Decarbonisation & Sustainability

SEE INSIDE FOR:

- *Transport Decarbonisation Plan:* what can it deliver?
- HS1's pledge to be carbon-neutral by 2030
- The revival of the community garden
- The bid to build Scotland's first hydrogen train
- SYSTRA takes carbon management to a new level

JOHN STRETTON.

PAUL BIGGS.

Welcome

Time is fast running out to avert a 'climate catastrophe' in the coming decades.

That is the sober conclusion of the latest report delivered by the UN's Intergovernmental Panel on Climate Change on August 9.

Accompanied by stark warnings from scientists that the report is a 'code red for humanity' to avoid key temperature limits being broken, all eyes will soon be on politicians to robustly respond at the international COP26 climate change conference in November.

Due to be held in Glasgow under a UK presidency, it is widely hoped that the conference will provide the platform for governments to finally embark on the scale of action that is so urgently needed.

Remaining within these shores, and the UK has already attempted to show leadership in this area by becoming the first major economy in the world to set a net zero emissions target into law.

Introduced by former Prime Minister Theresa May in June 2019, the legislation requires the UK to end its contribution to global greenhouse emissions by 2050.

As the largest single emitter of UK emissions, the transport sector is accordingly being readied to deliver large reductions in its carbon footprint.

This includes Britain's railways, which are planned to become a carbon-neutral network by 2050 alongside a phasing out of all diesel traction some ten years earlier.

The pathway to achieving this was announced by the Government on July 14 via the publication of its long-awaited *Transport Decarbonisation Plan*.

Although it does provide firm and welcome commitments to funding a rolling programme of electrification and the deployment of hydrogen- and battery-powered trains, whether it goes far enough is a question addressed by former Campaign for Better Transport Chief Executive Stephen Joseph in his comprehensive analysis of the plan on pages 40-41.

Elsewhere in this 15-page supplement, we hear from HS1 on its highly ambitious target to become a fully carbon-neutral railway by 2030, and how its Sustainability Strategy provides a blueprint for the UK's only dedicated high-speed line to become the most sustainable way to transport goods and people to the continent (pages 42-43).

Meanwhile, Atkins provides an update on the Zero Emissions Train project to build Scotland's first hydrogen train and to lay the groundwork for this alternative technology's more widespread deployment across the country (pages 44-45).

Last, but not least, we hear from SYSTRA on how it plans to support the sector to make carbon savings from infrastructure, by using its innovative new CarbonTracker BIM carbon management tool (pages 46-47).

PAUL STEPHEN
Features Editor, *RAIL*

Contents

Editorial
Managing Editor: Nigel Harris
Deputy Editor: Stefanie Foster
Features Editor: Paul Stephen
Production Editor: Mike Wright
Art Editor: Charles Wrigley
Sub Editor: Richard Hampson
Managing Director: Tim Lucas

Advertising
Account Manager: Tom Staggs

SHOWING PROMISE

The Department for Transport's recent plan to clean up our roads and railways makes all the right noises, but does it really represent a firm commitment to 'net zero' travel? Former Campaign for Better Transport Chief Executive STEPHEN JOSEPH takes a critical look

At first glance, the Department for Transport's *Transport Decarbonisation Plan* (published on July 14) seems to bring big new plans for the railway. It reiterates many of the themes in the *Williams-Shapps Plan for Rail*, and the commitment to remove all diesel-only trains from the network by 2040.

The plan talks of the rehabilitation of electrification: "Electrification - a proven, existing technology - is likely to be the main way of decarbonising the majority of the network".

It also commits to the development of battery and hydrogen trains. It restates a commitment to HS2 and - rather more clearly than previous government documents - sets out clearly the benefits of releasing capacity on existing lines for freight and local passenger services.

The main new element is in rail freight. The plan is far bolder on this subject than previous government policies. The Williams-Shapps commitment to set a rail freight growth target is repeated, but there is a new commitment to incentivise early take-up of low-carbon traction for rail freight, including short infill electrification projects to allow more rail freight services to switch to electric traction.

However, just looking at the railway sections in the plan will obscure the bigger picture.

For starters, the plan includes measures and commitments to decarbonisation of all vehicles in some way. This includes a commitment to phasing out diesel truck sales by 2040 (no other country has set such a target), alongside diesel buses, coaches and motorbikes.

Aviation will also be decarbonised, through "sustainable aviation fuels" and electric planes for short-distance flights. Some of this does rely on new technologies which are still to be developed, and the plan is quite open about this, but in general this means that railways will be operating in a rather different environment from now, with emissions from its competitors potentially much lower than current targets.

But the plan is clear that new transport technologies alone will not be enough to meet the targets in the sixth carbon budget (2033-37), let alone net zero by 2050. So there is a lot in it about changing travel behaviour.

An electric vehicle charging point at Eskbank station on the Borders Line in Midlothian. The *Transport Decarbonisation Plan* includes an ambition to significantly expand provision of cycle storage, car-pooling parking spaces and electric vehicle rental and charge points at stations on the network. ALAMY.

