Net Zero Transport Infrastructure

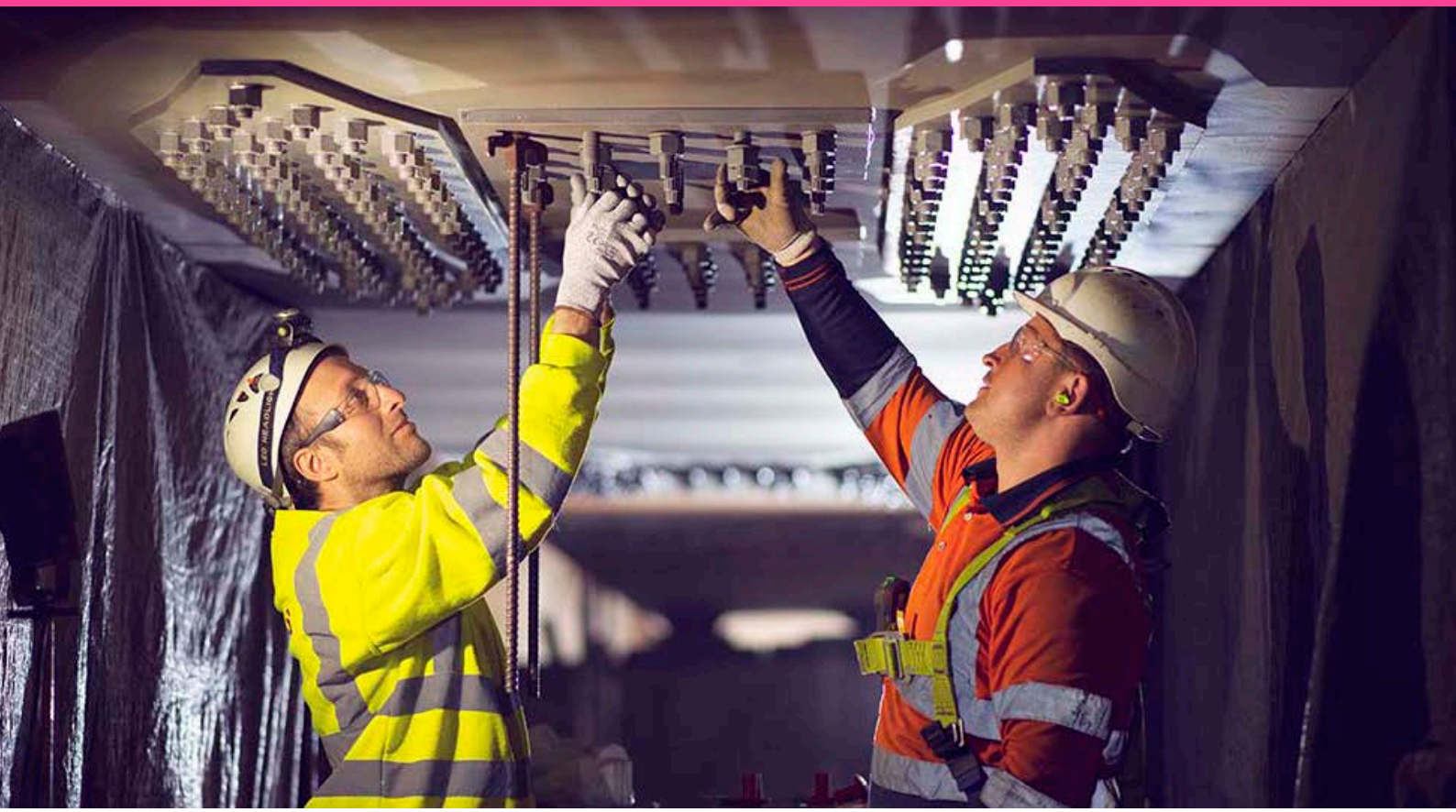
Where We Are, Where We're Going

If the destination is net zero carbon transport networks, what does the journey look like? And how far along it are we? It's a complex issue and a massive challenge - there are so many facets to consider.

Getting to true net zero involves rethinking how people and goods move around, locally, regionally, nationally and internationally. It also involves how we build, maintain, connect and improve our transport networks - counting both embodied and operational carbon at every stage of the value chain.

The backdrop will change significantly in the coming years as internal combustion engines are phased out and fossil fuels are eliminated from power generation. New materials, technologies and methods will evolve that we need to embrace. Plans and priorities will have to adapt constantly to emerging realities.

Based on what we currently know, here's our assessment of where the industry and our business are heading.



Transport Trends in The UK

To understand the scale of what net zero transport infrastructure means it helps to see the total travel picture across the nation. For a realistic representation it's best to go back to 2018 statistics, which were unaffected by Covid travel restrictions. A total of 808 billion passenger kilometres were travelled in Great Britain. 83% of those kilometres were travelled by cars, vans and taxis.

