TRANSPORT

TRANSPORT POLICY STATEMENT: 09/06

THE CARBON CHALLENGE
CO_2 EMISSIONS FROM TRANSPORT

Institution of MECHANICAL ENGINEERS

Technological advances over the last 100 years have led to an exponential increase in energy use. In the main energy has been provided by fossil fuels which scientists have linked to dangerous rises in atmospheric CO_2 levels. Fossil fuels are a convenient source of power with high specific energy, which up to now have been available at an affordable cost. The downside is that in 2007 alone the UK released 560 million tonnes of carbon dioxide into the atmosphere[1]. Transport is responsible for 24% of the UK's CO_2 emissions and reducing its contribution is a cornerstone of the Government's aim of reducing our total greenhouse gas emissions by 80% by 2050.

Mechanical engineers will be at the forefront of reducing emissions from transport, across all the modes and in both the passenger and freight sectors. Most of the transport emissions data previously available has been presented in ways that support particular positions, thus making objective comparison difficult. This document identifies transport emissions by source using comparable metrics and highlights opportunities for the greatest reductions. It was compiled during a meeting of experts from across the transport sector in 2008.

THE CARBON CHALLENGE

PASSENGER TRANSPORT

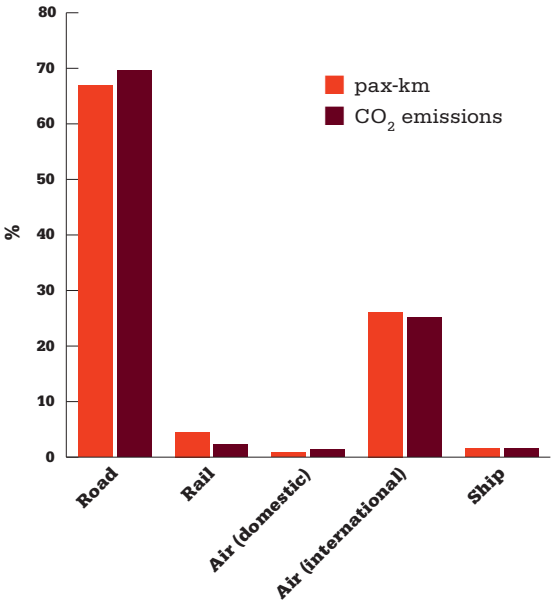
2007 statistics for UK passenger transport in passenger-kilometres (pax-km)

Road		Rail		Air (domestic)		Air (international)		Ship		Total	
pax-km total (billion)	% total	pax-km total (billion)	% total	pax-km total (billion)	% total	pax-km total (billion)	% total	pax-km total (billion)	% total	pax-km total (billion)	% total
742.0	**66.9**	**50.0**	**4.5**	**9.9**	**0.9**	**290.0**	**26.1**	**17.8**	**1.6**	**1109.7**	**100**

2007 CO_2 emissions from passenger transport

Road		Rail		Air (domestic)		Air (international)		Ship		Total	
Mt (CO_2)	% total	Mt (CO_2)	% total	Mt (CO_2)	% total	Mt (CO_2)	% total	Mt (CO_2)	% total	Mt (CO_2)	% total
91.64	**69.61**	**3.01**	**2.29**	**1.89**	**1.44**	**33.03**	**25.10**	**2.05**	**1.56**	**131.62**	**100**

COMPARISON OF 2007 PASSENGER-KILOMETRES AND CO_2 EMISSIONS



The above figures reveal much about our passenger transport system both in a domestic and international context. For example:

- Road transport, (which includes buses, motorcycles, scooters and light vans), accounts for just under 70% of total passenger transport emissions and it therefore has the potential to deliver significant reductions.
- Rail transport offers the lowest carbon impact per pax-km and this will improve as our energy supply becomes more sustainable.
- Emissions from domestic aircraft appear to be very small but this data does not include foreign owned airlines operating from the UK, such as Ryanair whose emissions are attributed to Eire. Foreign airline statistics are difficult to determine, but even if it is assumed that the UK's emissions from aviation were to double if all were included, it would still be relatively small compared with road transport. However, complacency is not an option as domestic air traffic is forecast to rise by 28% by 2012[2].
- Similarly shipping's contribution is also small but these figures are based only on UK registered passenger ships bunkering at UK ports.

SO WHAT SHOULD BE DONE?

- It would seem logical to encourage a shift from road to rail or sea where road travel is deemed non-essential. This could be achieved by developing a co-modal approach, based on the best carbon cost of the total journey, and maximising modal shift to rail where practical
- Rail accounts for relatively few passenger-kms but with more capacity – some of which being high speed – it has the potential to provide a viable alternative to road and air.
- Even so, low carbon vehicles, including electric and hybrid cars, will be an essential component of any strategy designed to reduce the carbon impact of passenger travel.
- There is also potential here to counter the forecast growth in domestic air travel and the consequent increase in emissions through new technology, improved operations and possibly the use of alternative fuels.

HOW DO WE DO IT?