A Great Western Railway passenger alights with his bicycle at Pershore on February 20 2020. The Government's *Transport Decarbonisation Plan* advocates a move away from today's 'predict and provide' transport planning system to one that sets specific outcomes, such as increased active travel and multi-modal integration. JACK BOSKETT.

Some of it restates previous commitments on support for walking and cycling, and buses as well as rail. Transport Secretary Grant Shapps, in his foreword, says that "we must make public transport, cycling and walking the natural first choice for all who can take it… we want to reduce urban road traffic overall". He holds out the prospect of "a reduction, or at least a stabilisation in traffic more widely".

It's in this area that there are some real opportunities for rail. There is a lot of focus in the plan and associated documents on active travel and, as in Williams-Shapps, there is greater commitment to integrating rail with walking, cycling and other modes of transport, with an expansion at stations of cycle storage, cycle and e-bike hire, car-share parking spaces and electric vehicle rental and charge points.

But beyond these individual measures, the local transport world will change.

Local Transport Plans, which at one point were downgraded to voluntary status and were almost abolished, are to be reborn. Councils will have to submit such plans with "quantifiable carbon reductions", as a condition of getting transport funding.

Transport decarbonisation principles will be "embedded in spatial planning and across transport policymaking".

On spatial planning, there are ambitions to support the principle of '20-minute neighbourhoods', and improving design and location of new developments around existing transport hubs.

The plan even suggests that "we need to move away from transport planning based on predicting future demand to provide capacity to planning that sets an outcome communities want to achieve and provides the transport solutions to deliver those outcomes (sometimes referred to as 'vision and validate')". To lead the way there will be at least one "zero emission transport city".

Taken together, all these measures will reinvent local transport planning, especially in towns and cities, and focus it on decarbonisation.

There will also be big changes for business transport. The plan proposes a 'commute zero' initiative, bringing together leading companies and large employers to change workers' travel habits and supporting lower carbon commuting. There will be pilot schemes for consolidating goods deliveries in cities, and also for local authorities franchising waste collection to reduce lorry movements.

These wider ambitions and the changes in travel behaviour they signal are huge opportunities for rail. Improved rail and light rail can be a key part of those "quantifiable carbon reductions" that local authorities will be expected to deliver. New development around "existing transport hubs" (ie stations) should bring new traffic to the railways, and funding to upgrade them.

Great British Railways needs to seize these opportunities. It needs to have people on the ground, with authority, working with local authorities, sub-national bodies and developers, offering them options and solutions, looking for opportunities to improve walking and cycling access and turning stations into mobility hubs.

Its promised "freight champion" needs to be part of these discussions, offering cities integrated freight services with the new converted EMUs feeding into city stations with electric vans and cargo bikes offering emission-free first and last-mile deliveries.

However, the plan has its omissions. You can see where DfT has lost (or at least not yet won) battles with other departments, or where forces inside the Department have pushed back - there isn't a firm commitment to new planning guidance, and although Shapps' foreword highlights the fall in motoring costs and the rise in public transport fares over the last 20 years, and says that "gradually we will change this", the plan is then silent about reforming rail fares which, it is widely believed, the Treasury has blocked.

The plan also has nothing to say about managing demand for aviation or restricting the growth of airports (even though the Committee on Climate Change has said that this is essential). The Government's £27 billion road programme in England survives unscathed (yet again).

But perhaps the biggest issue avoided by the plan is how to pay for motoring. As many commentators have pointed out, the move to zero-carbon vehicles demolishes the £28bn or so that the Government gets annually from fuel and vehicle taxes, making the case for some form of road user charging, but the plan is almost silent on this.

It merely repeats a sentence from last November's ten-point plan for decarbonisation: "As we move forward with the transition to zero-emission vehicles, we will need to ensure that the tax system encourages the uptake of EVs and that revenue from motoring taxes keeps pace with this change, to ensure we can continue to fund first class public services and infrastructure."

At some point the Government - politicians generally - will have to confront this issue.

Nonetheless, the plan is a step forward and the rail industry can use it to make the case for investment, funding and wider rail-friendly policies and innovation, not least in the coming spending review.

The impacts of climate change - floods, wildfires and record temperatures - are with us now. As we approach the big COP26 climate change conference in Glasgow in November, the Government will have to put its fine words into action, fund rail electrification and upgrades, and give GBR the clout it needs to make a difference. ■

"The plan is silent about reforming rail fares which, it is widely believed, the Treasury has blocked."

Stephen Joseph, *former Chief Executive, Campaign for Better Transport*

HOW GREEN IS YOUR RAILWAY?

RAIL finds out how HS1 Ltd's Sustainability Strategy has set the UK's only dedicated high-speed line on track to reach its full potential as the 'Green Gateway to Europe'

When it comes to carbon emissions, there is simply no better way to move people and goods to the European continent than via HS1.

