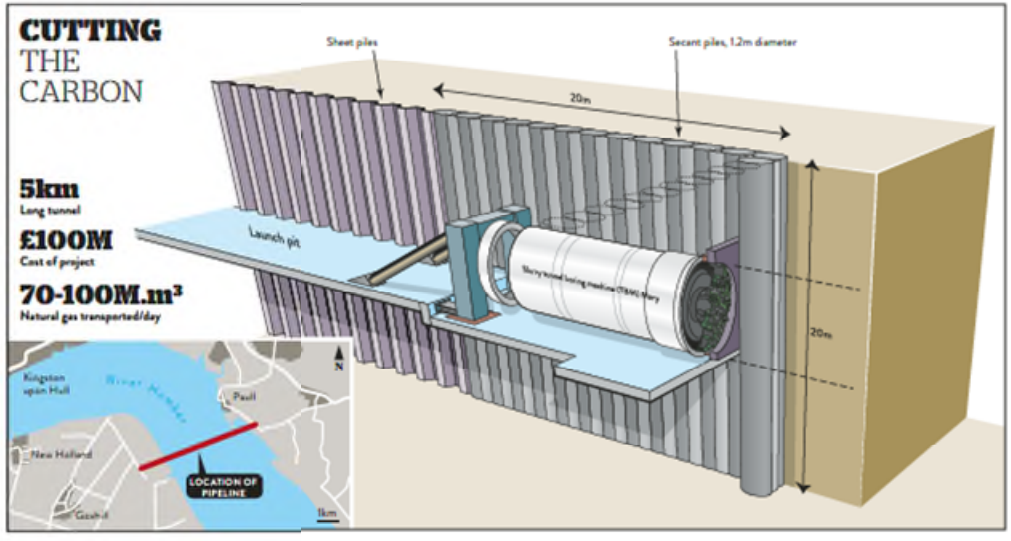
CUTTING OUT THE CARBON

A gas pipeline under the River Humber has become a model for carbon-saving methods in the construction industry. **Catherine Kennedy** reports.



> Going on to future projects we'll have the baseline from this project of how the digital integration of carbon works

Between Goxhill and Paull on the River Humber, a slurry tunnel boring machine (TBM) known as *Mary* has dug a 5km-long tunnel.

This spring, the tunnel will be flooded with water and two hydraulic thrust machines will push in the first of eight sections of gas pipeline. Each section is around 610m long and weighs 850t.

The pipeline will be able to transport between 70M.m³ and 100M.m³ of natural gas per day, and is poised to supply 20% of the UK's peak winter demand. It will replace an existing gas main which has become exposed due to the changing Humber riverbed profile.

When the £100M project is completed later this year, the tunnel will house the longest hydraulically inserted pipe in the world.

Skanska UK in joint venture with Porr and A Hak, is constructing the pipeline on behalf of client National Grid and is pushing boundaries in other ways too.

KEY FACTS

50%
Skanska UK's 2030 carbon reduction target

Major carbon saving steps have been taken, with Skanska UK using the project as a carbon reduction case study so that it can gain PAS2080 certification. This shows clients that a company follows best carbon reduction practice. Skanska UK is the first UK contractor to have secured this British Standards Institution (BSI) accreditation.

But gaining this type of accreditation is only part of the story.

"Reduction targets aren't enough," says Skanska UK environment technical director David Mason. "You've got to be looking at net zero, you've got to be looking at the step beyond."

> You've got to be looking at net zero, you've got to be looking at the step beyond

As such, the company has set a target of being net zero across its whole business by 2045, with an interim target of a 50% reduction by 2030. In a departure from the usual principle of reporting only direct emissions, the target also includes all supply chain emissions, as these make the carbon impact of a construction project an estimated 10 times greater.

"If we were to report exactly what we're responsible for, we're not reporting very much carbon," says Mason.

"So, it doesn't matter what subcontractor is working – if we're putting them to work, we're reporting the carbon. We're trying to show now what it takes to do construction. We want to push the message across that it takes a more sophisticated approach to reporting."

Applying the carbon reduction agenda to the Humber tunnel project requires an understanding of the surrounding environment. The site is remote and includes a highly-protected aquifer.

"We're not building in a vacuum," explains Skanska UK environment and carbon manager Ruth Finlayson. "We're building in the real world. So, we are making sure that we're protecting carbon, the carbon emissions, but also the environment that we're working in."

5D+ BIM MODEL

The drive to reduce carbon has been facilitated by 5D+ building information modelling (BIM). The model operates like the traditional 3D model, but also includes time (4D) – animations of the construction programme can be created; cost (5D); and carbon data (5D+).

The carbon data indicates the emissions associated with an activity or material, which allows the team to choose a design that maximises carbon reductions.