The 8.3 billion passenger journeys made on public transport vehicles represented an increase of 170% compared to 1960. The average person made 602 trips by car or van compared to 95 trips by public transport (source: **DoT**).

Predicting how travel patterns will change over an extended period is far from an exact science. The expectation is that government policy will include disincentives for private car use, particularly in urban areas, with perhaps 50% of urban trips being made by walking or cycling by 2050. And if 'last mile' deliveries really do switch from vans to drones alongside this, the nature of our town and city centres could change drastically.

Patterns for longer distance travel will possibly see more freight moved by rail. Passenger journeys by rail will be affected by capacity, convenience and accessibility. Trends for total rail passenger journeys between 2014 and 2019 were fairly static at about 1.7bn (source **ORR**) so it's unlikely that the total will grow significantly.

Planes, Trains And Automobiles

One thing we can predict with certainty is that the use of petroleum products in transport will fall dramatically in the coming decades. Innovate UK predicts that by 2050 UK transport will use 5.9 m tonnes of petroleum products. That might sound a lot but it's a massive reduction from the current level of approximately 60 m tonnes **(UK Transport Vision 2050)**.

How the carbon impact of different transport modes might change with technology isn't easy to quantify. There are many nuances and interconnections to consider.

For example, Virgin recently powered a plane from Heathrow to JFK using 100% Sustainable Air Fuel (SAF). If an aeroplane can be fueled sustainably, why not road and rail transport, you might think. Do we need to worry about tempting people from short haul flights to rail if planes can be powered by sustainable fuel? Of course, it's not quite that simple.

SAF is a mix of 88% HEFA (Hydroprocessed Esters and Fatty Acids) and 12% SAK (Synthetic Aromatic Kerosene). The HEFA is made from waste fats while the SAK is made from plant sugars. The first thing to note is that the combustion products still include CO2 (although the whole life carbon cost of SAF can be as low as 20% of that of conventional aviation fuel).

The total carbon cost of SAF depends on how raw materials are cultivated, processed and transported. Traceability is easy when you need enough fuel for a single flight, but currently SAF only accounts for 0.1% of global jet fuel.

The fuel is unquestionably more sustainable than using fossil fuels, but does it mean that the climate can withstand the current volume of airline and private jet flights, even if SAF-powered? And should we be giving over valuable arable land to growing fuel anyway?

Road Transport And EVs

Road transport has its own complications. Phasing out internal combustion engines that burn fossil fuels is obviously a positive step. It will have a massive impact on carbon emissions from transport. But designing and manufacturing a new electrically-powered vehicle currently has a huge embodied carbon cost. Maybe the length of time people retain new vehicles has as much impact as the fuel they use.

EVs also wear out tyres and brake pads faster than ICE equivalents because of their greater weight. They wear out road surfaces faster too. And personal preference means that the **average car weight** has increased 100kg over the last 10 years, only a small part of which is down to EV growth. We're dealing with a complex system.

Rail and bus journeys powered by renewable electricity are hard to beat when it comes to direct carbon emissions. But there currently isn't the capacity or high speed network to replace short and medium haul flights or many car journeys. Carbon emitted when we build and maintain the rail network also has to go into the ledger.

The answers concerning transport modes and carbon are complex and we need to look beyond simplistic 'this is good, that is bad' views of the world. The expectation is that car and aeroplane journeys will continue to increase unless, perhaps, governments step in with penalties and incentives that change behaviour on a massive scale.

Rail

As the rail network is increasingly electrified the focus shifts to how the electricity is generated. As the grid moves progressively towards renewables, rail transport will become even more sustainable.

Even so, less than 40% of the UK rail network is currently electrified. To have a fully electrified rail network by 2050 we will need to convert 448km of line every year until then. In 2022 just 2.2km of track was electrified. There may have to be a Plan B.

Active Transport And Easier Modal Shifts

Where there's an unarguable case regarding carbon reduction is with expanding active transport. While there will be an embodied carbon cost in building more safe walking and cycling routes, the reduction in carbon emissions when routes are in operation will more than compensate.

Easier modal shifts will facilitate greater use of active and sustainable transport for many journeys - at least in part. Effective carbon reduction from transport networks will increasingly feature transport hubs as essential components. Transport hubs connected to active transport routes make it easier for people to use active and public transport for at least some of their journey, reducing pressure on road networks particularly in urban areas.

Construction Materials

Every time we extend, improve or maintain road and rail infrastructure we consume materials.

Electrification of existing rail routes will involve vast quantities of steel and other metals to distribute power and concrete to support towers, poles and switchgear stations. Coming back to our earlier point about the need to electrify 448km of track every year, that's a lot of materials as well as plant and people to move around.