Fully opened in 2007, the 68-mile route from St Pancras International to the Channel Tunnel ordinarily carries up to 26 million passengers a year on domestic high-speed services operated by Southeastern to Kent and via Eurostar's international links to a range of destinations, including Paris, Brussels and Amsterdam.

HS1 is, therefore, estimated to remove 6,000 cars and lorries from the roads and the equivalent of 60,000 short-haul flights from the skies each year.

With average carbon emissions some 93% lower for train passengers than airline passengers over the same distance, HS1 has been a flagbearer for the manifest benefits of modal shift.

And as the Government prepares to host the international COP26 climate change summit in Glasgow later this year, there has never been a greater focus on how low-carbon transport will help the UK to reach its net zero goal by the middle of the century.

The Government's commitment to decarbonise the entire transport system was re-affirmed on July 14, following the publication of the long-awaited *Transport Decarbonisation Plan* which, for rail, will mean achieving a zero-carbon railway by 2050.

But despite its existing reputation for being the Green Gateway to Europe, HS1 Ltd has already embarked on an even more ambitious pledge to become fully carbon neutral by 2030.

HS1 Ltd's Head of Assurance Steve van Niekerk explains: "When I joined the company a couple of years ago there was some really good carbon reduction work going on across HS1 and the supply chain. But by talking to stakeholders we quickly identified that there was much more that we could be doing together to go from being a low-carbon option to a no carbon option.

"Our strategy is aligned with wider sustainability goals set by government, but we feel uniquely placed to achieve modal shift as a privately owned concession with an ability to move quickly to get the best out of our high-speed infrastructure."

Engineering Director Richard Thorp adds: "It has been absolutely the right thing to focus on from a personal and moral perspective because we can't ignore what is going on across the world. The Government recognises its importance, our supply chain and customers have their own ambitions too, and that is what led us to think about what more we could be doing."

The roadmap to becoming fully carbon neutral was subsequently set out in HS1's *Sustainability Strategy*.

Published in October 2020 following extensive consultation with internal and external stakeholders including staff, passengers, train operating companies, shareholders, the Department for Transport and RSSB (formerly the Rail Safety & Standards Board), the strategy focuses on six priority areas.

These areas incorporate climate change, energy use, transparency, waste and resources, biodiversity and social impacts.

Van Niekerk describes the document as a 'greenprint' to place an environmentally friendly future at the forefront of everything the infrastructure operator does.

Strict governance and progress reporting has also been put in place to ensure that the strategy is delivered by HS1 in collaboration with its supply chain and train operating customers.

"I think that transparency is the area that surprised most people," he adds. "But we wanted to live our strategy and embed it in the organisation rather than make it a corporate document that sits on a shelf and gathers dust.

"We felt it was particularly important to get the views of staff on what we wanted to achieve and what we thought was possible. It helped us enormously in identifying where we were being ambitious but also perhaps too unambitious and where we could do better."

The strategy sets a number of stringent targets for 2030, including the recycling of 90% of waste from operations and maintenance and the elimination of non-hazardous waste sent to landfill. Commitments have also been made that build on HS1's legal obligation to protect and enhance lineside habitats, including the assessment and monitoring of the quality of 136 habitat areas known as 'tiles'.

The two areas that directly relate to decarbonisation are climate change, and adaptation and energy use.

The latter builds on HS1's proud claim to be the first railway to run entirely on renewable electricity.

This is currently achieved via the purchase of Renewable Energy Guarantees of Origin certificates from the company's supplier, nPower Business Solutions.

But under the *Sustainability Strategy* this will be stepped up by HS1 securing Corporate Power Purchase agreements and Private Wire Power Purchase agreements instead.

These CPPAs and PW PPAs demonstrate direct investment in green energy generation and renewable energy sources being directly linked to HS1's infrastructure.

Complementing this is a pledge to reduce overall energy consumption by 30%, plus the publication of a new materials standard to lower the amount of carbon embodied in infrastructure and emitted from operations, maintenance, and renewals activities.

In terms of energy use, HS1 now claims to have reduced carbon emissions by 97% in this area compared to baseline figures. The company used three years of statistics to make this calculation due to the distortive effect that the Coronavirus pandemic has had more recently on passenger numbers across the globe.

To add greater credibility to its claims, HS1 has sought external verification through Achilles Reduce Carbon and is investigating the setting of science-based targets through SBTi.

But both Thorp and Van Niekerk believe that the largest single contribution to tackling climate change will come from the strategy's commitment to encouraging modal shift.

Even before the pandemic the line was running at approximately 50% capacity, allowing HS1 to double the use of its railway by the end of the decade.

To help achieve this aim, HS1 Ltd will be an official partner at the Investment COP at COP26 and is hosting a workshop to discuss approaches to decarbonising transport.

This will include a call for a modal shift of some 4.9 million people per year to high-speed rail in the UK, which HS1 says will prevent a further 450,000 tonnes of CO_2 from entering the atmosphere and would deliver an additional £427 million worth of economic benefits.

"It's all very well making our railway greener, but we need it to be full and we need to be taking more planes out of the sky," says Thorp.

