Delivering net zero

Helping our customers decarbonise Scotland's infrastructure

January 2020

Balfour Beatty

Foreword

The Scottish Government's Programme for Government 2019-20, *Protecting Scotland's Future* places tackling climate change at the heart of its agenda following the Scottish Government's declaration of a climate emergency. Achieving net zero will require every sector to make real changes.

The construction and infrastructure industry has a critical role to play in supporting and advising its customers in the transition to a net zero economy. Not only is it widely recognised that reducing carbon emissions in the built environment is the least expensive way of lessening the adverse impacts of climate change, but there are also significant opportunities to reduce carbon, materials and waste if infrastructure is designed and built better.

To meet net zero emissions by 2045, the construction site of 2045 will be free of fossil fuels. Electrification of plant, equipment and vehicles and a transition to hydrogen carrier fuels will ensure what cannot be achieved off-site will be efficiently processed onsite using no carbon. Lifecycle carbon analysis (LCA), integrated into the BIM design process with early contractor involvement will optimise carbon performance of built assets using artificial intelligence.

Companies such as Balfour Beatty, which have a proud track record and extensive experience in this area across a wide range of sectors over a number of years, have the expertise to advise customers on the best approaches, materials and techniques to keep the carbon footprint of their asset as low as possible. We put sustainability at the heart of what we do and in the solutions we provide to our customers.

Balfour Beatty's leading position in the sector means that we must set the pace and show leadership in tackling climate change within our sector. The steps we have already taken to meet our ambitious carbon reduction targets have seen Balfour Beatty reduce its own carbon footprint per £m revenue by 41% based on our 2010 baseline[1]. While we are pleased with this progress, we know we must do more. This is why 2020 will see us refresh our own sustainability framework, to ensure we are playing our part in moving towards a net zero economy.

We are working with our supply chain to ensure that they reduce their emissions. One of the key ways in which we will deliver this is through increasing the use of Modern Methods of Construction and new technology, something which is key to Balfour Beatty's approach and which will drive lower emissions and faster, safer delivery. But above all, we are working with customers to develop a cradle-to-cradle view of the assets they are commissioning, rather than just considering how they are constructed. This includes encouraging them to play contractors in at the earliest possible opportunity to allow us to bring our expertise to the table in terms of the best design, materials, techniques and solutions, to ensure the lowest possible overall carbon footprint of the asset within the parameters the customer sets.

This paper draws on Balfour Beatty's expertise in this area to advise how those commissioning infrastructure and those operating in the construction and infrastructure sector can work together to contribute to the rapid decarbonisation of the economy.

The huge potential to make improvements makes this a very exciting time for the industry. Our aim is to support our customers, supply chain and others operating in the industry so that together, we can decarbonise the sector.

Hector Macaulay
Managing Director, Scotland

[1] UK figures which cover our scope 1 and 2 emissions as set out in our sustainability reporting guidance: https://www.balfourbeatty.com/media/318113/balfour_beatty_annual_report_2018.pdf

Context

In June 2019, the UK became the first major economy to pass a law committing to cut all greenhouse gas emissions to net zero by 2050 based on 1990 levels. Scotland has been even more ambitious, committing to becoming a net-zero society by 2045.

Although huge progress has already been made in recent years in reducing emissions, achieving net zero will be a significant challenge which will require every sector to make real changes.

As the backbone of the economy, the Scottish construction and infrastructure industry has two important roles to play in helping to deliver on these plans:

1. The sector designs, finances and builds the efficient transport networks and utilities that help reduce carbon emissions. It builds energy efficient buildings and other low carbon infrastructure. And it plays a key part in helping ensure towns, cites, buildings and other assets are made more resilient to the effects of climate change and that the carbon emissions of both the construction and the in-use phases of the assets are kept as low as possible.
2. The construction and infrastructure sector uses significant resources that require a lot of energy to process and which generate greenhouse gas emissions: from the extraction of raw materials and the emissions which stem from the manufacture and transportation of the building materials, the pouring of concrete and use of steel, to the operation of heavy machinery and multiple, temporary sites. The industry therefore has a responsibility to modernise its approach, reduce carbon emissions from its operations and its supply chain as well as consider other factors such as water use, air quality and biodiversity.

The key to success, in our experience, is to ensure designers, contractors and the supply chain are brought in as early as possible. They must be incentivised to work together, before the specification has been set too tightly. Design is critical and so are the practicalities of construction and de-construction. All of those with expertise in how to reduce capital[2], operational, and user carbon need to be involved in schemes from the outset, as defined by PAS 2080.

