



STORY

High speed in London.

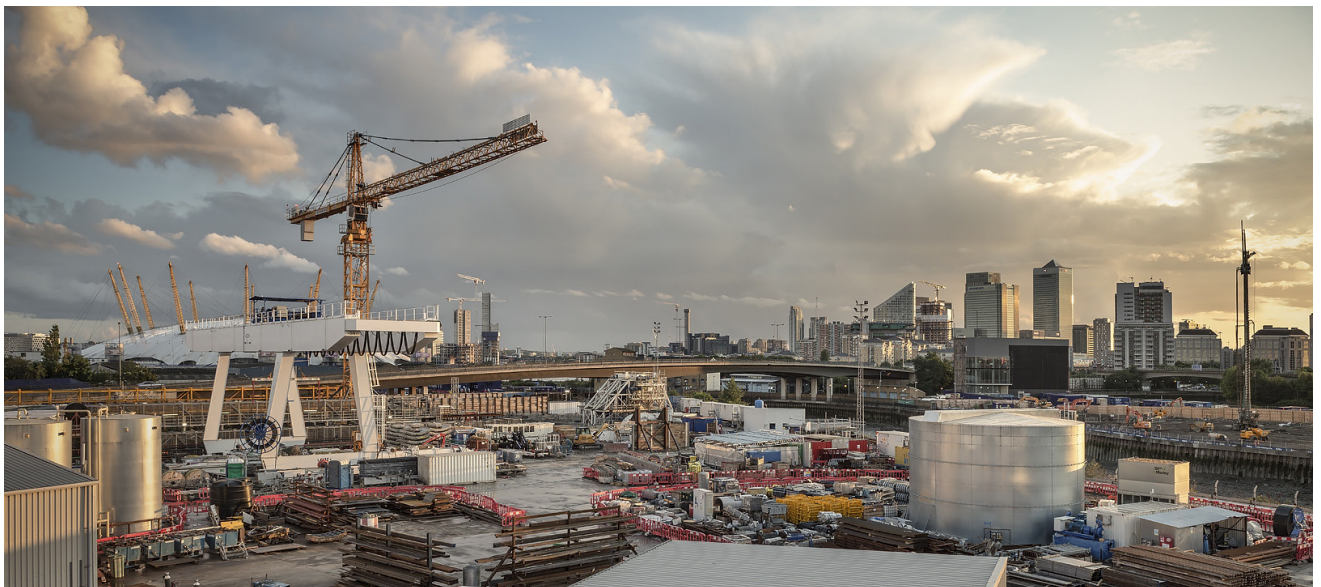
A visit to Europe's largest construction site.

Author: Bernd Hauser
Photography: Günther Bayerl

In London eight Herrenknecht tunnel boring machines are creating a continuous rail link through the megacity. To maintain the safety, quality and performance demanded by the client Crossrail Ltd, each day the construction companies rely on Herrenknecht's service and support. Around the clock, specialists from the company provide assistance to the engineers and workers on the construction sites with advice and practical support. A visit to Limmo Peninsula, the main point of attack for Contract C 305 – one of the most important sections of the tunnelling work.

View across Limmo Peninsula. The worksite is the main point of attack for Contract C 305 – an important section of the tunnelling work under London.

Roger Escoda smiles only rarely, and small talk is not his thing. The Catalan is concentration and seriousness personified. Get to the point, says his look. Time is short. "We are under great pressure," Escoda emphasizes. "We are building railway tunnels through the heart of a metropolis! All London is watching us. We can't afford delays or mistakes."





Roger Escoda, 39, is tunnel manager at Crossrail Joint Venture DSJV and responsible for construction of the tunnels in Contract C 305.

Europe's largest construction project

_____ Escoda, 39, a slim man with graying temples, is Tunnel Manager at DSJV, a joint venture between Spanish company Dragados and John Sisk & Son from Ireland. With 25 engineers and 250 workers he is building the twin-bore tunnels of Contract C 305 of Crossrail – the largest construction project in Europe. An east-west railway alignment is being struck right through the center of the metropolitan region with its 8 million inhabitants: a new main artery for the congested traffic in the mega city.

