Tideway

CARBON CASE STUDY

Our approach to managing and reducing our Scope 3 (embedded) carbon footprint during construction

Carbon reduction was a key legacy commitment. This case study sets out how we have manged to reduce our Scope 3 (embedded) carbon footprint to 553,625tCO2e, 28% less than the anticipated figure at contract award of ~770,000 tCO2e – refer to our Sustainability Report for a detailed breakdown of our Scope 3 (embedded) data.

It also explores lessons learnt on our approach to measuring and monitoring carbon emissions throughout the project lifecycle, from early design stage, procurement, contractor selection and construction. These lessons learnt were identified in a number of ways, including by holding a series of workshops with our MWCs, attended by their senior leadership team. The findings are captured in Table 1.

Adapting to an evolving climate landscape

We have endeavoured to adapt to an ever-evolving climate landscape in the ten years since the DCO for Tideway was produced, but it has not always been possible to keep pace with best practice. For example, the Science Based Targets Initiative (SBTi) was not launched until 2015, coming too late for Tideway to set a SBTi as we did not meet the criteria needed.

One main criterion that could not be met was: 'Targets must cover a minimum of 5 years and a maximum of 15 years from the date the target is submitted to the SBTi for an official validation'. As a science-based target cannot be set, Tideway cannot claim to be a net zero project as we don't have a net-zero target in line with a 1.5°C future.

Equally, PAS 2080: Carbon Management in Infrastructure and Built Environment, first launched in 2016 and revised in 2023 with the aim to speed up the decarbonisation of the infrastructure sector, also came too late for Tideway. PAS2080 in particular would have helped us adopt a more streamlined approach to carbon reduction and management.

The Thames Tideway Tunnel, London's 'super sewer' – taken at Carnwath Road in Fulham

Key examples of how we have managed and reduced our carbon footprint

1. Route optioneering

The opportunities to address the carbon footprint of the built environment, building or infrastructure, is within the early design stages where a whole life emissions approach can be taken. Within the early design stage we looked at design opportunities, materials specification, plant and machinery and energy in use of the asset. One early design win was when we looked at route options. 199,000tCO2e was saved through the initial route selection, because it led to 19% reduction in material due to the shorter route.

2. Materials specification

Within the Environmental Statement it was originally predicted that our concrete mixes would contain a maximum of 25% cement replacement – such as Pulverised Fuel Ash (PFA) or Ground Granulated Blast furnace Slag (GGBS), however through consultation with the designers it has been possible to achieve up to 75% PFA in the baseplugs of the shafts and between 25% and 45% GGBS in the tunnel segments whilst still meeting the performance specification. The design of the baseplugs was also amended to adopt a concave design which further reduced the amount of concrete and steel required.

The main tunnel – taken at Chambers Wharf, Bermondsey

3. Contractor engagement

Upon contract award in 2015, Tideway requested that the MWCs develop a Carbon Management Plan and Policy, setting out their corporate commitments to managing their emissions, including monitoring tCO2e from construction activities and managing the emissions across the supply chain. The MWC were contractually required to report against a suite of carbon KPIs on a quarterly basis and report on any innovative procedures they have adopted to further reduce their emissions.

Tideway did not develop a bespoke carbon accounting tool for the programme. We originally specified the MWCs use the Environment Agency Construction Carbon Calculator (EACCC) tool for carbon reporting. Our MWCs also used a range of emissions factors, from verifiable data sets like Bath ICE V2.0 and UK Government emissions factors to emissions data from product or supplier specific data.

As the project progressed, we allowed some flexibility in the tools that our MWCs use. This had its downside as we were working with differing approaches, albeit they led to the same conclusion. However, the benefit of this flexibility was that it allowed the MWCs to adopt an approach that suited them and their working practices. It also allowed for the MWCs to reach back to their parent companies to use more sophisticated carbon management tools as they became available during the course of the construction programme. Some of the bespoke tools allowed for more robust data collection and analysis than Tideway tools could have offered.

Case Study

Our West contract BMB joint venture (Bam Nuttall Ltd, Morgan Sindalll Plc, Balfour Beatty Group Ltd), reached back to one of their parent companies, BAM Nuttall, who have developed a software tool that is used across their business.