Over-engineering schemes or sticking to standard specifications will significantly limit the industry's carbon savings. Those commissioning infrastructure must be bold and ambitious and be ready for them to be challenged if they want to achieve meaningful carbon reductions. They also hold the purse strings. This means that they can accelerate the industry's decarbonisation through measures such as: prequalifying contractors on the basis of their carbon performance; their ability to engage their supply chain; and their ability to drive and adopt innovation. It is the customer who must ensure an environment that allows and encourages the most carbon-efficient approaches and materials. Although they can be supported by the contractor, it is also the customer who ensures that the entire life cycle of a building – including maintenance and decommissioning - is taken into account from the outset.

Setting a carbon baseline at the start of project based on the initial design is key to enabling all stakeholders to demonstrate a reduction in emissions. Should the scope of the project change, this needs to be reflected in the baseline. The project team then needs to be set a target to reduce the baseline emissions. The entire value chain needs to collaborate and share responsibility in achieving this.

Aside from challenging the design and using alternative materials and solutions, there has also been significant effort dedicated to areas including:

- reducing the carbon associated with concrete and steel;
- optimising the use of recycled content material such as secondary aggregate;
- adopting closed loop systems for different material streams at the end of their asset life;
- minimising the transportation of materials and plant; and
- collaboration with other infrastructure providers.

The urgency of the climate change challenge requires rapid progress on decarbonisation. But a more carbon-responsible approach can also help to reduce costs for all parties.

For instance, as part of the eight2o Thames Water alliance contract Balfour Beatty has been able to significantly reduce costs by sharing trenches with other utility providers. This reduces the need for multiple road closures, excavations and disruption. The use of directional drilling, ground penetrating radar, underground BIM models and vacuum excavators has also allowed us to minimise the size of excavations saving carbon associated with material excavations, material movement, material backfill, operation of plant, and road traffic congestion.

Optimising the logistics of the supply chain to ensure that it is data driven is essential. This prevents half empty skips going offsite, fuel deliveries being turned back when tanks are not empty, or over-ordering of materials that are not required, all of which could present significant carbon and cost savings.

Engagement with the supply chain is also vital to ensure that innovation around plant and fleet remains at the forefront of contract renewals and investment in cleaner and more efficient plant is undertaken. Steps such as these help keep costs down for all parties. The size of the prize in terms of carbon and indeed cost savings both for the customer and for the industry makes taking a focussed approach a "no brainer", but doing it properly requires investment in effective data and systems which enable a business to look its numbers in the eye and set targets for improvement.

We must take an honest look at how infrastructure is commissioned and constructed and how this can be improved across the piece. We must ensure that the silos different parts of the industry operate in are broken down, so designers do not recommend approaches which reduce capital carbon generated during construction, but significantly increase operational and user carbon over the lifetime of the asset. And we must do more to make sure we are taking the large number of companies which make up the construction supply chain with us. The fact that many businesses in the sector have no serious plan for decarbonising their operations cannot be overlooked. Balfour Beatty has set clear expectations of its suppliers, sub-contractors and consultants and the positive role they must play in helping us achieve our sustainability goals. We are proactive in ensuring they can do so for example, encouraging them to take advantage of the support available through the Supply Chain Sustainability School in order to drive sustainability forward in the construction industry. We also understand the rich seam of innovation our supply chain offers in terms of fresh ideas which will speed up decarbonisation, and we work closely with them to turn these ideas into reality.

Most importantly though, we need to have sight of opportunities at the earliest stage possible in order to influence the design and recommend appropriate solutions when the marginal cost carbon reduction is at its lowest. As time passes our opportunity to reduce carbon decreases and the cost of doing so increases.

[2] Capital carbon refers to the greenhouse gas emissions associated with the creation, refurbishment and end of life of an asset. It includes the embodied carbon of materials, the use of construction plant, and the transport of materials and plant to construction sites. It also covers the emissions that arise from the demolition, waste processing and final treatment/disposal of an asset at the end of its life.

Case study: Hong Kong's first Zero Carbon Building, the ZCB

A joint initiative of the Construction Industry Council (CIC) and the Hong Kong Government, Hong Kong's first Zero Carbon Building (ZCB) was developed to showcase ground breaking eco-building design concepts, and the latest green technology available to the construction industry. Balfour Beatty's 50:50 Hong Kong and Singapore based joint venture, Gammon, was appointed Management Contractor of the scheme.