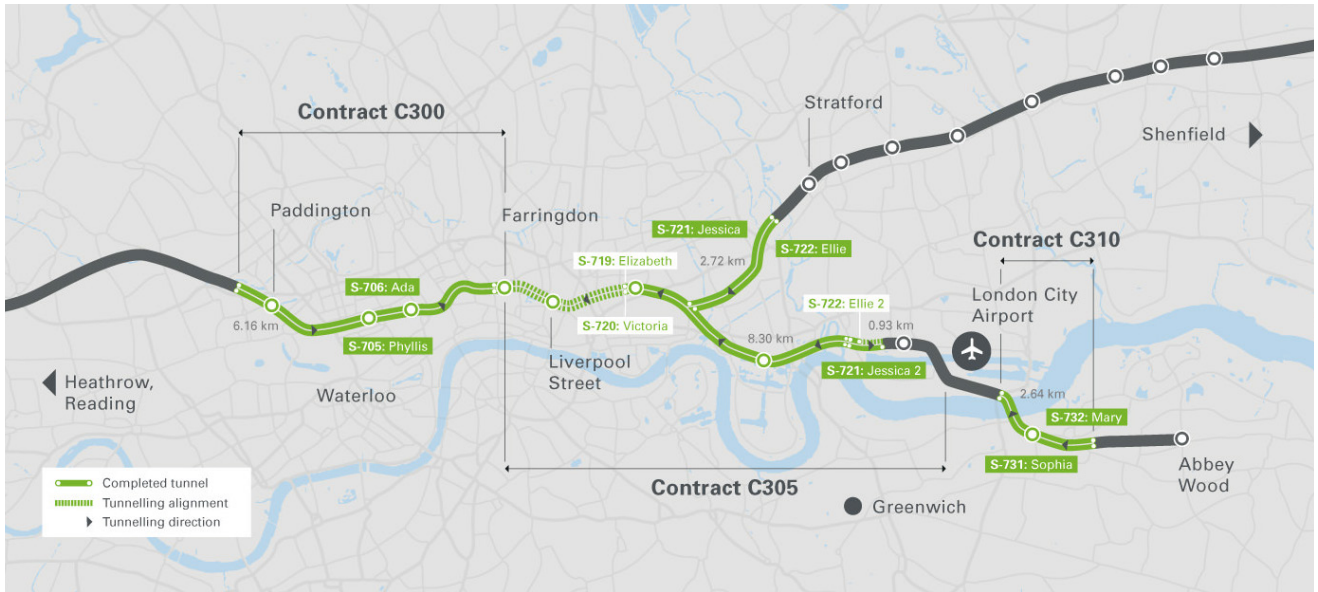
The 14.8 billion pound project is a veritable tunnel marathon: the three contracted joint ventures are building 42 kilometers in their three sections. All of them are relying on tunnel boring machines (TBMs) from Herrenknecht. A total of eight machines are being used, six Earth Pressure Balance Shields and two Mixshields. With millimeter tolerance they are boring through the bowels of the city, a maze of sewers, gas pipelines, building foundations, subway lines and shafts. Sometimes they almost touch the existing infrastructure – in some places the distance to the Crossrail tunnels is less than half a meter.

“We have four goals: safety, environmental protection, quality and performance – in that order.”

Roger Escoda, DSJV Tunnel Manager

Safety first

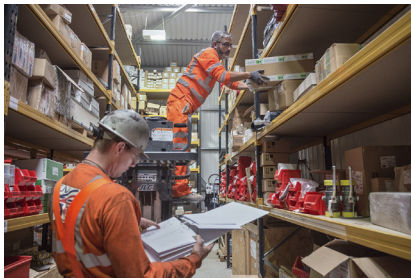
_____ The schedule is tight, but it's not just about the fastest possible advance. “We have four goals: safety, environmental protection, quality and performance – in that order,” says Tunnel Manager Escoda. Great Britain is a world leader in occupational safety: “This is a good thing - every man should return healthy to his family after every shift.” Environmental protection is also extremely important: “We are working with oils and other hazardous materials that must not get into the groundwater or the Thames.” But because the safety and environmental regulations are strict and time-consuming, Escoda must rely all the more on the machines and service from Herrenknecht to complete the tunnels in his section between Farringdon in the west and Victoria Dock in the east on time.



A total of eight machines from Herrenknecht are in use for the whole Crossrail project, on three lots with a total distance of 42 km.