The tool collects exact volumes of materials from their suppliers of key building materials (steel, concrete, aggregates, asphalt). In terms of concrete, their suppliers provide them with the exact concrete mix, allowing them to calculate the embodied carbon of concrete with increased accuracy. BAM Nuttal's approach has been subject to ISO14064 reasonable assurance for the past few years.

4. Lean design

The central section main tunnel is 12.5km long. In the design stage our Central contract FLO joint venture (Ferrovial Construction UK Ltd, Laing O'Rourke Construction Ltd) identified the biggest carbon savings would come from reducing the thickness of the concrete within the secondary lining and by utilising a high percentage cement replacement within their concrete mix design.

Reducing the thickness of the secondary lining by 15% shaved 2.5% off their total carbon footprint, saving 7,100tCO2e; 15,000m3 of concrete saved and £3million of cost savings. In addition, FLO increased the cement replacement in the concrete mix for the secondary lining, utilising a mix with 40% GGBS, which saved 13,000 tCO2e.

The tunnel at Kirtling Street, Nine Elms

Case Study – A platform for the integrated use of telematics on construction plant

The fuel consumed by Non-Road Mobile Machinery (NRMM) contributes to the project's carbon footprint and has a detrimental effect on local air quality. Telematics is a wireless monitoring system that captures idling times, power bands and fuel burn rates. To ensure that operators work efficiently and secure a sustainable behavioural change, a training programme was developed, using real-time data.

During the session, operators are advised on improvements to their behaviour and can observe the impact of their behavioural change on fuel consumption. Results illustrated that the idling time reduced after the briefings and the eco-training course; from the initial baseline, an 8.7% decrease was recorded on average.

Following on from FLO's success in reducing the thickness of the secondary lining in their main tunnel, our East contract CVB joint venture (Costain Ltd, Vinci Construction Grands Projects, Bachy Soletanche Ltd) also came forward with options to reduce the thickness of their main tunnel and connection tunnel. They reduced the thickness of their main tunnel from 300mm to 240mm and their connection tunnel from 250mm to 180mm, which saved 11,000m3 of concrete and 4500 tCO2e.

5. Innovation

Tideway was a founding member of i3P. We hosted our innovation programme, The Great Think, on the i3P portal and encouraged our MWCs to share all innovations with the i3P community via the portal. In October 2017, we introduced our E-mission Possible campaign. The proposal was that Tideway would fund the best ideas bought forward by the MWCs that tackled air pollution and reduced our carbon footprint. Tideway initially received 26 ideas from across Tideway Alliance members and invested in the Live Plant Telematics and Low Carbon Cement trials.

Case Study – Low-carbon concrete

In 2020-21, our Central joint venture FLO and East joint venture CVB undertook trials of a low carbon concrete called Cemfree, within several low-risk temporary works and the results were fed back to the industry through i3P to help inform future users. The Cemfree trails that took place on the programme were small trials and the lessons learned included:

- Ensure that the supplier tests the load at the batching plant prior to delivery.
- Ensure enough time is provided to allow for slump tests results to meet requirements prior to pour. It is recommended to pour earlier in the day.
- Hot weather increased the risk of the mix reaching an unsuitable temperature. This should be considered if the mix is required to wait prior to the pour.
- A smaller pour could be trialled first to prevent any issues arising from a larger pour leading to wasted mix.
- Cemfree has a lower rate of strength gain, so was not an option for time critical works.
- Cemfree was only used for temporary works because MWCs could not obtain approvals for permanent works owing to the lack of long-term data available on the product

6. Saving carbon the RightWay

Every year we hosted the RightWay Awards. RightWay is our health, safety and wellbeing approach and the Awards recognise the achievements of our MWCs in adopting best practice HSW and environmental initiatives on site. We introduced a Carbon Initiative of the Year category in 2021, which called for case studies and evidenced solutions related to carbon reduction efforts, large or small. Over the three years we received a total of 34 submissions to this category and without the RightWay Awards we would not have captured all the carbon saving initiatives that our MWCs were delivering.

Some examples of best practice in carbon management and reduction included:
In East, CVB used a parent company Resource Efficiency Matrix (REM) tool to effectively measure and manage energy, carbon, materials, waste and water and help improve our environmental performance. The tool challenges teams to use existing efficient methods and technologies and to investigate innovative ways of minimising their environmental impact. The matrix helped CVB identify and develop 40 best practices and highlighted a project saving of £2,321,068 and 51,143 tCO2e in addition to driving innovation.