The prime focus of the construction process was to create a building using only ecologically friendly material, from procurement to project completion. The onus was placed on Gammon to source low-carbon construction materials and to employ low-carbon construction methods.

Constructed in Kowloon Bay on a 14,300-square-metre site, the two-storey building, featuring indoor and outdoor exhibition areas, makes use of more than 80 technological advances and environmentally friendly design concepts. In addition to energy-saving natural ventilation and lighting and thermal insulation, a biofuel generator using biodiesel produced from waste cooking oil, in tandem with solar cells stretching across the roof.

Throughout the project, green materials – such as responsibly sourced timber, recycled steel, ecopavers, and a special concrete mix containing recycled aggregates and fuel ash – were used.

BIM technology calculated the exact balance of cut and fill needed during excavation, cut-and-bend techniques reduced rebar waste, construction and demolition waste was used for the planter wall, and excavated soil was used in the native woodland.

To account for captial carbon, Gammon examined the transport of materials, energy consumption by tower cranes, site offices and onsite plants, concrete mixes and so on, and identified possible mitigation opportunities.

The building's energy needs would be emissions-free, with 70% of electrical power coming from biodiesel, or waste oil, and 30% coming from solar cells on the roof of the structure. With more than 90 energy-saving facilities, the building generates excess, or positive renewable energy, eliminating more than 8,000 tonnes of carbon emissions over a 50-year period.

Once completed, the project was awarded a BREAM Plus Platinum rating, the highest recognition for excellent building and environmental performance.

The ZCB is testament to our expertise in green construction technologies and practices, especially our capabilities in procuring green materials and managing capital carbon during construction.

Key points and recommendations

1. There are significant opportunities to reduce carbon, materials and waste if infrastructure is designed and built better.
2. The key to decarbonising the sector is to ensure designers, contractors and the supply chain are brought in as early as possible and are incentivised to work together, before the specification has been set too tightly.
3. Those commissioning infrastructure must be bold and ambitious and be ready for their specifications to be challenged if they want to achieve meaningful carbon reductions.
4. Commissioners can drive the industry's performance on decarbonising through measures such as: prequalifying contractors on the basis of their carbon performance, their ability to engage their supply chain, and their ability to drive and adopt innovation for example.
5. Carbon reduction targets and wider sustainability metrics must be built into the tender process in order to incentivise and reward parties to design, build and deliver carbon efficient solutions. Targets should be set in a way that ensures maximum collaboration.
6. Optimising the logistics of the supply chain to ensure that it is data driven is essential. This prevents half empty skips going offsite, fuel deliveries being turned back when tanks are not empty, or over-ordering of materials that are not required, all of which to significant carbon and cost savings.
7. The size of the prize in terms of carbon and indeed cost savings both for the customer and for the industry makes taking a focussed approach a "no brainer", but doing it properly requires investment in effective data and systems which enable a business to look its numbers in the eye and set targets for improvement.
8. Balfour Beatty supports the use of PAS 2080, the world's first standard for managing infrastructure carbon, for infrastructure projects above £20m.
9. To ensure that the benefits of these approaches can be maximised, we must accelerate the pace of adoption of Modern Methods of Construction by ensuring the continuity of pipeline flow; encouraging greater flexibility around specifications of materials; emphasizing the economies of scale that come from aggregating schemes over a longer timeframe and improving the standardisation of components and design.

Decarbonising infrastructure

As outlined above, essential to the decarbonisation of infrastructure is to play in contractors early so that key elements such as the material choices, for example, are not "locked in". As soon as these elements have been firmly decided upon, it becomes much more difficult to make a meaningful reduction in the carbon footprint of the infrastructure, both during construction and from the emissions produced during the life of the asset. Indeed, ensuring a clear understanding of the impacts of capital, operational and user carbon from the outset, is essential. While reducing carbon during the construction phase is of course important, carbon generated by an asset's use can make up to 70% of its overall carbon emissions, underlining the importance of all parties working closely together from the design to ensure the right choices are made.

Standards such as PAS 2080, the world's first standard for managing infrastructure carbon, help support these aims, which is why Balfour Beatty would support the use of PAS 2080 for infrastructure projects above £20m.

