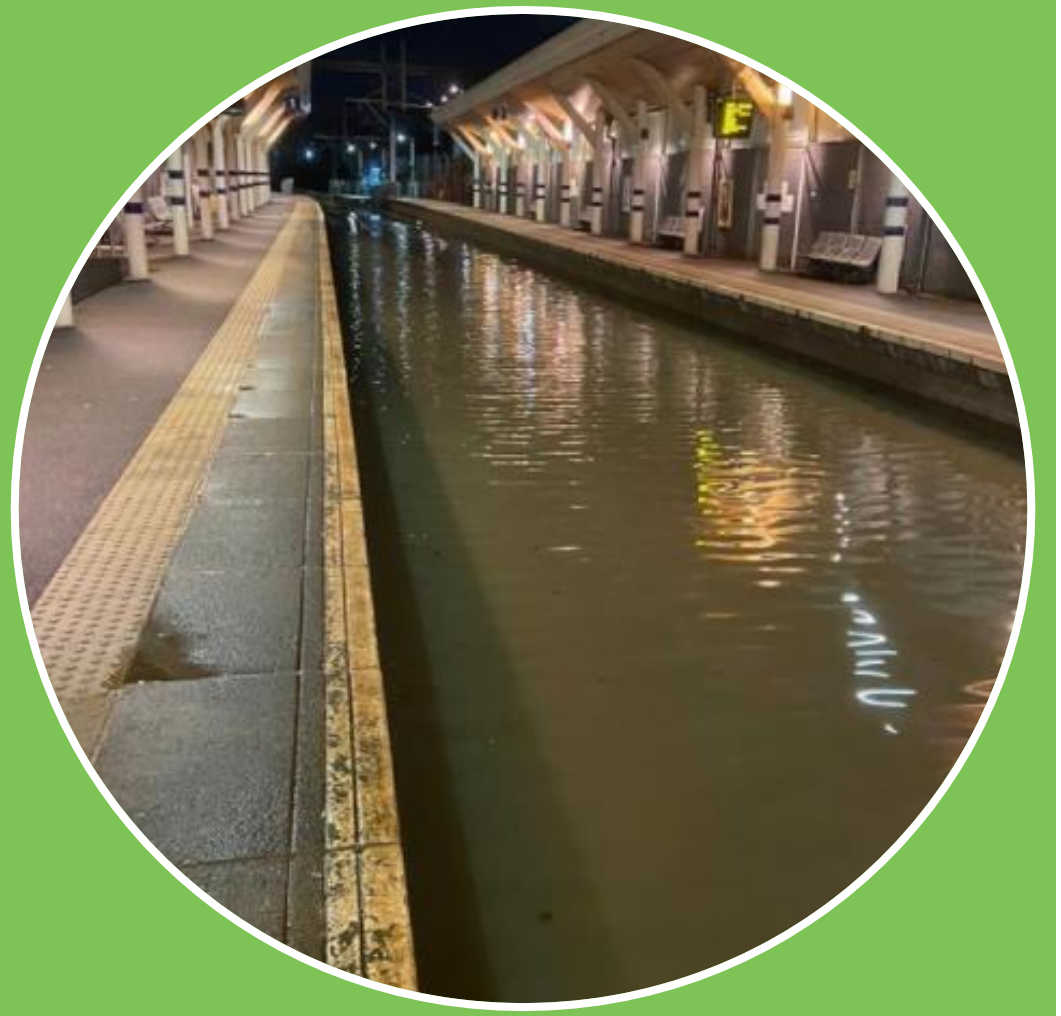
PWI Technical Seminar March 2022
The Climate Emergency
The Railway's Response