The BIM model contains a master database which details the various material quantities and the cost and carbon associated with each – and the impact on emissions of changes in design or construction is instantly visible on the model.

"We were looking at different solutions of interchanging materials and you could see a live update on how it would impact cost and carbon," explains Skanska UK senior BIM manager Scott Milner. "It gave you the overall total at the bottom so you could see clearly if we switch this out for this, then that's the impact."

"This carbon/cost link is a very strong message," Mason adds. "If you're managing with carbon as a lens, then you will unlock cost savings."

SHARING KNOWLEDGE

The model has been used across the project, and its ability to create visualisations showing where carbon is being saved has proved particularly effective.

"It's easy to see – the data is right there in front of people. As soon as you make it clear and more interesting to analyse, it becomes easier to not only develop it further but to get interaction from the team," says Milner.

Finlayson emphasises the importance of "getting carbon into the narrative" across different teams. Workshops have provided opportunities to generate discussions, while carbon hot spotting has pinpointed materials with high emissions.

"Inevitably around construction you'll get steel, you'll get concrete, you'll get aggregates," says Finlayson.

"I can tell you that right here, right now, but if I can show you a picture that backs that up then you know where to focus your conversations."

She adds: "The more you get it in as a regular part of the conversation, the more it becomes business as usual. Going on to future projects we'll have the baseline from this project of how the digital integration of carbon works."

LAUNCH PITS

The BIM model was used to assess materials for the construction of the 150m long launch pit for the TBM. The model helped identify carbon hotspots, allowing designers to reduce the amount of concrete used.

"I was able to see first-hand exactly what we're going to save. It backed up from a carbon perspective and a commercial perspective that it's saving money and it's saving carbon," says Milner.

Several changes were made to reduce the use of concrete and therefore carbon.

The original launch pit retaining wall design included 40m long, 1.2m diameter secant piles. The revised design reduced the number of secant piles and replaced most of them with sheet piles as well as reducing the depth of piles drilled into the aquifer.

The revised secant piles were 20m in depth and 1.2m in diameter and

> Treating on site meant that we had useful material come out

The TBM completed the drive to Paull last year

were placed along a 20m section of the pit wall around the TBM launch area. At the same time the length of the pit increased to 210m to accommodate a change in the pipe design.

When the TBM was in position, it pushed through the secant piles at the end of the trench as it began its journey.

Carbon savings resulting from the launch pit redesign were 11%, even though it had increased in size. The saving includes embodied carbon and carbon produced from the construction process.

Work on the Humber tunnel has shown that early engagement with the supply chain is key to cutting emissions. "If you've got that setup right at the beginning, and everybody's switched on to it, then that whole process becomes even more streamlined, even more accurate," Milner explains.

Mason agrees. "What's been striking is that before people were on the ground here, what's going to happen to the material at the end was part of the consideration."

MANAGING CONSTRUCTION WASTE

There have also been increased efficiencies in dealing with waste.

Skanska UK has cut carbon emissions on the project by 142t CO_2e, using a geographical information system (GIS) to assess how and where construction waste is removed from site. Lorry movements are tracked using a GPS, linked into the GIS, which provides a live feed, allowing multiple loads to be managed more efficiently.

"Some of the landfill sites and some of the quarries are further away than others," Milner explains. "So it gives us a much more accurate track of where the lorries are going to be, what the turnaround is."

This enables the contractor to manage its fleet more efficiently and as a result, it estimates that it has reduced journeys made by construction traffic by just over 152,000km.

A slurry treatment plant was installed on site and excavated material could be reused in landscaping, so that it does not have to go into landfill.

"This maximised programme and reduced the amount of movements on these roads, which is a big input as well to the human disturbance factor," Finlayson says.

Of the 160,000t of construction waste produced, just over 147,000t was recycled.

WHOLE LIFE CARBON VERSUS CONSTRUCTION CARBON

But how do projects balance whole life carbon savings with construction carbon savings?

"There's a long way still to go for the whole industry to be truly making the right whole life decisions, so we're focusing specifically on the capital carbon – the embodied carbon – of the construction activities," says Mason. "That said, we're not doing it at the expense of life cycle. We don't want to build something very light that needs replacing in five years."

Working with clients from the early stages of projects will allow the company to push the whole life carbon agenda, ensuring clients consider a carbon baseline from the outset.

This has never been more important. "A lot of people coming into the business – particularly the younger generations – are really engaged with this message," says Mason. "So there is a good employment angle – attracting the right staff who are inquisitive and keen to make a difference."

With carbon emissions playing a key role in climate change – and the construction industry being responsible for a large proportion of UK emissions – the pressure is on to transform ways of working.

The climate crisis will not just disappear but, it seems, Skanska UK's efforts will only increase. N