Early contractor involvement (ECI) is a key way of bringing contractors in from a point where they can add the most value. An ECI approach means that rather than the traditional approach where a client appoints a consultant to design the project in detail, with a contractor then appointed later to undertake the works, the contractor is introduced at the inception of the project. This allows contractors to bring their expertise and ensure design 'buildability' and cost and carbon efficiencies from the pre-construction phase onwards.

In Balfour Beatty's experience, an ECI approach also encourages collaboration and innovation, reduces risk and ultimately helps the customer meet their desired outcomes.

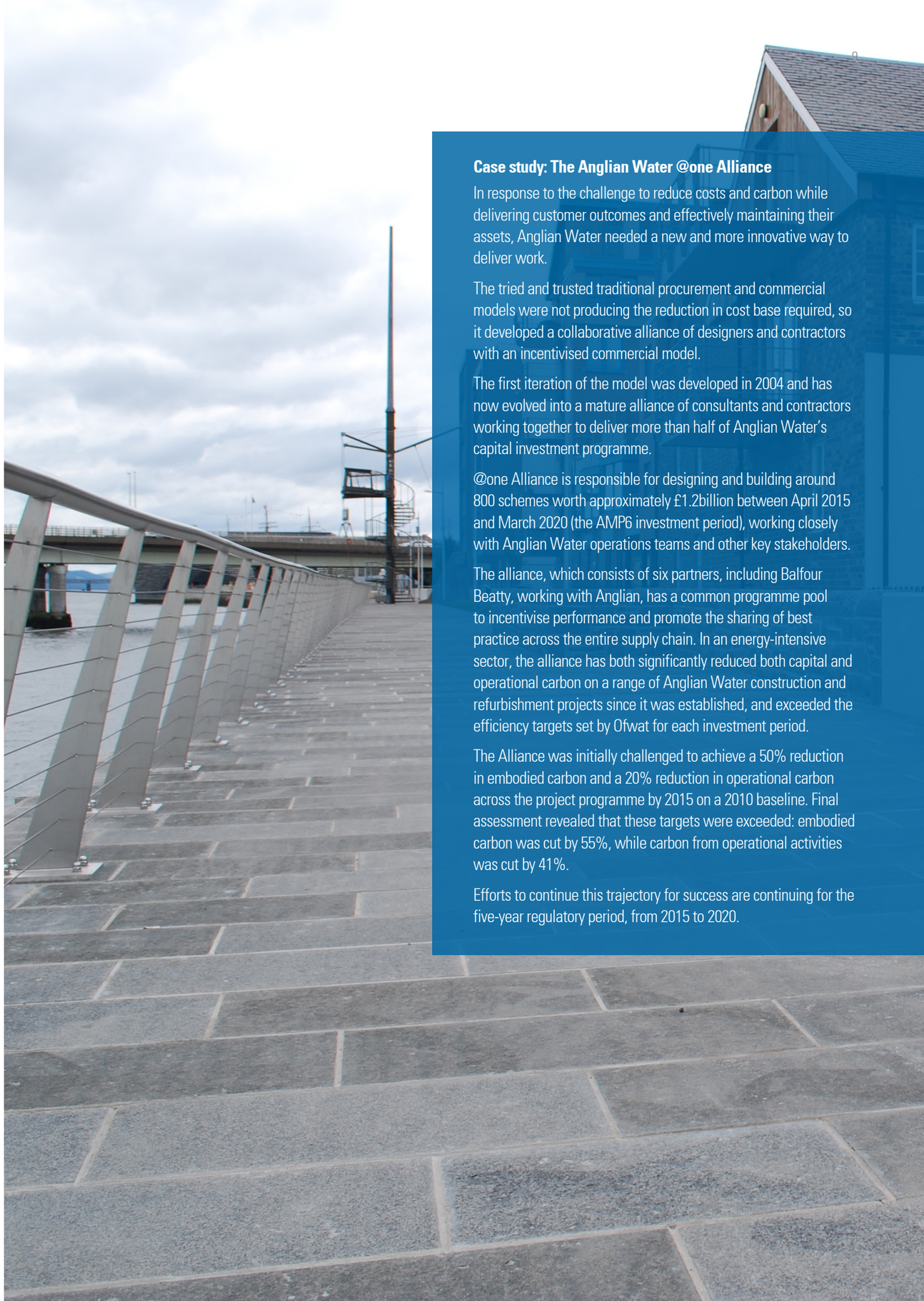
Carbon reduction targets and wider sustainability metrics also then need to be built into the tender process in order to incentivise and reward parties to design, build and deliver carbon efficient solutions. Targets should be set in a way that ensures maximum collaboration. For example, by giving designers, contractors and subcontractors an overall carbon reduction target that they need to achieve, meaning that they have to work together, rather than work in silos. This also prevents double counting and ensures effective communication throughout the value chain.