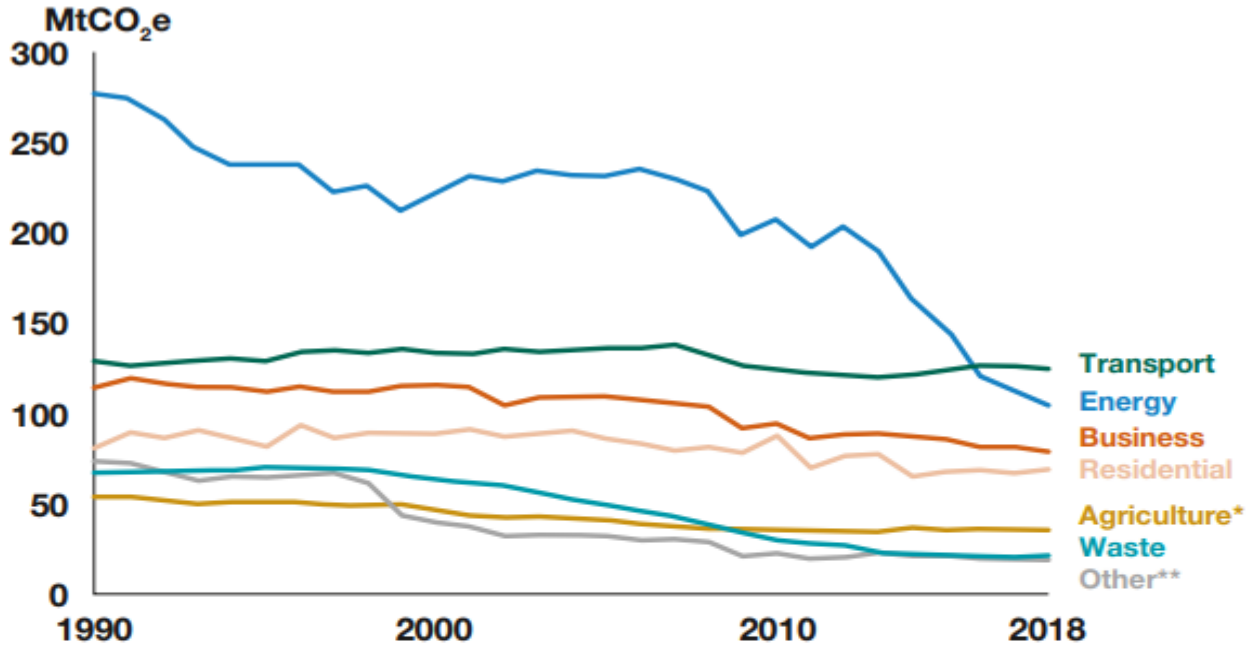
Brian Whitney

Technical Authority

Providing technical leadership

UK Domestic GHG emissions, 2018

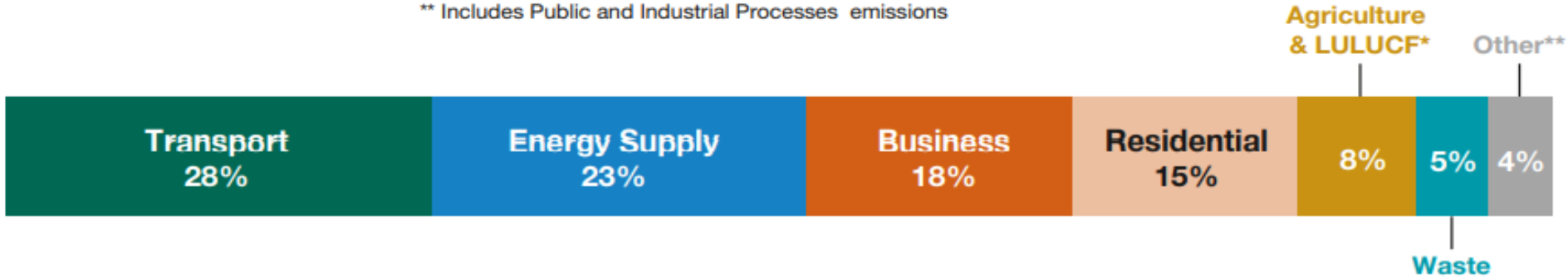
Figure 2: UK Domestic GHG emissions, 2018



* Includes Land Use, Land Use Change and Forestry
** Includes Public and Industrial Processes emissions

Transport became the largest emitting sector of GHG emissions in 2016
This follows large decreases in energy emissions while transport emissions have remained relatively static.

451 million tonnes of CO_2 equivalent ($MtCO_2e$)
is the total net domestic greenhouse gas emissions from all UK sectors in 2018, down 2.1% from 2017.



Source: 2018 UK greenhouse gas emissions[10]