"We are only half full and we'd like to do much more to encourage people out of their cars. We are already very good at doing that, but we are looking for help in how the industry can work with government and other key players to make our product and customer experience as attractive as possible.

"The Investment COP will be a great opportunity to reach out to a different audience of investors, policymakers, activists and other movers and shakers. It's not only about what's good for the environment but also what's good for business and how we can get people to choose decarbonised journeys for leisure, business and freight, and to achieve our objectives."

He adds: "We can make that modal shift happen right now, but we just need some entrepreneurial thinking around the sides. HS1 is built, the carbon is already invested and we are 50% full, so help us to fill it and let's get the most out of it." ■

2020-21 SUSTAINABILITY STATISTICS

- 97% reduction in CO_2 for systems including tractions.
- 14% reduction in electricity use
- 54% waste recycled.
- 435 hours of volunteering and *pro bono* support.
- £30,500 donated to charitable causes.
- 74% of 136 habitat areas surveyed.
- Eight biodiversity areas upgraded.

A Eurostar e320 service passes through rural Kent. HS1's *Sustainability Strategy* includes a target to work with Network Rail High Speed and Kent Wildlife Trust to deliver a net gain in biodiversity by 2030. EUROSTAR.

"Our strategy is aligned with wider sustainability goals set by government, but we feel uniquely placed to achieve modal shift as a privately owned concession."

Steve van Niekerk, *Head of Assurance, HS1 Ltd*

SOCIAL SUSTAINABILITY

HS1 Ltd has made being a good neighbour to local lineside, depot and station communities a high priority.

This is demonstrated by its decision to make social impacts one of the six priority areas in the company's *Sustainability Strategy* and its pledge to contribute time, skills and resources to create positive social value.

For example, HS1 works closely with Urban Partners, a voluntary business partnership organisation in the Euston, King's Cross and St Pancras areas of London.

Members of Urban Partners range from global corporations to local independent businesses, spanning sectors including transport, media and hospitality. These members commit funds, expertise and time to deliver initiatives that benefit the local neighbourhood and all those living, studying or working in the area.

HS1 Ltd's Head of Assurance Steve van Niekerk says: "Our infrastructure runs through large parts of London and Kent so it's about how we give something back. Unfortunately we haven't been able to do as much as we'd like in the last 18 months owing to all the difficulties from COVID-19. The volunteering side of things has been particularly problematic, but we've still done a lot of hours (see table) on mentoring in the industry and to support Urban Partners and Kent Wildlife Trust.

"It's an area we want to drive forward because volunteering is what gives us the biggest impact in local communities. We will be encouraging people in the business to consider volunteering and would expect the hours to go up dramatically in the next few years with a plan to contribute some 700 hours of staff time per year by the end of 2022.

"We are also always looking for additional charity partners to support through volunteering and will be basing this on suggestions from our staff."

IN THEIR ELEMENT

Atkins is front and centre when it comes to bringing hydrogen-powered trains to the UK's network.

Class 314 driving motor coach 64600 passes the famous Kelpies at Grangemouth while being moved by road on December 17 2020 from Shields Depot in Glasgow to the Bo'ness & Kinneil Railway. The unit was withdrawn from frontline duties by ScotRail in December 2019, and is now owned by St Andrews University. SCOTTISH ENTERPRISE.

The race to reach 'net zero' is transforming our transport system. Eliminating the sector's contribution to climate change involves not only the introduction of new technologies and ideas but also a strong collaborative effort on the part of the industry to solve several technological, engineering and operational challenges before the middle of the decade.

Despite contributing less than 1.4% to all transport emissions, rail is in pole position to shoulder much of the burden for decarbonising the entire sector by offering the only zero-carbon option for high-speed travel and freight.

But for rail to reach its full potential for modal shift then it must first hit an even earlier deadline set by then-Rail Minister Jo Johnson in 2018 to remove all diesel-only passenger trains from the network by 2040.

This target has since been enshrined in the Government's long-awaited *Transport Decarbonisation Plan* that set out a roadmap to achieve this goal when it was published on July 14.

Meanwhile, in Scotland, ministers have set an even more ambitious target to end diesel traction for passenger services by 2035.

For most of the network, this will inevitably require government funding a rolling programme of electrification to substantially increase the 42% of railways in Britain that are currently energised.

That is because electrification is proven to be the most viable and cost-effective solution on the majority of intensively used routes and is a tried and tested approach that provides additional benefits by lowering operational costs, increasing reliability and capacity, and reducing noise.

But electrification is also a complex technology that is expensive and slow to deploy. This means that there is a need for interim rolling stock solutions while lines are electrified, and on parts of the network with low passenger densities and where electrification simply isn't a viable option.

This is recognised by both the *Transport Decarbonisation Plan* and Network Rail's *Traction Decarbonisation Network Strategy*. The latter recommends that some 13,000 single-track kilometres (STKs) should be electrified while a further 1,300 STKs would be more suitable for hydrogen train deployment and more than 800 STKs for battery trains.