This kind of model is already being used by some important commissioners of infrastructure. Heathrow for example, are already setting minimum expectations for their supply chain through their Heathrow 2.0 strategy, Employer Requirements, Performance Assurance Framework and Tendering Requirements. These set out the carbon savings projects must achieve. They challenge designs to be more sustainable and also require demonstration of continual improvement. Furthermore, Heathrow actively promotes collaboration within its supply chain, where ideas to reduce carbon are shared and progress updates from its suppliers are shared.

This underlines the important role those commissioning infrastructure have in helping the construction and infrastructure to decarbonise its activities. Indeed, we have seen a number of customers expressing an intention to prequalify contractors on the basis of their carbon performance in the future, which is something we welcome.

Beyond individual schemes, there are a wide range of different measures which could be introduced by Government in order to speed up the decarbonisation of infrastructure.

This could include measures to improve energy efficiency standards for buildings as has been done in Singapore through the Building Control Authority's Green Mark, which is among the most stringent energy efficiency standards in the world. The Green Mark standard is based on actual energy efficiency performance of the building rather than a theoretical performance that the building could achieve. For buildings with a Gross Floor Area of above 5,000m^2, building owners must undertake energy audits every three years and submit energy consumption data annually. Initially, designed for commercial buildings, the Singapore Government has extended the Green Mark standard to all building types. To ensure that business did not bear all the costs, the Green Mark Incentive Scheme for Existing Building and Premises funded up to 50% of the retrofit costs for energy efficiency improvements for existing buildings through a $50m grant fund which has now been fully committed. The Singapore Government aims to ensure that all buildings are certified to its Green Mark standard by 2030.



Case study: The Anglian Water @one Alliance

In response to the challenge to reduce costs and carbon while delivering customer outcomes and effectively maintaining their assets, Anglian Water needed a new and more innovative way to deliver work.

The tried and trusted traditional procurement and commercial models were not producing the reduction in cost base required, so it developed a collaborative alliance of designers and contractors with an incentivised commercial model.

The first iteration of the model was developed in 2004 and has now evolved into a mature alliance of consultants and contractors working together to deliver more than half of Anglian Water's capital investment programme.

@one Alliance is responsible for designing and building around 800 schemes worth approximately £1.2billion between April 2015 and March 2020 (the AMP6 investment period), working closely with Anglian Water operations teams and other key stakeholders.

The alliance, which consists of six partners, including Balfour Beatty, working with Anglian, has a common programme pool to incentivise performance and promote the sharing of best practice across the entire supply chain. In an energy-intensive sector, the alliance has both significantly reduced both capital and operational carbon on a range of Anglian Water construction and refurbishment projects since it was established, and exceeded the efficiency targets set by Ofwat for each investment period.

The Alliance was initially challenged to achieve a 50% reduction in embodied carbon and a 20% reduction in operational carbon across the project programme by 2015 on a 2010 baseline. Final assessment revealed that these targets were exceeded: embodied carbon was cut by 55%, while carbon from operational activities was cut by 41%.

Efforts to continue this trajectory for success are continuing for the five-year regulatory period, from 2015 to 2020.

Modern methods of construction

A new generation of industrialised construction methods, including offsite and modular building techniques, are increasingly being adopted by the industry. These have an important role to play in reducing the both the energy used during the construction process and the waste produced. They also help ensure that the best approaches, materials and techniques can be explored and "game planned" in advance to ensure the most carbon-efficient end-product. A growing body of research has shown that, when compared with traditional methods of construction, modern methods of construction can result in an over 34% reduction in embodied carbon[3].

To ensure that the benefits of these approaches can be maximised, we must accelerate the pace of change in the following key areas:

1. Ensure the continuity of pipeline flow

We recognise that much of the responsibility for changing the industry and investing in new technology must lie with the sector itself. However, the industry currently operates largely on the basis of individual projects in which the significant up-front costs of offsite manufacturing and investing in new, large factories and an upskilled workforce, cannot always be justified.

