

# RAIL AND THE ENVIRONMENT

*October 2004*

Rail has long been, and remains, the least environmentally damaging form of powered transport. But advances in the automotive sector have significantly reduced harmful emissions from road vehicles in the past decade and some commentators are beginning to speculate that 'rail is now more environmentally polluting than the car'. However these comments are based on very selective and simplistic use of data. This booklet lays out the key facts on current performance and future developments.

Statistics on rail's current atmospheric emissions performance and the relative impact of rail in comparison with other modes show rail is still ahead. Nonetheless the UK rail industry is committed to further improving its environmental performance to ensure that rail remains at the forefront of the effort to minimise the impact of increasing transport use and provide the most sustainable transport solution.



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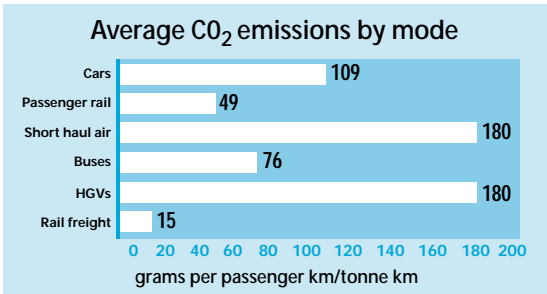


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## Global warming and climate change

In recent years climate change, as a result of global warming, has driven the need for significant reductions in harmful atmospheric emissions, particularly the principal 'greenhouse gas' carbon dioxide (CO<sub>2</sub>). Public transport, encompassing rail, buses and coaches, has a key role to play in reducing overall emissions from transport and, ultimately, in moving to a low carbon economy:

- rail produces less than 1% of the total UK emissions of CO<sub>2</sub> compared to 21% from road transport
- average emissions of CO<sub>2</sub> per passenger kilometre by rail are significantly lower than those from other modes: just 45% of those from cars, 27% of those from short-haul air and 64% of those from buses. Average rail freight emissions of CO<sub>2</sub> per tonne kilometre are just 8% of those from Heavy Goods Vehicles (HGVs)



Source: AEA Technology Environment for SRA, NAEI

- where passenger loadings are high, the environmental advantage of rail is even more apparent: along busy transport corridors CO<sub>2</sub> emissions per passenger kilometre from cars can be more than six times higher than those from trains on the same route

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## *High speed rail*

On longer distance journeys, high speed rail demonstrates clear environmental advantages over short haul air travel:

- CO<sub>2</sub> emissions and fuel use per passenger kilometre for rail are typically an order of magnitude lower than for air travel. For journeys between 250 and 500 kilometres (e.g. from London to destinations in continental Europe served by Eurostar) fuel usage on short haul flights is disproportionately high, largely due to the high rate of fuel burn required during take-off and initial climb
- short haul journeys by air can be up to three times more environmentally damaging than those by high speed rail in terms of their global warming impact due to the fact that aircraft deposit emissions much higher up in the atmosphere

## *Modal shift*

Rail can also make a significant contribution to reducing harmful CO<sub>2</sub> emissions through modal shift from road:

- the existing level of journeys by rail significantly reduces total CO<sub>2</sub> emissions: if 80% of current rail trips were made by car instead, over 2.25 million additional tonnes of CO<sub>2</sub> would be emitted into the atmosphere. Rail leaves a far less damaging environmental 'footprint' compared to the car
- electric trains, trams and light rail systems have the potential to be carbon-neutral if powered by electricity generated from renewable sources (e.g. wind, solar power)

Overall, rail has a key role to play in tackling greenhouse gas emissions and one that is unique in comparison to other types of transport since rail is the only form of powered transport realistically able to operate on a carbon-neutral basis, given the right power generation mix.

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## Pollution and air quality

In addition to greenhouse gas emissions, other harmful pollutants are emitted from transport including carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOCs), sulphur dioxide (SO<sub>2</sub>), and particulates (PM<sub>10</sub>). High levels of these pollutants can have serious detrimental effects on air quality and public health. In comparison with other transport modes rail performs relatively well in terms of emissions of these pollutants:

- rail generates, at most, only 1% of the total UK emissions of NO<sub>x</sub>, CO, and PM<sub>10</sub> whereas road transport contributes 49% of NO<sub>x</sub>, 62% of CO and 21% of PM<sub>10</sub>
- on a per kilometre basis, both passenger rail and rail freight perform better than cars and HGVs in terms of emissions of NO<sub>x</sub>, VOCs and CO. However performance on SO<sub>2</sub> and particulates is more mixed:

### Average pollutant emissions by mode

(grams per passenger km/tonne km)

	Car	Passenger rail	HGVs	Rail freight
PM <sub>10</sub>	0.012	0.016	0.048	0.004
NO <sub>x</sub>	0.5	0.31	1.74	0.11
SO <sub>2</sub>	0.003	0.21	0.005	0.016
VOCs	0.25	0.029	0.15	0.021
CO	2.57	0.08	0.33	0.032

Source: AEA Technology Environment for SRA

As the table shows, on average passenger rail produces more emissions of SO<sub>2</sub> and PM<sub>10</sub> per passenger kilometre than cars. Rail freight emits less of all pollutants than HGVs bar SO<sub>2</sub>.

Nevertheless, where local air quality is a particular problem – in major cities and conurbations – rail is part of the solution rather than a contributor to the problem since pollutant emissions per passenger kilometre are much lower where occupancies are high:

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- on busy urban routes (e.g. commuting into London) emissions per passenger kilometre from rail are well below the national averages and often significantly lower than emissions from cars: study results show that cars actually emit up to 8 times as much  $\text{NO}_x$ , 9 times as much  $\text{PM}_{10}$ , and 166 times as much CO compared to rail on these types of journey

### *Industry action to reduce pollutant emissions*

The UK rail industry is already working hard to significantly reduce harmful pollutant emissions, particularly from diesel operations, which make up about half of the total rail mileage in the UK:

- tough emissions standards as part of new EU regulations are now being implemented: new rail diesel engines entering service will be required to meet strict emissions standards, mirroring those already in place for the road sector
- an industry plan to switch to Sulphur Free Diesel (less than 10 parts per million) ahead of the regulatory requirement in 2012 is currently under development

In addition, significant investment since privatisation has seen new, cleaner diesel trains entering service on the network in recent years:

- the most modern diesel trains (built in the last 10 years) show a significant environmental improvement upon older stock and account for approximately half of the total diesel kilometres operated each year

The railway industry is making good progress on reducing the environmental impact of diesel operation in the UK. However more remains to be done and we are committed to ensuring that rail remains the least environmentally damaging form of powered transport.

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## *Did you know?*

In comparison with over 24 million cars and 425,000 goods vehicles, the railway industry uses only about 4400 diesel trains. These contributed to the movement of over 1 billion passengers and 89 million tonnes of freight in 2003/4

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average rail emissions of CO<sub>2</sub> per passenger kilometre are 45% of those from cars and 27% of those from short haul air. Rail freight emissions are just 8% of those from Heavy Goods Vehicles (HGVs)

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the UK rail industry is implementing tough emissions standards for new diesel engines entering service as part of new EU regulations

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short haul journeys by air can be up to three times more environmentally damaging than those by high speed rail in terms of their global warming impact

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