But these low-carbon alternatives come with risks of their own and demand specific standards and assurances.

They require substantial investment and new skills and ways of working that will require the support of government to deliver a robust rolling stock plan to replace an estimated 3,000-3,300 diesel vehicles that will need to be re-engined, converted or replaced completely by 2040.

Of these vehicles, it is believed that some 2,400 trains could be replaced by the low-carbon options offered by hydrogen or battery.

In the case of hydrogen, which has a higher energy to density ratio and volume than batteries, we have already seen progress in other countries to develop this nascent technology with Alstom's iLint fleet now in passenger service in both Germany and Austria.

It has been demonstrated that hydrogen trains can reach speeds of up to 100mph and ranges of 600-800 miles, making them a plausible direct replacement for existing diesel rolling stock for longer journeys on regional routes where there is no case for electrification and batteries lack sufficient capacity.

However, although hydrogen trains have zero emissions at the point of use, developers must still contend with their reliance on a fuel that is produced either via the electricity-consuming process of electrolysis, or as a by-product of carbon-intensive industrial processes.

This has therefore created a problem but also an opportunity to deploy hydrogen trains in areas where hydrogen is already created as a by-product, such as from chemical industries, or to develop the infrastructure necessary to create 'green hydrogen' using electricity generated from renewable sources.

There is currently a £2.5 million government-funded competition open for businesses to demonstrate how hydrogen can be used to power transport solutions. Last November, the Government published a *Ten Point Plan for a Green Revolution* that includes a pledge to drive the use of hydrogen power for a range of uses, including domestic heating.

In UK rail there are currently three 'live' projects to develop hydrogen train fleets and turn this vision into a reality for British operators and passengers.

These schemes include the Alstom Breeze project to convert a Class 321 electric multiple unit, and the launch by Porterbrook and the Birmingham Centre for Rail Research and Education of the HydroFLEX - which is based on a reconfigured Class 319 and has now commenced main line testing.

Meanwhile, in Scotland, work is in full swing on the Zero Emission Train project to convert a redundant Class 314 EMU in time to be demonstrated in November at the international COP26 climate change conference in Glasgow.

Underpinning this project is a £300,000 investment made by the Scottish Government last summer in a hydrogen accelerator at the University of St Andrews.

The funding requires the university to collaborate with industry partners and other relevant institutions to drive innovation, knowledge sharing, the establishment of a supply chain and the creation of commercial opportunities for hydrogen deployment.

For the Zero Emission Train project, St Andrews University's hydrogen accelerator has partnered with Transport Scotland and Scottish Enterprise to assemble a consortium of engineering and technology firms to create a fully certified and production-ready hydrogen train.

The £2.74m conversion of the ex-ScotRail Class 314 is being led by Arcola Energy working with partners including Arup, Aegis and Abbot Risk Consulting.

Further support is being provided by Angel Trains, NR and Atkins' rail consulting team.

Iain Rae, operational development director at Atkins (member of the SNC Lavalin Group) explains: "In Scotland, we are fortunate to be ahead of the curve in terms of the rest of the UK for decarbonisation and integration between industry bodies such as Network Rail and Transport Scotland. It represents a massive opportunity for businesses like Atkins to help our clients succeed, and we have been very proactive in this area.

"For the Zero Emission Train project we contacted Transport Scotland and asked how we could help. After the phase 1 feasibility study had been completed, we then got actively involved in phase 2 and did the procurement specification that identified some technical challenges not picked up in the early stages.

"We then formed part of the assessment body to score the procurement specification and are now part of the product delivery group."

The project's objectives include proving that Scotland has the capability to install hydrogen fuel cells to existing rolling stock, to work with regulatory bodies to develop necessary standards and to inform rail policy on the future application of the technology on parts of the Scottish network which are unlikely to be electrified, such as the West Highland and Far North lines.

There is also a requirement to provide the supply chain and educational institutions with the opportunity to develop knowledge and skills in the application of hydrogen technology.

Rae adds: "A key part has been the involvement of Scottish suppliers and SMEs to develop the supply base in Scotland and bring stakeholders along with us on the journey so that when hydrogen becomes a reality, they will already be very familiar with it.

"For example, ScotRail and Network Rail are both part of the meetings I chair as there is clear benefit for bringing them on the journey, even though it is not their product and they are not our clients. But we are front and centre of the project and our team is very focused on making this happen by November."

Among the technical challenges faced by Atkins and the rest of the consortium was a need to find space within the body of the three-car '314' unit to store up to 80kg of compressed hydrogen.

This is because, unlike in Germany where Alstom's iLint can make use of hydrogen fuel tanks on the roof, the British loading gauge is much less generous.

There was also a need to replace the DC motors on the '314' with new AC equivalents to pair up the traction system with the hydrogen fuel cells.

Having been withdrawn by ScotRail from frontline service in December 2019, the train has been based at the Bo'ness and Kinneil Railway since December 2020 for conversion and testing.