For these new technologies to take hold we need multiple projects and longer time horizons to truly spur the development of innovative energy efficient designs. Those procuring infrastructure must be bold and consider the benefits of new materials, techniques and processes, rather than relying on those which have been "tried-and-tested". For example, rethinking traditional specifications, or considering new materials and approaches can have a significant impact on carbon emissions. We will not see carbon reduction of the scale required unless we are bold.

There must be greater flexibility around specifications of materials, and clear escalation routes to allow them to be challenged and amended.

Those commissioning infrastructure must also look at their needs over a longer period of time than they do at the moment, considering the impact of climate change and the need for adaption of their assets. The economies of scale are not felt in constructing one scheme, but over a longer timeframe, in the construction of a number of them.

2. Improve the standardisation of components and design

While methods such as modular and offsite construction are already established in certain markets, for example, student housing and hotel construction, in other areas there has been poor take-up of the technique, meaning that the benefits are being missed. More must be done to tackle this and to help procurers understand that offsite manufacture requires repeatability. Prioritising the standardisation of designs and components will incentivise increased use of offsite manufacture and help deliver significant benefits to the public sector.

3. Improve the standardisation of components and design

Balfour Beatty believes that there is much that the construction industry and that those procuring infrastructure can learn from the manufacturing industry. For example, the aerospace and automotive sectors use manufacturing techniques that go all the way from digital models through to components in a factory. This is not yet how modular and offsite manufacturing works in the UK in the construction sector. Offsite in construction is often understood as constructing elements at a different location – sometimes using the same techniques and processes, as would be used onsite. This means that some of the key benefits of efficiency are being missed. This must be addressed if we are to harness the "lean" principles that have made such impressive productivity gains and carbon reductions in the manufacturing sector.

However, changing the way the industry operates requires investment, which in turn relies on a reliable pipeline. Furthermore, with others such as China, Japan and Scandinavian countries being more advanced in using modular techniques, it may be that there is more we can learn from them. Balfour Beatty's 50:50 Hong Kong and Singapore based joint venture, Gammon, for instance, undertakes a considerable amount of work offsite, with the completed predominantly precast Cathay Pacific Cargo Terminal at Hong Kong International Airport a recent example.

At Balfour Beatty, we believe that if the industry does not find a way to commit more firmly to this agenda the opportunity to reap its game-changing benefits, not only in terms of decarbonisation, but also in other areas such as cost, quality and safety, will be missed.

More must be done to educate and inform – both to build the evidence base about the benefits of offsite and modular building, and also to improve understanding about elements which are key to success, such as the need to aggregate schemes over a longer timeframe and the importance of building in repeatability.

Providers, too, must change. While Balfour Beatty has made reducing the amount of work we undertake onsite a core part of its strategy, and others on the supply side are following suit, there are those in the industry itself who are not yet investing in innovative approaches. They are held back by the significant upfront investment needed (in a low margin sector) and the limited profitability of offsite while the market for it remains narrow. Something needs to be done to incentivise the sector to create capacity now for when it is needed. This is why Government can make the difference. As the industry's largest client, it has the means, motivation and responsibility to throw its weight fully behind this agenda to release substantial productivity and job creation in the construction and infrastructure sector.

Case study: The onshore sprayed concrete lining (SCL) tunnels at Hinkley Point C

Balfour Beatty is contracted to deliver three major packages of works for EDF at Hinkley Point C. It was first appointed to deliver the electrical works package in a joint venture in 2015, the tunnelling and marine package in 2017 and most recently the 400kV overhead line project on behalf of National Grid in 2019.

The Reference Design for a total of 14 tunnels and shafts at Hinkley Point C included 300–600 mm thick sprayed concrete lining (SCL). A sprayed concrete lining involves applying concrete onto the exposed surface to provide a strong and permanent lining.

The Reference Design would have meant c.8550m^3 of concrete equating to 3506 tCO_2 (assuming 0.410 tCO^2/m^3). However, collaborative working between engineering and design teams over the application of innovative techniques the team resulted in achieve a significant reduction in the levels of embedded carbon.

The SCL Manager and team worked closely with the designer to approve a Lean Design involving a much thinner layer of shotcrete supported by rock bolts. This meant c. 6410 m^3 of shotcrete and c. 88 tonnes of steel. This equates to 2784 tCO_2 (assuming 0.410 tCO_2/m^3 for concrete and 1.77tCO2/t for closed loop production steel) a 21% reduction in CO_2.