The RightWay award winners from 2023

Increasing carbon literacy on the programme has been a key component of identifying carbon savings and increasing the confidence of the workforce in understanding their role in reducing carbon. All three joint ventures and the Tideway client organisation have rolled out carbon literacy training. The training has built confidence in seeking opportunities to save carbon and the process to accurately measure carbon savings. This training has been important in delivering a shift in awareness of the key aspects of greenhouse gas emission management and carbon reporting on major programmes.

The RightWay Awards trophies, ahead of the 2021 ceremony

7. Efficient construction operations

At our Chambers Wharf site in Bermondsey east London, we used an innovative, electrically-powered hydrofraise diaphragm walling machine to dig the shaft wall for the main tunnel, which ran off mains electricity instead of diesel.

Martin Stanley, Geotechnical Construction Manager for Tideway at the time, said: "As well as being more environmentally friendly, it also means the machine will be quieter when it's in use. This type of hydrofraise machine is thought to be one of the first of its kind in the world, so we are really proud we've been able to launch it and will continue to look at ways of reducing our carbon footprint and minimising any disruption to our neighbours."

To pivot away from using diesel within plant and equipment on site, Hydrotreated Vegetable Oil (HVO) fuel produced from waste vegetable oil sources, has been used as a transitional fuel on some of our sites and within some of our tugs and HGVs. In line with our responsible sourcing requirements, if our MWCs wanted to use HVO, they had to demonstrate to us that the fuel had been sustainably sourced in accordance with the renewable Energy Directive II as 100% waste derived and European sourced Used Cooking Oil (UCO) derived product.

In 2020 we commissioned a study to measure the emissions and fuel economy characteristics of a river tug operating on standard marine gas oil (MGO) and compare this to the same vessel fuelled with hydrotreated vegetable oil (HVO). This project was expanded in 2022 to complete a comparable test of a Euro VI heavy-duty road vehicle (HGV), working on the same infrastructure project, and operating around the same location.

The findings showed that switching the river tug to HVO significantly reduced carbon dioxide and carbon monoxide emissions when compared to the diesel equivalent. In addition, we found a 38.6% reduction in nitrogen oxides and a 47.6% reduction in particulate emissions from the river tug when switched to HVO fuel. Likewise, the HGV road vehicles showed a 50.7% reduction in nitrogen oxide emissions, which can exacerbate heart and lung conditions, compared to the diesel equivalent.

A barge transporting spoil from the tunnelling operation

"We're proud that Tideway is an environmental project not just in what we're doing – cleaning up the Thames – but in how we're doing it, and these results are the latest vindication of that philosophy. Reducing emissions by being mindful of the fuels we use to build vital infrastructure is a key part of our industry driving toward a better future."