The consortium has use of the five-mile heritage line, a diesel locomotive workshop and a specially built hydrogen fuelling station that is designed to compress and store the gas and fuel the train.

This forms part of a £500,000 investment from Angel Trains that was announced in May to create green hydrogen refuelling infrastructure.

The hydrogen fuel cell rafts themselves are being developed, built and tested at the Michelin Scotland Innovation Parc in Dundee.

"We're excited about this project and are now assembling everything and integrating it together," adds Rae. "Although the train itself will not be running at COP26, we look forward to demonstrating the technology and approach at the event."

The requirement to complete the conversion and other project objectives has been challenging. But, according to Rae, it has been overcome by a strong desire from all partners to succeed and a shared mindset to be creative, agile and open-minded.

It is this spirit of collaboration that will perhaps go furthest in securing the project's legacy as a development platform to encourage further investment and to scale up the deployment of this promising technology in Scotland and elsewhere.

Rae adds: "A key strength of this project has been that we've had a single goal, and everybody has come to the party ready and willing. Everyone has a lot of pride in this project and wants it to succeed which, from a project management point of view, is brilliant to have.

"We've now got a much better understanding of the challenges involved and how to build and maintain trains like this which is a good thing for the whole industry if we've done some of the legwork."

He concludes: "It's great to be part of a wider push for a hydrogen economy and to be part of something that has a wider implication than just rail. Hopefully what we do here will be a leading light for others to follow suit." ■

KEEPING TRACK OF EMISSIONS

SYSTRA introduces its innovative new BIM carbon management tool - known as CarbonTracker

SYSTRA employees are invested in providing sustainable transport systems as a matter of course. Innovations such as the U-Shaped Viaduct, implemented along hundreds of kilometers of metro lines throughout the world, is a key example. But SYSTRA says this is not enough and so it plans to implement a more systemic eco-design approach and not just rely on the carbon savings coming from mass transit and rail transport. ALAMY.

This November, the UK will host the 26th UN Climate Change Conference of the Parties (known as COP26) in Glasgow.

The conference will provide another opportunity for every country in the world to make key decisions on reducing greenhouse gas emissions, and to address what has been widely called an environmental and climate 'emergency'.

As the first major economy to pass a net zero target into law, the UK's presidency of COP26 is seen as an opportunity to raise the ambition of emissions pledges around the globe.

Meanwhile, the need for many countries to rebuild their economies in the wake of the Coronavirus pandemic and to 'build back better' through a green recovery places a renewed emphasis on achieving a low-carbon transition.

As the highest carbon dioxide-emitting sector in the UK, the transport industry is obliged to play its part in helping the nation to reach this goal.

This means not only reducing direct emissions from the day-to-day operations of our transport networks, but also cutting the carbon footprint of infrastructure across its entire lifecycle.

To help achieve this, various web-based applications are available to the rail industry, to enable organisations and companies to calculate and analyse the carbon footprints of projects and activities, and to select low-carbon solutions.

But SYSTRA is about to take this even further, with the impending rollout of its brand new CarbonTracker, an innovative carbon management tool. Developed by SYSTRA's Ecodesign and Sustainability team, involving experts with different expertise (such as architecture) in France in collaboration with the Group's Digital Tools Development team.

CarbonTracker is designed to capture both BIM (Building Information Modelling) and non-BIM data and promises to make carbon emissions easier to quantify and manage as part of any new infrastructure project.

Group Sustainable Development Director and sponsor of the new tool Christelle Chichignoud says: "CarbonTracker will help SYSTRA to better support its clients' carbon reduction objectives and to communicate their achievements in much the same way that project costs are measured and managed."

By mandating its use among all SYSTRA engineers and encouraging them to think about the environmental impacts of their design, CarbonTracker will also support the company's own sustainability transformation programme.

Digital Production Tools Development Director Eric Pruvost explains: "The commitments being made by governments and organisations to strive for carbon neutrality require a shift in how infrastructure projects are managed and how we use resources.

"We are now seeing engagement from clients on carbon emissions in much the same way that we have engagement in terms of cost and schedule.

"Using CarbonTracker we are able to simulate carbon emissions from infrastructure not only from the materials used and construction, but also from operations and then decommissioning at the end.

"By doing this, you have the ability to create a baseline at the start of the design process and then input client objectives for carbon reductions so that we can make optimised design proposals and evaluate their feasibility. This enables us to capture carbon data, analyse and then review it as a central design criterion in exactly the same way as other important aspects such as cost or schedule."

Although the accuracy of the calculations made by the CarbonTracker tool is enhanced if BIM data is used, its ability to also capture non-BIM data means that it can be applied to any project.

> ***"We are now seeing engagement from clients on carbon emissions in much the same way that we have engagement in terms of cost and schedule."***
>
> **Eric Pruvost,** ***Digital Production Tools Development Director, SYSTRA***

To achieve this, SYSTRA's eco-designers use all of the data that is created for design projects to extract the information that is needed for CO_2 calculation, and then combine it with a CO_2 factor database.