[3] An embodied carbon and energy analysis of modern methods of construction in housing: A case study using a lifecycle assessment framework, J.Monahan and J.C.Powell, Energy and Buildings, Volume 43, Issue 1, January 2011, Pages 179-188

The construction supply chain

When considering decarbonisation of the construction and infrastructure industry, an important point to take into account is how to apply this to the sector's large, complex, fragmented supply chain. The supply chain undertakes many of the most carbon intensive activities on site, and also sources many of the raw materials. Decarbonisation therefore needs to encompass the assets themselves, the activities of Tier one companies and indeed the whole construction supply chain.

Balfour Beatty believes that sustainability is a collective responsibility. Although the activities of our suppliers and subcontractors are beyond our direct control, we look to our supply chain partners to help us support our customers to decarbonise their infrastructure. All of our suppliers, sub-contractors and consultants are expected to do what is necessary to identify where they can play a positive role in helping us to reduce the energy use on our projects and quantify the embodied carbon of key materials.

We need our supply chain partners to consider the environmental, social and economic impact of their activities and support us in achieving best value and to improve sustainability outcomes for our customers. To assist with this, Balfour Beatty has published a sustainable procurement policy and guidance for buyers and suppliers[4] which clarifies its expectations and helps Balfour Beatty address and better understand risks and opportunities in areas such as circular economy and responsible sourcing. We also have regular, ongoing dialogue with them about the requirements of the scheme and the customer, to ensure the best possible carbon footprint within the parameters and to ensure that they understand the importance of embedding sustainable practices into their business models.

Balfour Beatty also ensures it is keeping carbon as low as possible by, for example, actively seeking suppliers and subcontractors based as close to the scheme as possible, in order to reduce travel emissions.

[4] https://www.balfourbeatty.com/media/195877/sustainable-procurement-policy-requirements-guidance-updated-feb-2017.pdf

Case study: Encouraging supply chain innovation to reduce carbon

Balfour Beatty aims to make continuous improvements to our products, services and processes. We are keen to nurture and unlock innovation wherever possible, with the combined goals of reducing carbon emissions, and improving the efficiency, safety and delivery of our work for the customer.

Our supply chain partners are market experts and often have the specialist knowledge to enable us to invest in new products, materials and services once they are ready for market. Innovation that helps to differentiate Balfour Beatty or make us more efficient, encourages growth and in turn provides more opportunities for our suppliers.

We want to encourage our supply chains to generate new ideas and share them with us. Our Innovation Gateway[5] is a tool that allows our partners to put forward innovative ideas relating to products, materials and services, with feedback process in place that keeps them informed. This could be a big, 'game changing' idea or something which brings about an incremental but important improvement in the way we deliver our projects.

We evaluate the ideas and engage in constructive discussion about them. If the ideas are workable, we will pilot them before making them available across our projects.

This is just one of the many ongoing improvements that we are currently making to encourage innovation within our supply chain.

Case study: The Supply Chain Sustainability School

Balfour Beatty is a funding Partner of the Supply Chain Sustainability School, an industry-led organisation which aims to improve sustainability performance throughout the construction and infrastructure supply chains. Balfour Beatty is proud to be a Partner of the Supply Chain Sustainability School. We are committed to supporting our suppliers in improving their capability to deliver sustainability outcomes for our customers and the Supply Chain Sustainability School plays a major role in building awareness and providing a support network which reaches the grass roots of our industry. The tools and resources it provides to our suppliers are helping us to be a better business and overcoming sustainability challenges with a common industry wide approach. We are members of the Supply Chain Sustainability School's carbon special interest group and are developing tools for the construction supply chain to enable them to report carbon, creating transparency and consistency in reporting across the sector.

The School provides CPD accredited e-learning modules and training workshops, tailored self-assessment and action plans, benchmarking tools, networking opportunities and access to thousands of online resources. The resources cover ten key topics: biodiversity, employment, skills & ethics, energy and carbon, environmental management, local business & community and materials, sustainable procurement, sustainability strategy, waste and water. Detailed information is given for the common building materials we use today; bricks, concrete, glass, steel, stone and timber.

Case study: Dorenell Wind Farm

Working with client SSEN, Balfour Beatty installed 140 newly-designed composite poles to carry a power cable connecting the remote Dorenell wind farm to the Blackhillock Substation, near Keith, Scotland. This innovative technology is the first of its kind to be installed in the UK and was specially adapted to meet the unique terrain and environment of the north east of Scotland.