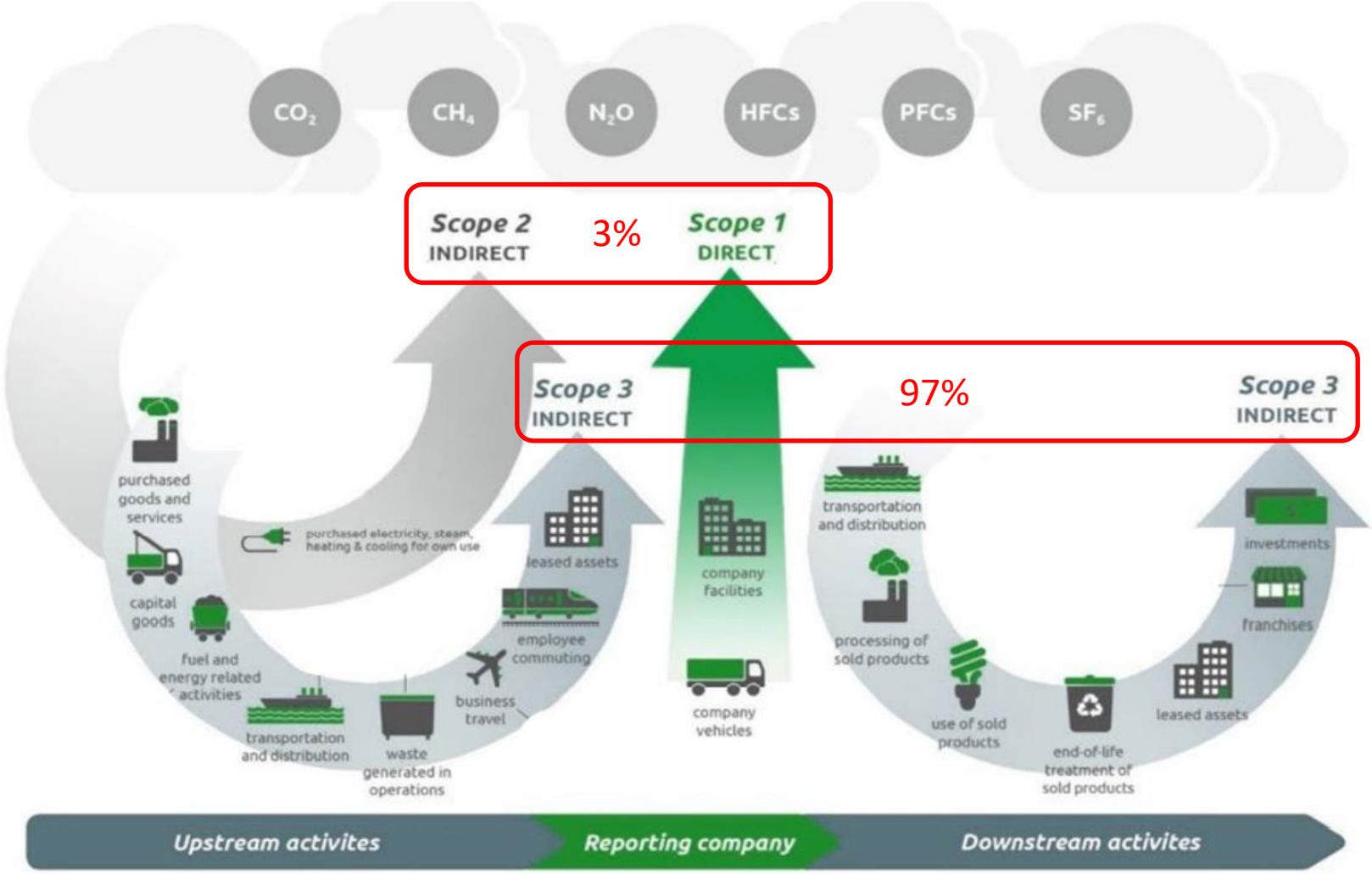
Scope 1, 2 and 3 Emissions

Scope 1 & 2 emissions will often be referred to as operational carbon, which is the energy needed to power the organisation's facilities and activities (including managed buildings and stations as well as company vehicles).

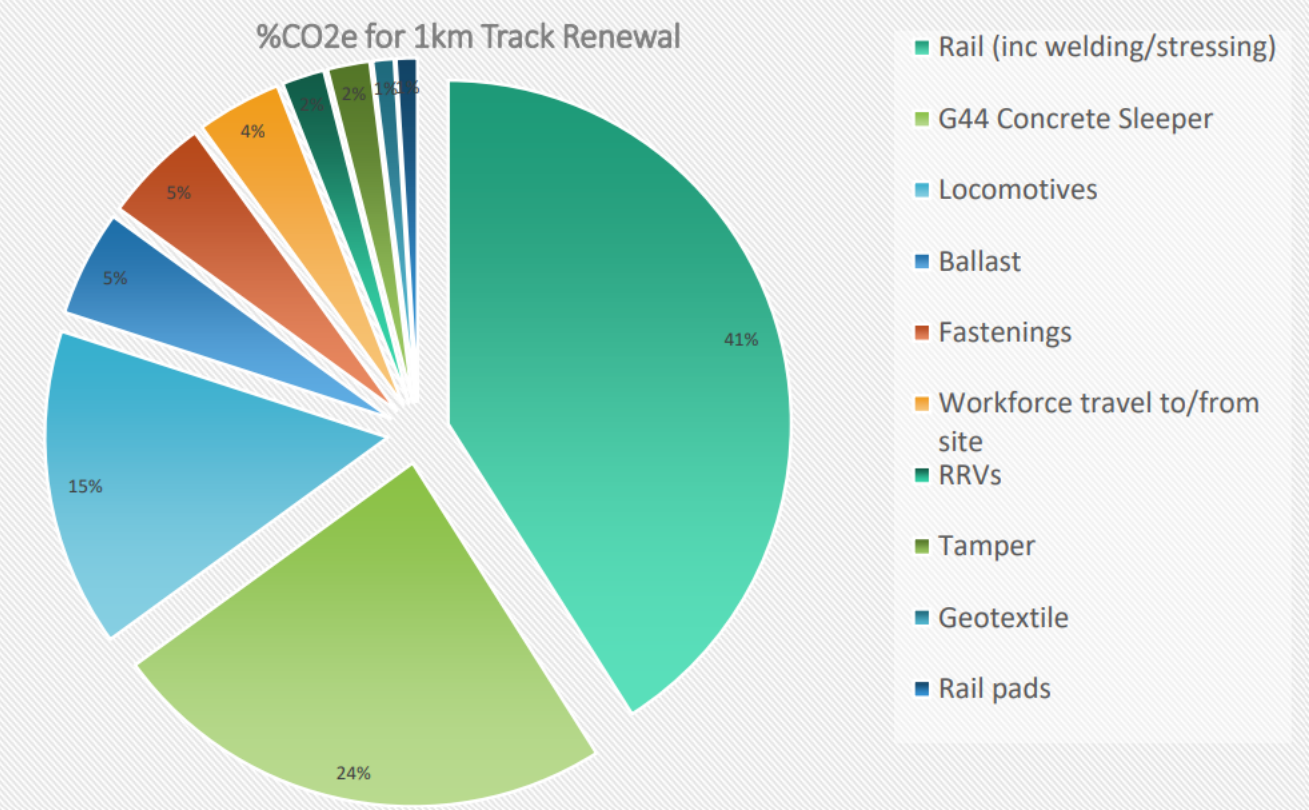
Scope 3 emissions will be mostly considered as capital carbon, which is the energy needed to build, renew, maintain, use and decommission the rail infrastructure.

In Network Rail, it is estimated that Scope 1 and 2 carbon emissions (its operational carbon) only account for about 3% of its global carbon footprint. The rest sits under Scope 3 (its capital carbon).