To extract the data, SYSTRA uses Autodesk FORGE software for BIM data and ESRI ARCGIS web services for GIS data that allows a CO_2-based digital replica of the infrastructure to be built. All of the extracted data is then 'federated' into a web application that enables CO_2 emissions to be simulated and visualised.

"The information we manage on our projects used to be drawings and spreadsheets, but BIM has enabled the digital transformation of engineering," says Pruvost.

"We now have a much better understanding of infrastructure, but these are still 'dead' models until we create a digital twin and integrate all the functionality that is needed to show that the CO_2 level is fulfilling the client's objectives.

"But we are not here to say 'your project needs to be fully BIM', because we know that in 80% of our projects the maturity is not there yet. That's why CarbonTracker has been designed to work even without all the BIM data and to capture data in a more classical way."

A pilot project led by the Ecodesign and Sustainability Team at the Department of Consulting and Planning in France was concluded at the end of June. The applicaion is now being rolled out across the entire company to be completed before the end of September.

> ***"The simplicity and efficiency of the tool means it can be used on any project without cost of programme impacts."***
>
> **Michael Toher,** ***Head of Business Development in Conventional Rail, SYSTRA***

Michael Toher, SYSTRA's Head of Business Development in Conventional Rail, says: "Our plan is to make this 'business as usual' - considering the carbon impact on the whole life of the project at the very early stages of development. The simplicity and efficiency of the tool means it can be used on any project without cost of programme impacts and allows decision makers to consider the part their project plays on the journey to net zero at concept stage.

"Our vision is for CarbonTracker to be central to early design thinking and part of the fundamentals - similar to the way our approach to safety has evolved and is now an integral core consideration in design.

"We have created transparency in carbon measurement and placed it at the centre of design considerations, alongside project safety and cost. Of course, we've always undertaken carbon assessments within our projects, but the tools available have too often worked too late in the process, or been seen as sitting outside of the design process, almost as a trade off against cost.

"A change in our perception of carbon, driven in part by policy and in part by a change in culture by what I call 'the Greta generation' has meant we've had to change our approach to design for the passenger of the future. Interestingly, we often think that costs will go up as you reduce carbon but in my experience, that's not actually the case. Lower carbon often means lower costs, and this new tool allows us to demonstrate this with evidence to our clients."

In terms of CarbonTracker's deployment in the UK, Toher believes that the biggest benefits will be seen at the option selection stage of rail projects.

It will also enable individual contractors to present sustainability and cost benefits to the ultimate client when bidding for and delivering works packages on large-scale projects.

For example, how carbon emissions can be removed and optimised from the logistical perspective of delivering construction materials to complex infrastructure projects such as the TransPennine Route Upgrade (TRU) that have multiple worksites spread across a substantive geographical area.

He concludes: "CarbonTracker will help us to develop schemes for our clients by presenting the embodied and whole-life carbon as part of a balanced view against other priorities such as safety, cost, Putting Passengers First, and providing whole-life value.

"We are certainly excited to use this in the UK on a number of planned enhancement and renewal schemes where the value of carbon will be a key measure.

"SYSTRA is also leading the Low Carbon workstream on behalf of the Northern Rail Industry Leaders (NRIL) group, which published its first report on low-carbon traction options in December 2020. Their next report promoting the case for a rolling programme of electrification schemes in northern England will be published soon.

"The tool we have developed could help demonstrate the whole life-carbon saving of an electrified versus a non-electrified railway, and that we can successfully decarbonise 'decarbonisation schemes' through the use of materials and embodied carbon.

"We are certainly looking to bring the benefits of CarbonTracker to NRIL, to help promote the Government's levelling-up agenda and to 'build back better' in the North. I'm really hoping that in one year we'll be able to say that CarbonTracker was born in France, but made in the UK." ■

CarbonTracker enables carbon emissions from all stages of the lifecycle of any new piece of infrastructure to be visualised and then benchmarked, so that informed design decisions for lower-carbon alternatives can be made. SYSTRA.

FLOURISHING FLORA AND FAUNA...

Included in the *Transport Decarbonisation Plan* is a notion for sustainability to be at the heart of levelling up, with people everywhere reaping the benefits of cleaner, greener, healthier and more prosperous and pleasant environments in which to live, work and enjoy.

Community groups at stations up and down the country are already living by this mantra, with garden and wildlife projects popping up all over the place with the intention of improving local environments, encouraging people to use the railway, and creating valuable habitats for wildlife. NICK BRODRICK reports

The railway has arguably undersold its green-fingered credentials for too long.

Gardens were once the pride and joy of stationmasters and signalmen. Their efforts showed passengers that the stations were being cared for, and certainly did no harm to bees and other important wildlife.

Which is why it is good to see concerted efforts to reintroduce that spirit to more of our network. Some have been neatly tended for several years, while others are only just taking root.

The station garden at Tunbridge Wells is among Southeastern's 'top five' for promoting diversity and beautifying local areas. SOUTHEASTERN.

A meadow area at Whitlingham Junction in Norfolk is encouraging wildflowers that attract pollinating species. NETWORK RAIL.

