piles (refuges for reptiles/amphibians) have been installed
- 40 hibernacula installed (for hibernating reptiles/ amphibians)
- Over 2,800 animals moved to a new habitat including: Great Crested Newts, Adders, Grass Snakes, Slow Worms and Common Lizards
- 209 water voles released into their new habitat alongside the River Colne



Serving the community

Industry Awards

- RoSPA Gold Award for Occupational Health & Safety 2011
- Institute of Civil Engineers Merit Award 2010
- Brownfield Briefing
- Construction News, Environmental Project of the Year (short listed)
- National Recycling Awards
- Green Apple Bronze
 Award 2011
- Considerate Constructors
 Scheme 5 Silver & 1
 Bronze Award to date
- Recycling Stars Gold Award
- CEEQUAL, 87% "Excellent"

Collectively, 215,000 vehicles per day pass through each of the M25 DBFO Major Improvement Schemes. Apart from the temporary traffic management measures, the project team kept the Highways Agency informed, in order to update the Highways Agency website and press notification process.

Involvement of and communication with local communities during planning and construction phases has been of great importance across the scheme. Dedicated site-based community relations teams have been responsible for proactive communication with residents and stakeholders via letters, emails and phone calls, visits, public exhibitions, local charity events, educational engagement with local schools and the training of local people to leave a legacy of skills in the community.

As members of the Considerate Constructors Scheme (CCS), the project team has worked hard to be a good neighbour and to minimise the impact of construction works on the travelling public and local communities. This effort has been recognised through the award of five Silver and one Bronze Considerate Constructors Awards to date.





Working in Partnership



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Serving the community

The community relations teams have answered more than 5,000 individual approaches from members of the public, and have received more than 500 expressions of thanks, from the rescued drivers at Customer Care units, from residents and from motorists:

Excellent vehicle recovery from the M25. Thank you for providing comfortable and clean amenities whilst waiting to be collected . . . Community relations activities across the Improvement Schemes have included:

- working with school and university students
- more than 2000 students have had site visits, presentations on the projects and on the dangers of construction sites, worked on their own projects with young engineers, taken part in competitions
- involvement with local interest groups by contributing materials, equipment and/or expertise to:
 - wildlife conservation
 - animal welfare
 - museums
- village amenity areas
- ambulance service rescue training
- Duke of Edinburgh Award Scheme activities
- Build a School overseas aid project
- and by raising more than £33,000 for charities including
 - The Peace Hospice
 - Little Havens Hospice
 - Willow Foundation
- Macmillan Nurses
- Women's Aid
- Royal British Legion Poppy Appeal
- The Base Youth Project
- Air Ambulance Service





I would just like to say as a regular user of the M25 Section between the M40 and the M1 I cannot praise your company enough. If it is early in the morning or at night your team is always working, somehow you have managed to keep all 3 lanes open at peak times; overnight gantries appear as if by magic, it has made no difference at all to my journey time. One has to concentrate on ones speed not just looking at the exhaust pipe of the car in front . . . A happy and impressed motorist.

Well done to all. A job well done – both the widening and the communications.

Operations and maintenance



In addition to undertaking major improvement and lifecycle works, Connect Plus is responsible for the operation and routine maintenance of the M25 and key spur roads.

From control centres at South Mimms and the Dartford Crossing, and our network of seven depots, our 700 employees interface closely with the Highways Agency, managing a network of 273 miles, including five tunnels and the QEII bridge.

Around-the-clock monitoring captures all aspects of the network's performance, and the recent implementation of our Travel Time Monitoring System is helping us to improve it further by giving us the information we need to identify improvement initiatives and proactively anticipate and deploy our resources to help tackle congestion and ease traffic flow.

GPS technology is used to track the position of our 16 incident support vehicles (ISUs) and winter maintenance fleet. This enables a more dynamic approach to incident and winter service management.

Live Emergency Exercise

A full scale, live emergency exercise successfully tested new fire and safety systems in the refurbished A1(M) Hatfield Tunnel on Saturday 1 October 2011. The exercise simulated a multiple vehicle collision and car fire in the tunnel, allowing the Highways Traffic Officer and Emergency Services to practise their response to a major incident.

The exercise included a complicated scenario, with artificial smoke to reduce visibility, a vehicle carrying LPG, and risk of leakage of an environmental pollutant all testing the response by the services involved. Volunteer actors played the role of casualties who suffered a variety of injuries and trauma, and had to be safely rescued from the tunnel.



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