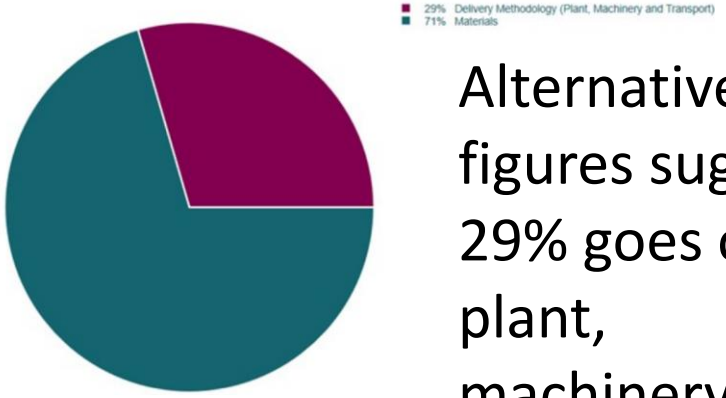
Figure 2 Scope 1, 2 and 3 Emissions (Source: GHG Protocol)



Percentage CO_2e for Concrete Sleeper Track Renewal



Manufacture and quarrying of materials accounts for 77% of the total equivalent CO_2 during installation



Alternative figures suggest 29% goes on plant, machinery and transport with 71% on materials

What does 100 tonnes of CO_2e looks like?

250m of single ballasted track (including transport of materials) =;

- 200 average diesel HGVs (59% laden) travelling 500km
- 50 average electric trains, each carrying 200 passengers over 500km
- 15 average diesel trains each carrying 200 passengers over 500km
- 3 average domestic flights carrying 200 passengers over 500km (e.g. Luton to Edinburgh)

1km of track = 1Diesel HGV driving 400,000 km

1km of single rail = 1 Diesel HGV driving 98,000 km

or

12 domestic flights each of 500km = construction of 1km of track

1 domestic flight of 500km = 16 electric train journeys over the same distance

4.2.2 Service lives

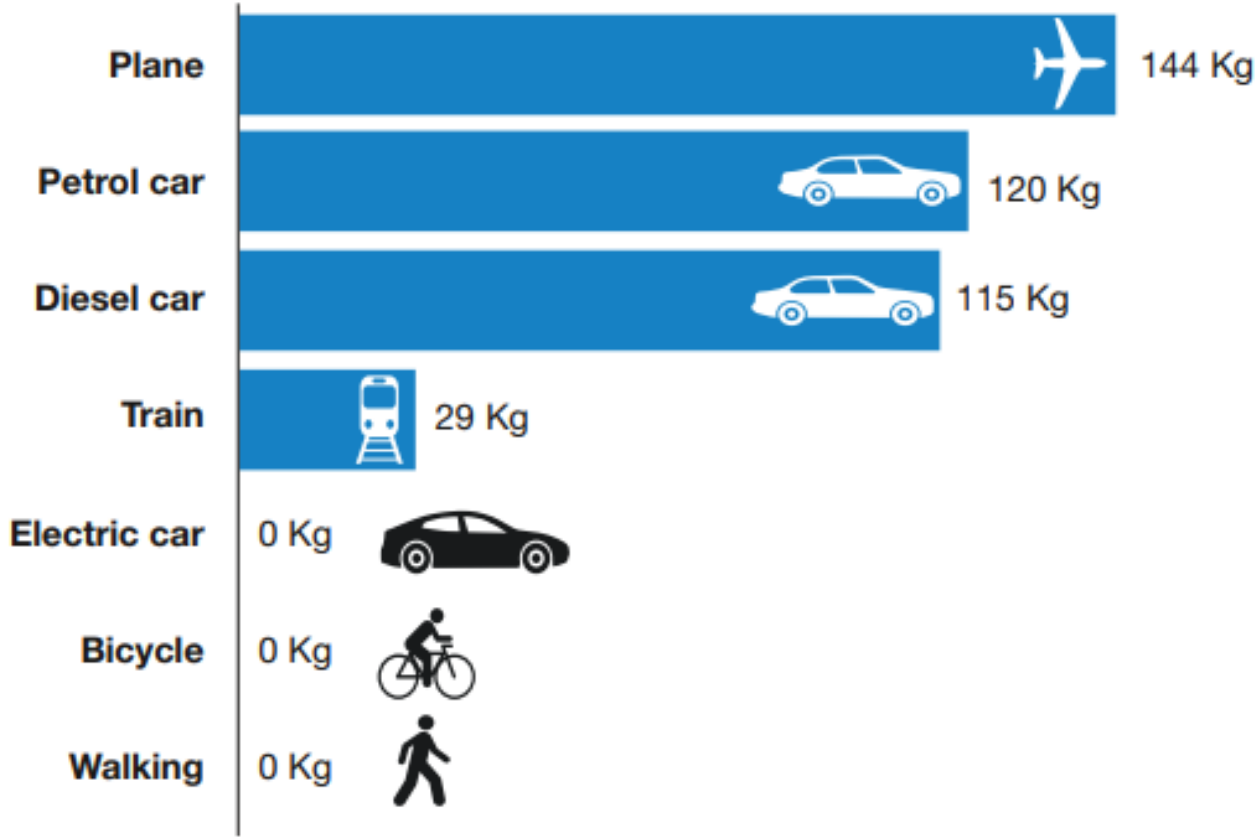
For product and systems approval, new designs of track and track components should be developed with the aim of achieving the following service lives. A design life for Sleepers, bearers, baseplates and rails in normal service conditions of:

- CEN60 track systems: the lesser of 1200 Equivalent Million Gross Tonnes, (EMGT) or 60 years for plain line and 1000 EMGT or 60 years for S&C;

- CEN56 track systems: the lesser of 1000 EMGT or 60 years for plain line and 800 EMGT or 60 years for S&C.