One such project is at **Westerfield**, in Suffolk, where the local community has pulled together to create a delightful scene in a former area of wasteland.

Several hundred perennials, grasses and wildflowers have been planted, alongside herbs (thanks to the local cub group) which can be picked by visitors.

Sandy Burn, recognised as 'volunteer station adopter', has helped bring a true sense of community to Westerfield.

"People in the village are very interested in the project," she says.

"Residents from the nearby Fairways care home for adults with learning disabilities go to the station on a regular basis to look at the trains and the station with their carers, so I hope that the new planting will also help to improve their sensory input and well-being when they visit."

Information boards have also been installed, thanks to the Suffolk Butterfly Conservation Trust and Friends of the Earth.

Funding was provided by the East Suffolk Lines Community Rail Partnership, Community Rail Network and Westerfield Parish Council with in-kind support from Greater Anglia and the Essex and South Suffolk Community Rail Partnership.

At **Tunbridge Wells** in Kent, platform assistant Debbie Jagniaszek says her station's floral arrangement attracts "lots of passengers who stop and admire it, and they are respectful of the garden".

The station garden is ranked in Southeastern's acclaimed 'top five', along with Snodland, Elmstead Woods, Petts Wood and Eynsford. The operator acknowledges staff and local community volunteers for maintaining them, promoting "biodiversity and beautiful local areas".

Railway depots aren't necessarily renowned for descriptions such as "a place to relax and unwind after a long shift", or one that "promotes better well-being". But that's just what Network Rail can say for its Clapham site.

Staff there have recycled materials such as sleepers to create an "oasis of calm" with plants and a pond, and the company says that the garden has become an important place for trackworkers after "long shifts" maintaining the Wessex Route.

'Downstream' at **Wimbledon**, similar work has taken place.

"Everyone chipped in to help transform the yard in their spare time," says Christopher Courtney, section supervisor (track maintenance) from the Wimbledon depot.

"The feedback has been really positive ➜

➜ and having a place to relax and unwind is so beneficial, especially in our high-pressured environment… and to take a moment to rebalance."

That feelgood factor is being replicated in Norfolk at **Whitlingham Junction** (just east of Norwich), where NR has made a virtue of encroaching lineside tree and vegetation clearance by equipping it with a meadow to encourage wildflowers (annuals and perennials).

The main beneficiaries are pollinating insects, created in harmony with Buglife. The charity reminds us that "since 1940 we've lost 97% of our flower-rich meadows and hundreds of our pollinator species are in decline".

Part of a new 'Bee Line Map' (get it?), NR has taken a commendably serious approach, as exemplified by Anglia Region route engineer Liam Allen.

He says that the replanting is really important and plays a big part in helping the environment and to sustain habitats, adding: "Working with Buglife has been a real benefit to ensure that correct species are planted in the correct location."

Happily, it is expected to be the first of many such sites.

Greater Anglia is also teaming up with the WildEast movement to hand over a total of 6,400m² of land at 56 of its stations, as part of a bid to return 20% of the region's area to nature by 2050.

The local community has pulled together at Westerfield, with Suffolk Butterfly Conservation Trust and Friends of the Earth adding information boards. GREATER ANGLIA.

The garden at Wimbledon depot provides Network Rail staff with a place to relax and unwind. NETWORK RAIL,

Nor have bees been forgotten at **Sandy**, on the East Coast Main Line. A new garden dedicated to the winged wonders has been developed on the Bedfordshire station's platforms by Govia Thameslink Railway and environment charity Groundwork East.

And four more are being developed along the GTR route at Flitwick (Beds), Palmers Green and New Southgate (North London), and Newhaven Harbour (East Sussex).

NR's North West & Central Region press team have also been championing projects that will help nature to flourish at **Shap** summit on the West Coast Main Line, where the beneficiaries will be a local population of snakes and lizards.

Even at such altitude, the Up side (or west facing) of the cutting provides "ideal conditions for cold-blooded reptiles to bask in the sun's warmth".

However, the area had "become overgrown with birch and brash, providing too much shade for certain species to survive and thrive". These include the county's only venomous snake - the adder - which relies on exposed elements to successfully breed its young.

"When you think of animals living beside the railway, snakes and lizards aren't perhaps the first ones which spring to mind," says NR's very own ecologist Matthew Thomas.

"But like for so much other wildlife, embankments and cuttings that are rarely visited by humans provide a perfect sanctuary.

"We used special equipment to quietly clear overgrown trees and plants to provide perfect sunbathing conditions for our cold-blooded Cumbrian creatures at Shap."

Piles of logs have also been deliberately assembled to give sanctuary to some of the trackside's other critters and creatures.

Whoever said Network Rail, or indeed the railway, was just about track and trains? ■

Staff at Sandy station have been getting a buzz out of their new bee garden. GTR.

On the mountain slopes at Shap summit, trees and plants have been cleared to provide perfect basking conditions for reptiles such as this adder. NETWORK RAIL.