Record achievements through optimal cooperation

The TBMs work around the clock, seven days a week. Herrenknecht guarantees they are operational 90 percent of the time. In fact, levels of 95 percent and more are achieved. This is possible because Herrenknecht specialists are at the side of the construction companies' employees with their experience. They check components and replace worn parts with new ones, which are kept in stores at the worksites. They train the operators, accompany them on the machines around the clock, give advice during the drive. Such as, how changing small parameters in the control system can make the drive even more efficient and safer. And so records like these are made possible: in mid-April S-722, named "Ellie", managed a distance of 72 meters in 24 hours.



Top: Container stores on site guarantee the rapid replacement of wear parts.

Bottom: Check during assembly at Limmo Peninsula

“Herrenknecht doesn't just sell a machine and then only leave a phone number.”

Roger Escoda, DSJV Tunnel Manager



Sebastian Kohlmeier, Herrenknecht Service Project Manager in London for Section C 305.

Closeness to the customer as a USP

“Herrenknecht always try to satisfy us with their service,” says Roger Escoda in his office at Limmo Peninsula in East London. “The company doesn’t just sell a machine and then only leave a phone number. The Herrenknecht people are actually always on site: I have a contact any time I need one.”

On this day in mid-August too: Escoda hurries out of the large office where a good dozen of his planners pore over drawings and spreadsheets. He takes a few steps across the corridor to the austere equipped Herrenknecht site office. In the meeting room he consults with Sebastian Kohlmeier, 30, a mechanical engineer and Herrenknecht Service Project Manager for Section C 305.

Kohlmeier was still a graduate student at the University of Dresden when he came to Herrenknecht: in his master’s thesis in the area of research and development he dealt with the question of how the gripper unit of hard rock TBMs could be further improved. “We are very close to the customer. That is our USP,” says Kohlmeier. “We don’t know nine to five. Our philosophy is: the machines have to run. We only call it a day when everything is running smoothly.”



Top: **Recovery of TBM “Ellie”** in the shaft at Stepney Green.

Bottom: Mechanics from Herrenknecht and DSJV work **hand in hand** to disassemble the TBM.

Time savings thanks to logistics know-how

Roger Escoda and Sebastian Kohlmeier discuss the details of an agreed plan change: at Stepney Green, where the alignment forks, “Ellie” has successfully broken through into the access shaft. Now she is being recovered there and the individual parts brought to Limmo Peninsula on heavy trucks. Here “Ellie” – like her sister “Jessica” (S-721) before her already – is to do the last part of her job in London and push 900 meters towards the east.

At Limmo Peninsula a main and an auxiliary shaft were sunk for the construction work; the original plan was that “Ellie” would be assembled in the auxiliary shaft while the back-up would be lowered through the main shaft. But because “Jessica” was able to finish her job at Limmo Peninsula faster than planned, there is now enough space to lower and assemble all of “Ellie” through the auxiliary shaft. While this is going on the main shaft can already be used for the logistics of the lining work. “Altogether this change saves us a week”, says Escoda. “But we were only able to organize it with the input of the experts from Herrenknecht: they know the details of the machine, they were able to tell us whether and how our plan is technically feasible.”

Forward planning allows customized solutions

On this August day Escoda and Kohlmeier also discuss the dismantling of the machines S-719 (“Elizabeth”) and S-720 (“Victoria”), which are currently still on their way westwards - although this disassembly is not for another nine months. “Forward planning is everything in our service. When the machines are working, I am already planning many months ahead for the disassembly and the transfers to other sections,” says Sebastian Kohlmeier after the meeting. “At the bifurcation point Stepney Green, for example, the shaft is so narrow that the back-up must be lifted out at an angle – that takes advance planning and coordination because our engineers in Schwanau need to design stiffeners, and they have to be welded on to the equipment on site.”



Only thanks to special stiffeners can the TBM parts be safely recovered raised at an angle during recovery from the narrow shaft at Stepney Green.

“With such a sensitive project the most comprehensive construction supervision possible is crucial.”

Frank Jenkins, Crossrail Construction Manager



Top: Construction Manager **Frank Jenkins** monitors the work on Contract C 305 for Crossrail.