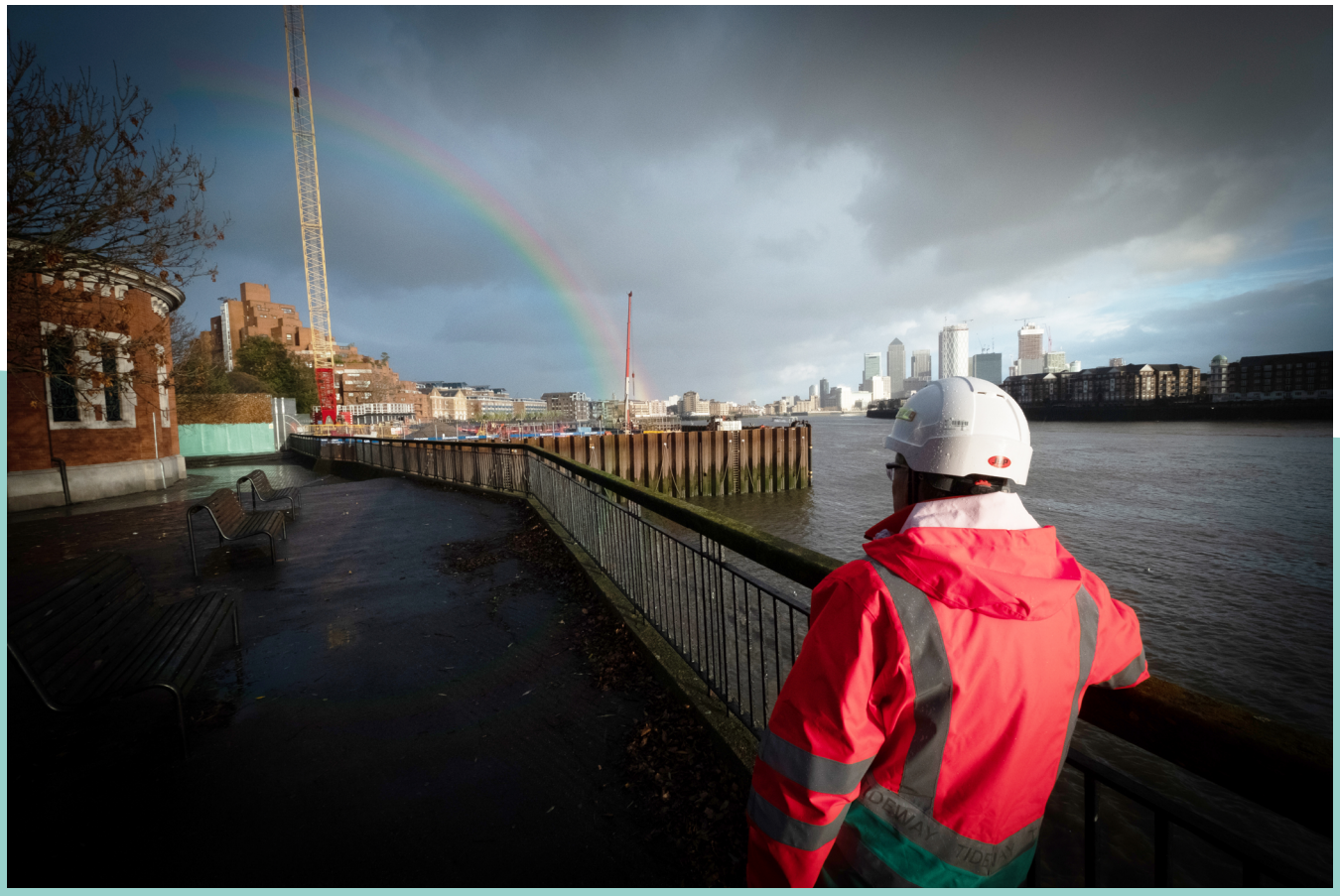
Darren Kehoe, Project Manager at Tideway's Greenwich site

8. Investing in carbon solutions

In addition to achieving carbon reduction through design and construction, we also sought opportunities to mitigate our carbon footprint and actively contribute to the challenges our sector faces in transitioning to net zero.

We were a funding client to the Infrastructure Client Group (ICG) Concrete Decarbonisation Accelerator. The Accelerator sought to identify what the funding client organisations can do together to help accelerate the uptake of low carbon concrete, clearly identify how much concrete the client organisations use, and start to consider how this could be funded. The Accelerator developed a suite of funding client commitments that will provide certainty and incentivise the concrete supply chain and drive concrete decarbonisation.

Tideway invested in the Accelerator to tackle the biggest contributor to our Scope 3 (embedded) emissions - concrete. Despite the project nearing completion and the vast majority of our concrete poured, we invested in the Accelerator because we saw it as an opportunity to redress our carbon impact through involvement in an industry changing group that will leave a substantial positive legacy for the sector.



Conclusions

Tideway has always embraced a spirit of collaboration amongst our Alliance members – Jacobs (Programme Manager), Designers and our three MWCs. We have endeavoured to adapt to an evolving climate landscape and keep pace with best practice. This case study has set out areas in which we have been successful. We have also identified the areas in which we felt we could have improved our approach to carbon management. These approaches are captured as Conclusions in Table 1 below, which have been identified in collaboration with our MWCs.

TABLE 1: Key findings from carbon workshops with Main Works Contractors (MWCs).
The issues identified were raised by the MWCs, the Conclusions are Tideway's response to those issues.