Sub-elements, e.g. ballast, rail pads, rail insulators, and rail fastenings, rail lubricators, switches and crossings, switch rollers, and insulated rail joints may have a design life of half of the sleepers, bearers and rails. Formation treatment and drainage should have a design life of 60 years.

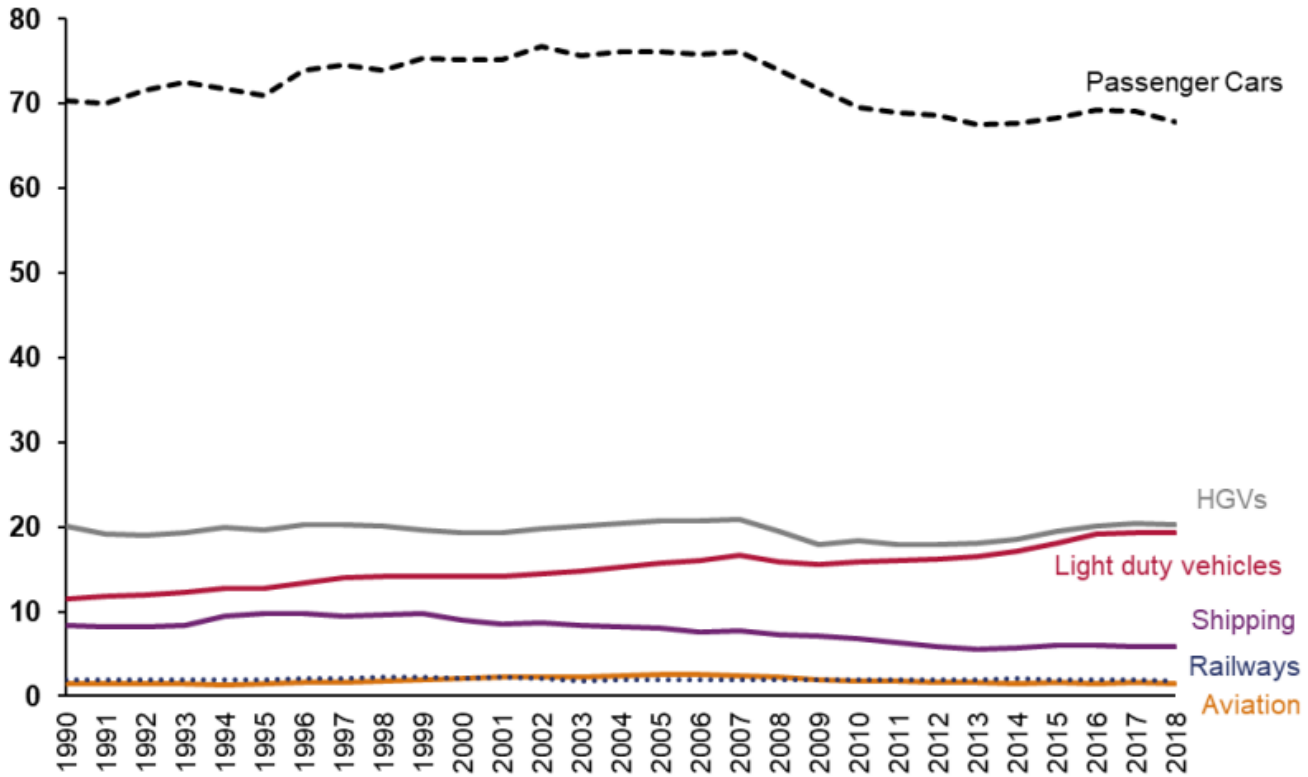
Indicative GHG emissions for a passenger travelling from London to Edinburgh, 2018



Source: Energy Saving Trust[15]

Notes
Plane journey excludes travel to/from airports.
Car emissions exclude tyre and brake wear.
Train emissions are based on an average for diesel and electric trains; if a route is fully electrified, emissions would be lower than those presented.

Estimated emissions of carbon dioxide ($MtCO_2e$) by transport category, UK, 1990 to 2018