Bottom: From 2018 approximately **200 million passengers a year** will use the new Crossrail routes.

The underground system in London, here Liverpool Street Station, is to be further developed and improved by **more large-scale projects** in the future.

Monitoring and analysis for safety

_____ A floor above Herrenknecht and DSJV, Frank Jenkins, 47, Crossrail Construction Manager, works in the site office. With his team of engineers, geologists and inspectors he monitors the work on section C 305 for the client: “Of course this is a sensitive project. There are many players who have valid concerns.” Such as building owners who are afraid that their property could be exposed to subsidence damage. Or energy suppliers with their gas pipelines underground. “Therefore the most comprehensive construction supervision possible is crucial,” explains Jenkins. Each day there is a meeting with DSJV in which all the machine and ‘as-built’ parameters of every tunnel ring installed are analyzed with the help of numerous data and graphics.

And like Escoda and Kohlmeier, Jenkins also emphasizes the importance of early and collaborative planning: “We’re talking about a large contract. Money that comes from taxpayers. We have to be efficient.” For example, initially Crossrail wanted to buy six TBMs for the section C 305: “But then we saw that with the support and expertise of Herrenknecht, within just three months we could disassemble machines at Stepney Green and reassemble them at Limmo Peninsula – and thus save the purchase of two machines.”

Benefits for other projects too

_____ Jenkins sees a great future for tunnel builders in England: “Many large projects are due to start in the coming years, for example for the High Speed Rail or improvements to the subway system in London.” These future projects would benefit from the experience gained at Crossrail. “In any event, with their performance here DSJV and Herrenknecht certainly recommend themselves for future projects,” says Frank Jenkins.



“The most important thing is: alone you are nothing in this job.”

Dedlef Smeets, Technician at Herrenknecht



Service technician **Dedlef Smeets** has worked for Herrenknecht on construction sites around the world for 16 years already.

Millimeter precision with a 72 tonne colossus

Back in his office, Sebastian Kohlmeier is meanwhile lacing up his safety shoes. Because while the last back-up for “Ellie” is being recovered at the Stepney Green shaft, her cutting wheel is already hanging from the crane hook at Limmo Peninsula. It has a diameter of seven meters. Carefully the crane operator lowers the cutting wheel into the depths. With millimeter accuracy the 72 tonne colossus must be precisely placed via radio so it can be bolted onto the main drive with 112 double-ended studs.

“Two centimeters up!” shouts Herrenknecht technician Dedlef Smeets from inside the front shield. “Very, very slowly, please!” The cutting wheel is not precisely perpendicular in the air because the rotary coupling makes it tilt slightly downward. Claude Metz from the Alsace and Spaniard Jorge Zapico, both responsible for the electrical service of the machine, help as a matter of course. They attach chain hoists to the cutting wheel. Gasping like bodybuilders lifting weights, they pull the lower half of the wheel toward the main drive. Engineer Kohlmeier also steps in and helps with the fine adjustment.

Finally the holes of the cutting wheel and the main drive for the 700 millimeter long threaded spindles fit exactly over each other and they can be inserted. Now the DSJV workers can handle it on their own: they put washers with the diameter of a saucer in place and tighten the spindles with fist-sized nuts. Claude Metz quickly says goodbye and rushes to the elevator to catch his flight. After ten days with twelve-hour shifts he is going home on leave for four days, at home in Alsace his two sons await him.



The cutting wheel is lifted by crane 45 m into the depths and then **adjusted with millimeter precision** by hand.

The greatest challenges have already been overcome

“We only supervise the assembly, but with our years of experience we know the basic tricks, and that makes us so valuable,” says Sebastian Kohlmeier: “Naturally when it comes down to it, if necessary we give a hand too.” Dedlef Smeets, 40, wipes the sweat from his forehead. “Was it a good day?” “Yes. But I am not quite satisfied,” he says with his Dutch accent. “It would have been better if we had been able to push the shield forward already and bring down the first back-up.”