Perhaps as battery technology improves more trains will carry their own power. Or perhaps green hydrogen in place of diesel will become a viable alternative to a fully electrified network.

National Highways anticipates achieving net zero for maintenance and construction by 2040. The following chart outlines the key actions involved.

Key Actions and Anticipated Impact

Zero Carbon Concrete

Zero carbon concrete would seem an unlikely concept to most people. A huge amount of energy goes into producing cement, as well as extracting and processing and transporting other raw materials. Yet zero carbon concrete is technically feasible (in theory at least) and there are already lower-carbon alternatives on the market.

Recent changes implemented by the BSI allow up to 20% of the CEM 1 content to be replaced with finely ground limestone, which can be combined with fly ash and other materials to reduce carbon emissions by up to 20%.

As with other materials, decarbonising concrete also relies on using more energy from renewable sources during processing and for transport, instead of fossil fuels. To get to fully net zero concrete, new technologies such as carbon capture and storage will need to be deployed. Reducing the total amount of concrete used on each project through smarter design will remain a priority for the foreseeable future

Zero Carbon Steel

Steelmaking is another industry traditionally associated with high levels of carbon emissions. But steel isn't an easy material to replace. It's strong, durable, versatile and recyclable. It's also cost-effective.

Today, fossil-free steelmaking plants exist. The process uses hydrogen rather than coal in the reduction process for iron ore. The output from the steelmaking plant is obviously much cleaner than one using conventional blast furnaces. The big questions concern how easy it will be to scale up production to meet global demand and how the hydrogen used to fuel the process is generated.

Producing green hydrogen by electrolysis of water is usually 70-80% efficient (although new technologies claim up to 95% efficiency). If the electricity comes from a certifiable renewable source there's a large overall reduction in carbon emissions. Blue hydrogen is less attractive as it's still a byproduct of the petrochemical industry.

Organising The Work

The way that transport infrastructure projects are designed, planned and implemented must increasingly have carbon reduction as a fundamental objective. This is a powerful case for collaborative working and early contractor engagement so that collective knowledge and experience is directed at improved sustainability.

Minimising the movement of people, equipment and materials is another feature of our Lean implementation. Not only is this more efficient overall, it also helps reduce the use of fossil fuels.

Measuring Our Progress

Net zero is such a vast challenge that it's tempting to think you have minimal opportunity to make an impact. But we're committed to the view that change will happen through individuals and every business playing their part. If we all leave it to someone else, nothing changes. With disastrous consequences for us all.

Octavius Infrastructure will become a carbon neutral business in 2024. We have a plan to be zero carbon by 2030. This is how we're going about it:

- Avoiding carbon emissions by refining scopes of work.
- Minimising emissions using less fuel, less material, and using materials with lower embodied carbon wherever possible.
- Using alternative energy sources such as renewables and alternative fuels including certified and sustainable HVO and biofuels.
- Applying best practice principles in project delivery including innovation, low carbon alternatives, ensuring we have a better understanding of ecosystem services, Lean management and more efficient ways of working.
- Reducing avoidable waste using circular economy principles and targeting single use plastics.

Where current technologies, materials or equipment mean we're unable to eliminate all carbon emissions we have a programme of certified offsetting.

Everyone's Job

High level goals are one thing. Progress comes from the choices we make on every project - and often those our people and supply chain partners make every day. And this we can measure.

We use Thrive to measure the social value delivered on each project and framework. Carbon and waste reduction are key measurements within this. This could feature reduced vehicle movements through better planning, reduced material quantities or substituting lower carbon alternatives. We also document and measure carbon saving by using renewable and sustainable power for work cabins, plant, lighting and so on.

Our Lean implementation programme helps everyone stay focused on these goals as we strive for more efficient and less wasteful ways to do everything.

Sharing What We Learn

If you're committed to the goal of net zero it means being determined to learn from those who might be further advanced, as well as sharing what you know to help others on their journey.

We regularly share our sustainability learning with customers and supply chain partners through the Supply Chain Sustainability School, dedicated seminars and our freely available STOPThink! bulletins.

We welcome the recent launch of the UK research hub to decarbonise transport networks launched by Innovate UK. The **Research Hub for Decarbonised Adaptable and Resilient Transport Infrastructures (DARe)** will identify pathways and solutions for delivering a resilient, net zero transport system that works for people and communities. The aims are fully aligned with our net zero carbon mission.

This is a great example of how we can achieve net zero transport infrastructure through innovation, collaboration and shared best practice, which is how Octavius approaches every business challenge.

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For more information about our drive towards sustainability visit our Transport Infrastructure Resource Centre or contact us by email at hello@octavius.co.uk