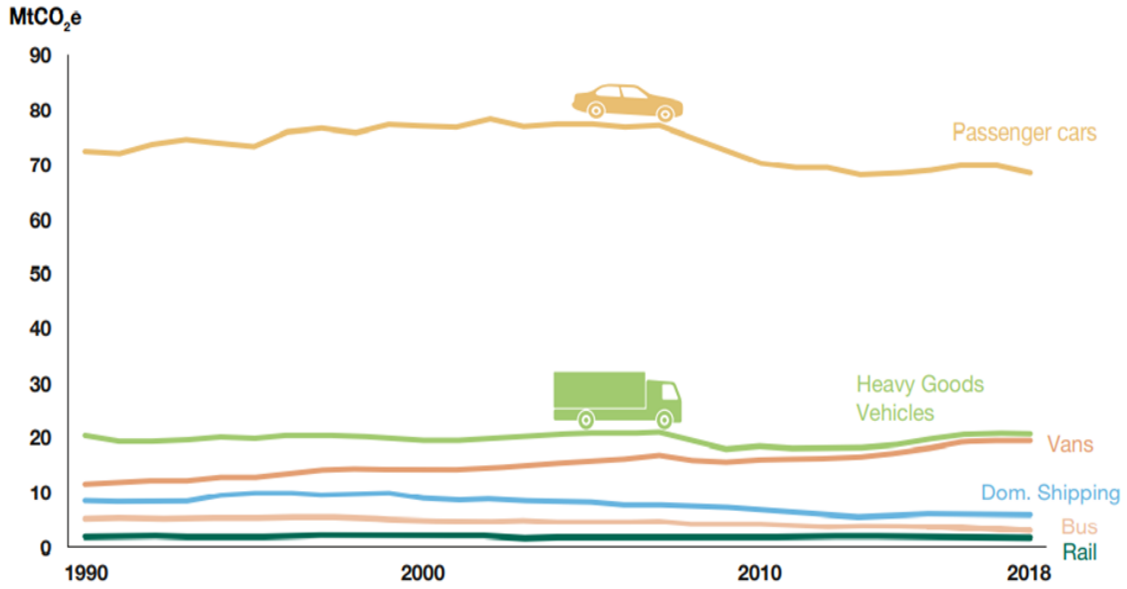


Rail is a relatively low-carbon form of transport, and is one of the most efficient ways of moving high volumes of people into city centres and moving people over long distances. In 2018, GHG emissions from rail (passenger and freight) made up just 1.4% of the UK's domestic transport emissions, while 10% of passenger miles travelled in Great Britain were by rail

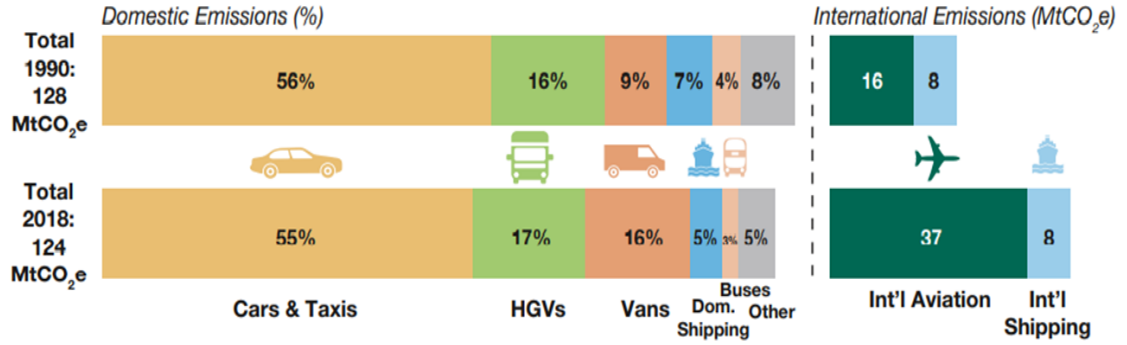
Source: Office of Rail and Road, 05 November 2020, Final UK greenhouse gas emissions national statistics: 1990 to 2018 BEIS (Table 4)

Only includes emissions from vehicles and not from transport related infrastructure. Aviation is for domestic aviation only