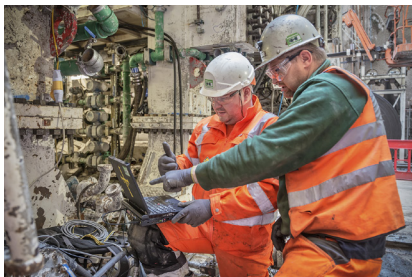
And yet they are still well on schedule. The men still have almost a month before “Ellie” must be ready to start her last stage. The greatest challenges were thus already behind them, says Sebastian Kohlmeier. For example, the construction of a monorail in the western section of the tunnel, which was developed by engineers in Schwanau specifically for Crossrail: “The access shaft was very narrow, only with the help of this crane runway was it possible to dismantle the machines S-705 and S-706 safely and quickly.”



When working with the extremely heavy individual segments in the narrow launch and target shafts, **teamwork and precise coordination** are absolute prerequisites.

“Basically this only works because everyone sees each other as partners.”

Roger Escoda, DSJV Tunnel Manager



Service as the foundation of project success: collection and analysis of all data from the drive for joint **identification of improvement potential**.

Exact plans as a basis for safe and fast implementation on site

_____ Kohlmeier is especially proud of how the future Crossrail station at Canary Wharf was driven through. Tracks were laid, consoles welded to the machine’s shield and moving skates placed underneath. For the back-up, engineers in Schwanaue designed special shunting units. In this way it was possible to shunt the entire 150 meter long TBM on tracks through the 250 meter long station – without time-consuming and costly disassembly and reassembly work. An additional challenge for the structural engineers: the right rail had to run on an approximately 50 centimeter high pedestal. “The movement only took seven days, coordination between client and designers, on the other hand, took up a lot more time,” says Kohlmeier.

Despite their pride in their own achievements, all the players know they depend on each other. “What we are creating here will remain in existence for decades and centuries,” says Tunnel Manager Roger Escoda seriously. “But it would be unfair to emphasize my own role. Basically this only works because everyone sees each other as partners: we are working towards a common goal.”



When time pressure is business as usual: despite the most careful planning, on site, fast and sometimes unconventional solutions are called for.

Real construction site experts up close



Shaun King, Site Foreman for construction company DSJV at the Stepney Green shaft

"I am responsible for ensuring that this site works. On the day shift 40 men work here, on the night shift around 30, seven days a week. Our main problem on the site is the lack of space: the access shaft for the tunnelling work takes away so much space, we hardly have any room for the cranes and the material. People think when the tunnel boring machine has broken through, the job is done. But it's not like that at all. Right now we are recovering the TBM S-722. The shaft is very narrow: we have to lift out the individual components at an angle, it's the only way they fit through. Herrenknecht has developed detailed lifting plans for us. Project engineer Sebastian Kohlmeier does all that for us. He knows the shaft size and the exact dimensions of all machine parts. Naturally we check his plans, but they are perfect: everything we've done so far has worked. Today we are bringing up the tenth back-up, the last one. We could have been a week and a half faster if there was more space here on the surface."



Claude Metz, 42, electrician at Herrenknecht

"I speak five languages. German, French, Spanish, English – and my native language Alsatian. I have learned my foreign languages mainly on construction sites. In Spain alone I have spent seven years working on railway tunnels in the Pyrenees and on the subway in Barcelona. Since the beginning of 2012 I have been in London. I helped assemble the machines and the belt systems for S-705 and S-706. Then I assembled and commissioned S-719 and S-720 and supported them during the drive. Recently I disassembled S-721 in Stepney Green, reassembled it in the Limmo Peninsula shaft and also supported it during the drive. The customers do have their own electricians. But we've gathered our own experience from numerous projects. I consider what we can do to be something special. I'm proud of it."



**Samuel Ogunnaike, 29,
Project Engineer at Herrenknecht**

“I’m a Londoner. We’re keeping London moving! My son Jeremy is two and a half, my daughter Mirabelle is six months old. I can tell them and someday my grandchildren that I was part of this. We are making history here.”

**James Fazzini, 40,
Supervisor at Herrenknecht**

“When we are not disassembling or assembling a machine I support the drive. Then I am on the machine for twelve hours. I am responsible for the maintenance of pumps, filters and all other components. But I also advise the construction company’s operators on how to change small parameters such as air pressure, water or foam level, if the ground is wet, sandy or chalky, to perfect the drive.”

HERRENKNECHT AG
D-77963 Schwanau
Phone +49 7824 302-0
Fax +49 7824 3403
pr@herrenknecht.com
www.herrenknecht.com