Project Lifecycle		Issues raised by our contractors
Tender	1	Earlier contractor involvement would have allowed the MWCs to have greater influence on the design, material specification and programming.
	2	The tender process could have incentivised carbon savings by providing greater weighting to lower carbon solutions.
	3	Opportunities identified by the MWCs during the tender process were not always captured within contract requirements.
Contract	4	Tideway could have set out the carbon baseline and identified the top wins within the design, for the MWCs to explore. More time and support from the client following contract award would have led to a more accurate carbon baseline.
	5	There could have been greater incentivisation for carbon reductions in the contract.
	6	The contract was too restrictive and didn't allow for flexibility, particularly in relation to the use of newer materials and technology that would bring carbon savings.
	7	Specific KPIs to reduce embodied carbon could have been set.
Design	8	The 120-year design life of the tunnel was paramount and the MWCs felt that at times this stifled innovation. It was also suggested that the 120-year design requirement limited efficiency in design and the ability to obtain warranties from material suppliers to meet the design life. ***Refer to Conclusion 6 below.***
	9	Our MWCs had the following thoughts on concrete mix designs: • They would have liked more opportunity to flex the concrete mix designs to achieve lower carbon options. • There are many levels of approvals for concrete mix design. This meant that with time pressures, you use the easiest mix that has been approved, which might not be the lowest carbon.
	10	Opportunities to explore and use novel mixes with lower embodied carbon in the temporary works structures were missed.
	11	We were tunnelling through London Clay in our West section and part of our Central section. The MWCs challenged whether secondary lining was required within the London Clay.
Construction	12	Our MWCs felt that consciousness around carbon and the climate emergency evolved and matured over the duration of the programme. This improved understanding could have led to more radical innovations. However, it was acknowledged that the establishment of Tideway's Innovation programme did bring forward innovations that were implemented during construction.
	13	Having sustainability professionals on site has been key to driving initiatives forward and for offering carbon literacy training. MWCs were required to have a suitably qualified, dedicated Sustainability team.
	14	The requirements of MWCs' parent companies helped to capture data on sustainability performance and has been a driver for improvement.
	15	Tideway was a bit slow at rewarding carbon innovations and best practice. Tideway addressed this by including a Carbon category in the RightWay Awards from 2021.
	16	Working to a moving and shrinking construction programme doesn't allow you the space for innovation. Don't have the luxury of extensive concrete trials and if you do undertake trials, there are programme implications if you want to use this mix more extensively.

Conclusions by Tideway	
1	Early contractor involvement allows for earlier mobilisation and maximises the opportunity for cross collaboration during design. It also allows for the adoption of low carbon solutions and delivery of innovations at the earliest opportunity within the project lifecycle.
2	Provide greater weighting within the tender process to reward the adoption of robust, low carbon solutions that have been identified during the tender process.
3	Client to develop a robust carbon baseline and lead the collaborative exercise across the programme. We have achieved a 28% reduction on our anticipated carbon footprint. Undertaking an accurate carbon footprint is not an easy task due to the many unknowns and uncertainties. Some of the 28% savings would have come from an inaccurate baseline, in addition to the real carbon savings that have been identified in this report.
4	Set an embodied carbon target within the contract and incentivise delivery against it.
5	Where low carbon solutions have been identified in the tender process, ensure they are captured and embedded in the contract.
6	Lower carbon materials in the ultimate supply chain may offer additional opportunities to reduce the overall project carbon footprint, but the engineering requirements of the project must not be compromised in the pursuit of avoiding GHG emissions. The 120-year design life of the tunnel requires little maintenance or partial replacement, and this represents optimal GHG performance over the whole life cycle of the asset. Tideway did not accept that secondary lining was not required when tunnelling through London Clay, however it was accepted that the secondary lining could be reduced in thickness, without impacting the 120-year design life. This was adopted on the Central and East sections.
7	Earlier contractor engagement identified under Conclusion 1, would allow for greater opportunity to explore alternative low carbon concrete mixes and gain approvals.
8	Explore opportunities to use novel mixes in non-critical assets and within temporary works.
9	If major programmes are established in a rigid manner, they don't allow for future innovations. There should be flexibility within the contract to respond to technical innovations as time progresses so that major programmes with long design and construction programmes are able to embrace innovation and best practice.