UK domestic and international GHG emissions, 2018

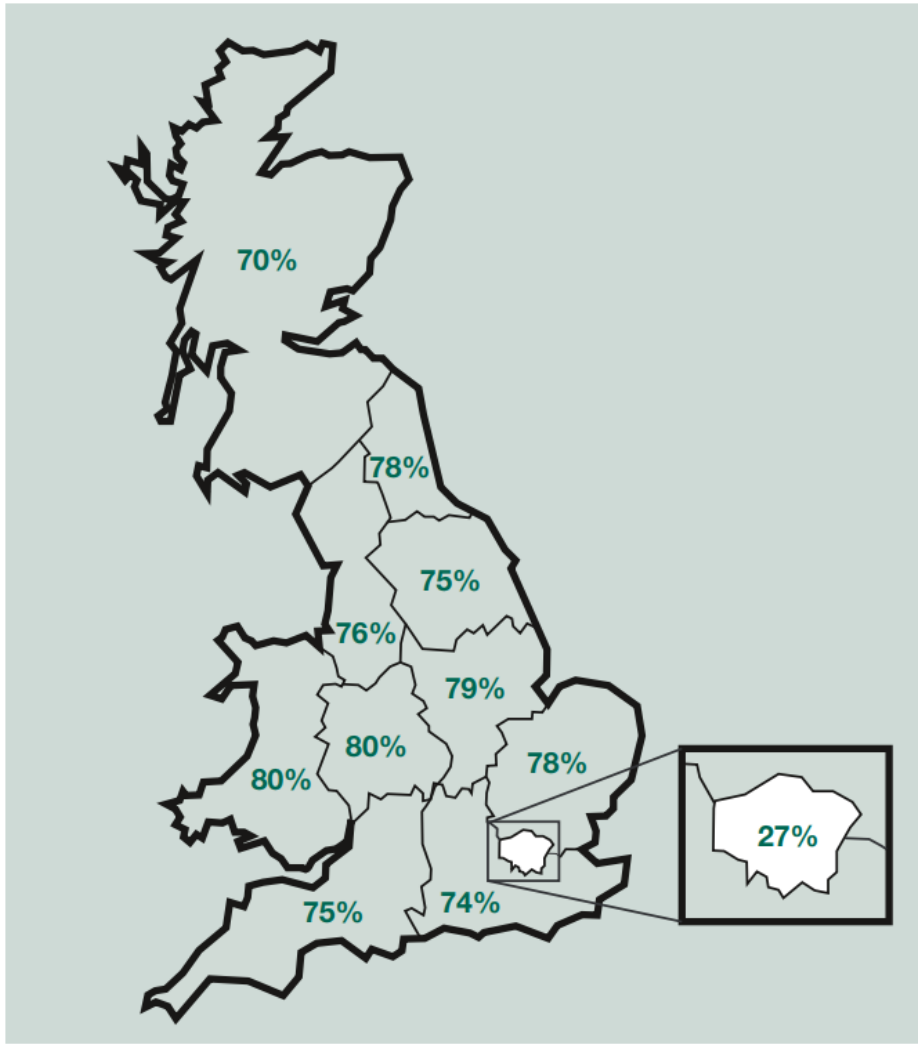


UK Transport GHG emissions by mode, 1990 and 2018



Source: 2018 UK greenhouse gas emissions[12]

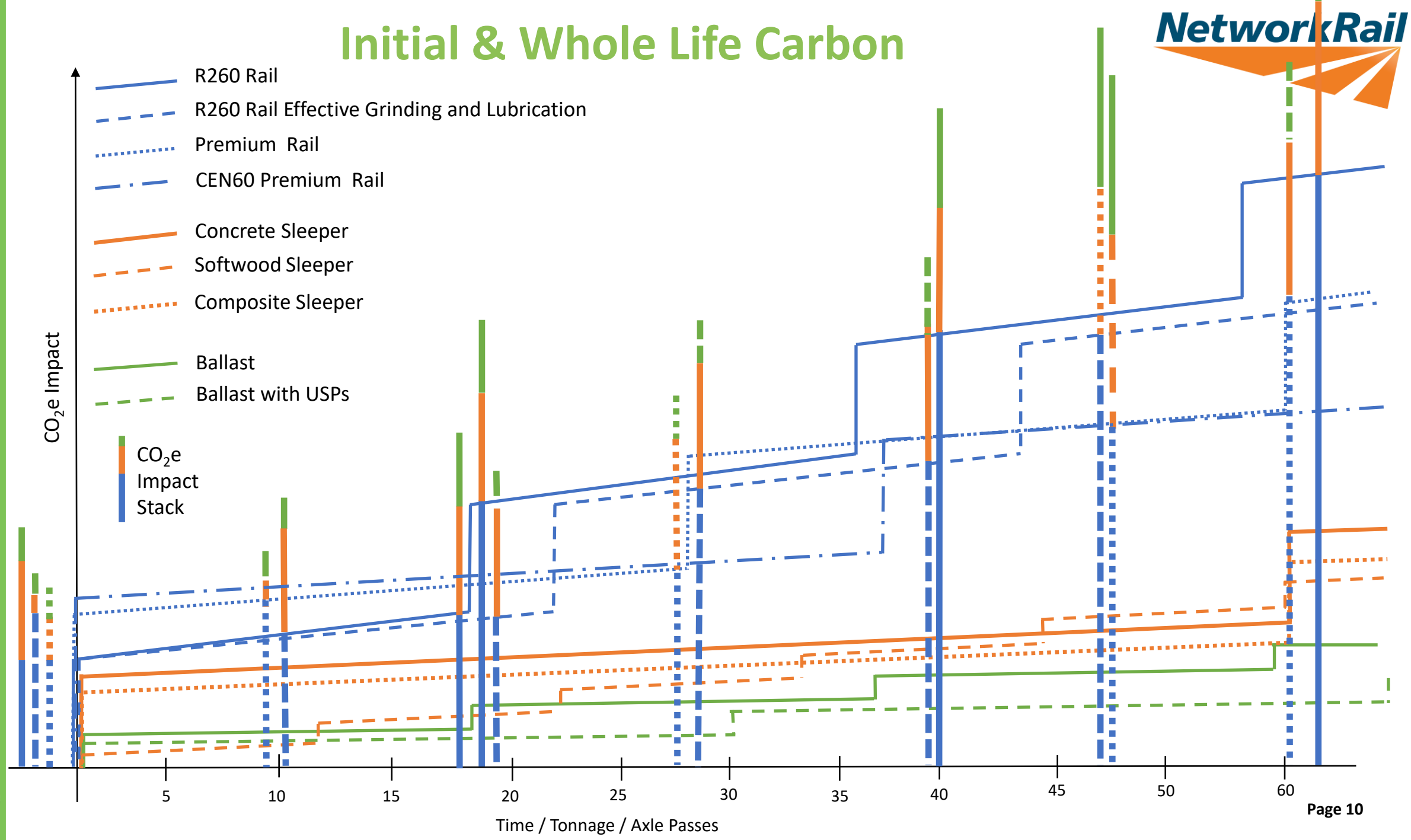
Percentage of workers usually travelling to work by car by region of workplace, Great Britain, 2018



Source: TSGB 2019, Chapter 1 – Modal Comparisons[13]

Across Great Britain, 68% of workers typically travelled to work by car in 2018. This did vary by region with London having a substantially lower proportion at just 27%