Balfour Beatty used two specialist Erickson S64-F Air Crane helicopters to lift and install the poles. This innovative installation method meant that we did not need access tracks for the erection process and could install the poles quickly in locations that would have been difficult to access by crane. It also minimised the impact on the Scottish countryside.

Using the helicopter erection method meant we could preassemble all the poles in a single location. In these assembly yards we were able to create a standardised high quality assembly and fabrication facility, reducing the work that needed doing at each tower location. This made the fabrication and assembly of each pole safer, quicker, easier and more accurate.

Working in collaboration with SSEN, we developed an entirely new infrastructure solution which meets industry specifications in both the UK and Europe. This includes modifying the pole structures to be less intrusive, enhancing the durability of the insulators and utilising cutting edge conductors to enable real-time monitoring of windfarm and substation performance. Composite poles have a stronger strength/weight ratio than the traditional wood pole alternative, and are less visually intrusive than steel lattice towers. They are also environmentally-friendly, eliminating the need to harvest trees, and can be repurposed or recycled at the end of their useful life, and can carry a greater weight than traditional timber structures, meaning fewer of them have to be used.

[5] http://www.balfourbeatty.com/SupplierInnovation

Conclusion

In the light of the climate emergency, there is a pressing need for the construction and infrastructure industry to address head-on its significant carbon footprint. This will require a change in mind-set for the whole industry, from the customer, through the design and construction process and beyond – ensuring that carbon is front-and-centre at every stage.

- Contractors such as Balfour Beatty know that we must show leadership – and we are grasping the nettle to drive change, ensuring that we take our supply chain partners with us. Our refreshed sustainability framework, due to be published later in the year, will set out how we will do this in the coming years
- Customers must ensure they have the vision, strategy and the right partners to deliver the changes needed. Doing so will yield rewards not only in carbon savings, but also in cost efficiencies.
- Government must also play its part by ensuring the right framework and incentives are in place to accelerate the pace of change.

Only by all parties stepping up to the plate and taking responsibility to change can we truly decarbonise infrastructure.

[7] http://www.balfourbeatty.com/SupplierInnovation

About Balfour Beatty

Balfour Beatty is a leading international infrastructure group. Our main geographies are the UK, US and Hong Kong. Over the last 100 years we have created iconic buildings and infrastructure all over the world including the London Olympics' Aquatic Centre, Hong Kong's first Zero Carbon building, the National Museum of the Marine Corps in the US and the Channel Tunnel Rail Link.

With 26,000 employees. Balfour Beatty finances, develops, delivers and maintains the increasingly complex infrastructure that underpins the UK's daily life, with projects across transportation, power and utility systems, social and commercial buildings.

Balfour Beatty has been operating in Scotland for over a century. Today, the company employs 2,000 people across Scotland and works with a supply chain that includes a substantial proportion of local businesses.

Significant projects in the Company's current portfolio include The Gatty Marine building for the University of St Andrews, Forth Valley College's Falkirk Campus, University of Strathclyde's Learning and Teaching Hub, Edinburgh Futures Institute, The Darwin Biology Building and the Institute for Regeneration and Repair projects for the University of Edinburgh, Glasgow Queen Street Station Redevelopment for Network Rail and A9 Dualling Luncarty to Pass of Burnham for Transport Scotland. The company's construction business recently completed Perth Futures Trust Phase 1, Dundee Train Station Redevelopment and the Prince & Princess Wales Hospice and Radisson Red Hotel, both located in Glasgow.

In 2017, Balfour Beatty's UK business became the first company in the world to be assessed against ISO 20400:2017, the international standard for sustainable procurement. This was followed by Gammon Construction, the Group's joint venture in Hong Kong and Singapore, becoming the first Asian company to be assessed against the standard for its Hong Kong operations.

In both the US and UK construction businesses, Balfour Beatty's vendor qualification process has been expanded to identify vendors with sustainability programs in place and to allow project teams to provide feedback on vendor performance specifically around safety, sustainability, schedule and quality. As contracts are renegotiated with Impendi in the USA, under Balfour Beatty Group's procurement strategy, Balfour Beatty ensures vendors include sustainable measures as a key part of their revised service offerings. That means providing data about carbon use or matching green product pricing with less sustainable options.

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