Initial & Whole Life Carbon



Opportunities

Decisions made at the earliest project stages will have the greatest impact

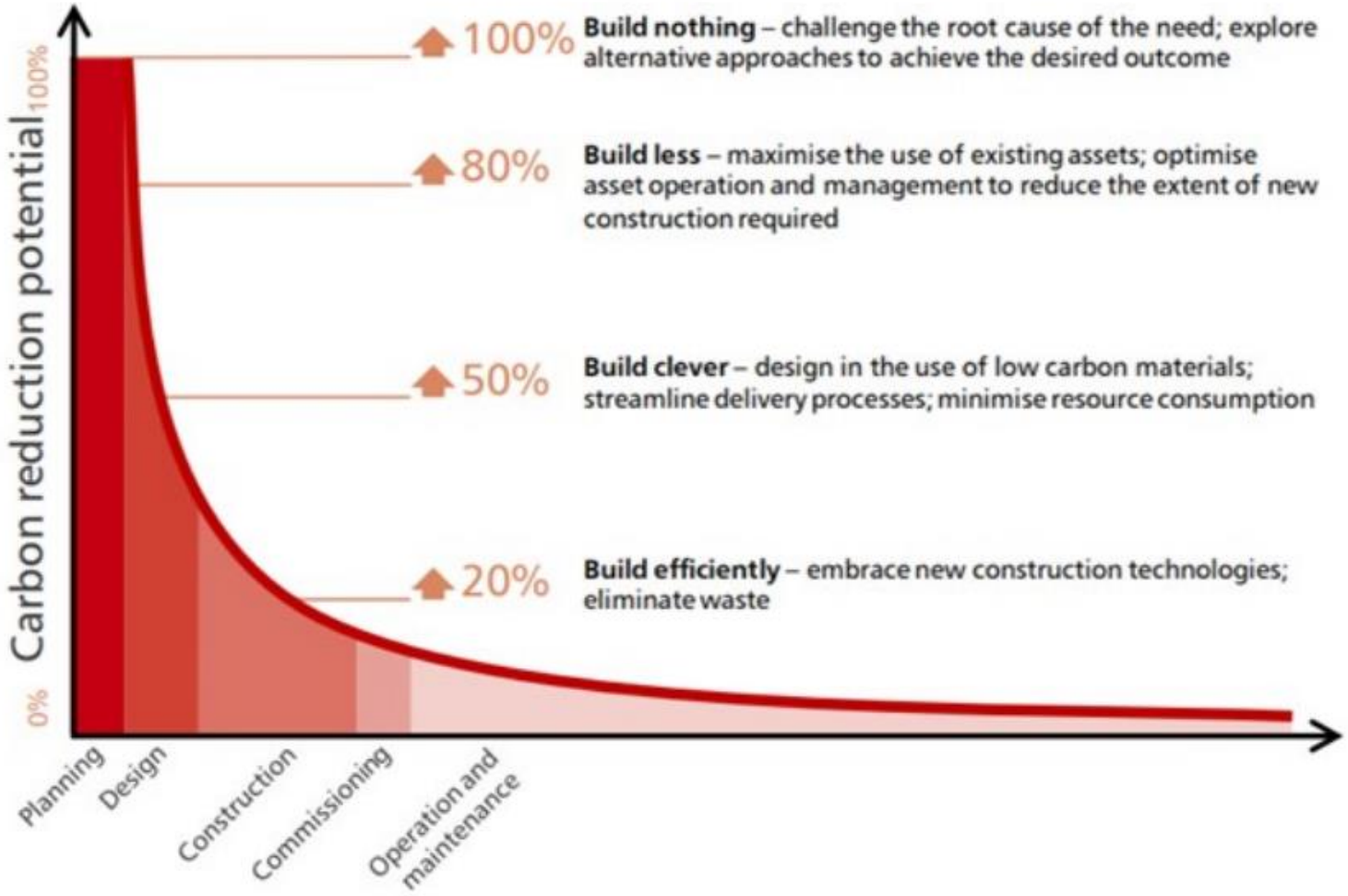
As a project progresses beyond option selection (GRIP 3), the potential for significant carbon reduction drastically reduces

Build nothing is the most effective but not normally practicable. Build less and more efficiently are options

The railway typically operates as a series of replacement cycles of different components which often have a different service lives

The avoidance of early renewal and the installation of assets which maximise life and lengthen the cycle between replacement offers a high potential for significant carbon reduction

Once installed there is little opportunity to reduce carbon during the assets life



Conclusions and Questions / Challenges

Initial Carbon and Cost can be in conflict

Whole Life Carbon and Cost are better aligned over the right time periods

Assessment timescales are critical – an assessment over 10 years gives a very different answer to an assessment over 60 years

Looking at the track as a system rather than separate components offers significant efficiencies

Can we extend the life of ballast through USPs or improved ballast sub layers to extend its life to a similar age as the sleeper? Will this also extend the life of sleepers and rail through improved track quality and reduced dynamic loading?

Extending the life of existing components through effective asset management can offer major benefits in reducing carbon emissions as 60 to 70% of the CO2e in track is created during the manufacture or quarrying of track components

In 2018, 68% of workers typically travelled to work by car and probably this is an even higher % today. How does the railway or the UK reduce that percentage? An example of London where this drops to 27% where cost and congestion make it largely prohibitive and public transport is more of a necessity than choice

Good asset management can deliver significant reductions in cost as well as reducing carbon emissions

Once installed there is little opportunity to reduce carbon during the assets life

We have to work better as a system as there is a limit to how much can we afford with costs for track renewal now around £1.48M per km

Many Thanks For The Invitation To Present and Attend Today

everyone home safe every day

Brian Whitney

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Technical Authority

Providing technical leadership