Road Passenger Vehicles. The rate of progress with new road vehicle technology is encouraging; there are a wide range of options both on the market or close to being available that will deliver very significant emissions reductions. These, in order of their market availability between now and 2050, range from vehicle light-weighting, advanced petrol/diesel IC engines, biofuels, hybrids, electric vehicles, fuel cells and hydrogen IC engines. It may well be that Series Hybrids with advanced IC engines using 2nd generation biofuels will be the optimum solution until our electricity is supplied by renewable sources or there is a technology breakthrough with fuel cells.

This progress has been – and continues to be – in part motivated by EU legislation. Average vehicle passenger fleets are required to reduce emissions from 160gCO_2/km to 130g/km by 2015 and 95g/km by 2020. We believe that with rising car numbers and higher average mileage these targets fall short of what is required and will not necessarily result in a net reduction in emissions. To accommodate growth in vehicle numbers, much more stringent targets should be set. Even without fuel cells or hydrogen IC engines, we consider 70g/km to be achievable by 2020. Targets should also be set for 2050 and match the attributable emissions for a fuel cell powered vehicle – 30g/km. We believe that both of these targets are feasible and necessary if we are to make a meaningful contribution to emissions reduction.

Passenger Rail. As it stands, the passenger rail network is already near full capacity. Despite this the industry considers that by fully deploying new technology, particularly for signalling, further electrification and by improving operating procedures, it can increase capacity by up to 30%. However, further growth of 22.5% more passengers is forecast by 2014[3] leaving little scope for any modal shift without more rail capacity. The recently announced intention to electrify the Great Western Mainline will help but it is not enough. The resulting 15% increase in capacity on this line will not significantly reduce road traffic and the effect on emissions reduction will only be marginal. If modal shift to rail is a desirable outcome, far more capacity will ultimately be needed. Government plans for new high speed rail are welcome and will, in the long term, go some way to providing a viable alternative for domestic air passengers.

Domestic Air Travel. The inclusion of aviation in the EU Emissions Trading Scheme in January 2012 is seen by some as a solution to aircraft emissions. However this merely passes the problem on. Our long term aim should be to reduce the number of domestic air flights by providing viable and less pollutant alternative means of travel.

In the meantime there is potential to reduce emissions of existing aircraft by improved operating patterns, through the use of even lighter materials for furniture and fittings, more efficient engines and alternative fuels. These measures would result in a significant reduction in emissions. We also believe that more runways are necessary to reduce the time that aircraft are in the air and negate the current need for aircraft to stack to await a landing slot or queue to take off – not for more aircraft movements.

The production of new aircraft also offers an opportunity to design for optimum flight profiles and operating patterns. But with the average operating life of an aircraft being more than 25 years, this will take time. The international nature of the aviation industry also means that consensus for significant operational changes is very slow. Apart from airport development, where the UK can decide policy, most new aviation regulation, including domestic flights, now originates from the EU or internationally[4].

> **WE BELIEVE THAT WITH RISING CAR NUMBERS AND HIGHER AVERAGE MILEAGE, CURRENT VEHICLE FLEET TARGETS DON'T GO FAR ENOUGH. WE CONSIDER A TARGET OF 70gCO_2/KM BY 2020 BOTH TECHNICALLY ACHIEVABLE AND DESIRABLE.**

FREIGHT TRANSPORT

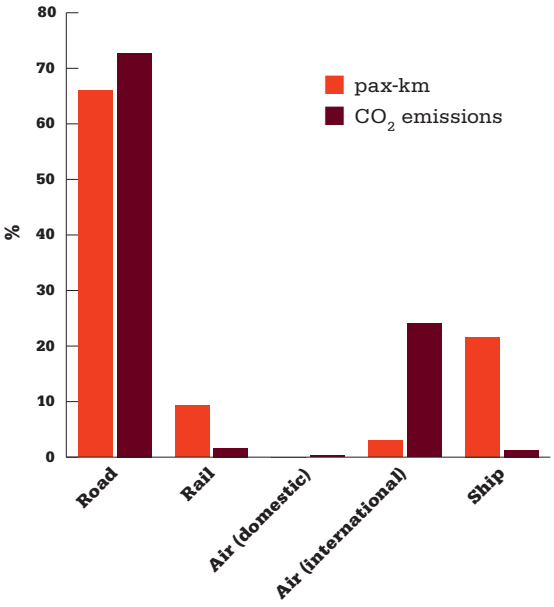
2007 statistics for UK freight transport in tonne-kilometres (t-km)

Road		Rail		Air (domestic)		Air (international)		Ship		Total	
t-km total (billion)	% total	t-km total (billion)	% total	t-km total (billion)	% total	t-km total (billion)	% total	t-km total (billion)	% total	t-km total (billion)	% total
155.6	**66.03**	**22.00**	**9.34**	**0.04**	**0.02**	**7.00**	**2.97**	**51.0**	**21.64**	**236.00**	**100**

2007 CO_2 emissions from freight transport

Road		Rail		Air (domestic)		Air (inter-national)		Ship		Total	
Mt (CO_2)	% total	Mt (CO_2)	% total	Mt (CO_2)	% total	Mt (CO_2)	% total	Mt (CO_2)	% total	Mt (CO_2)	% total
20.34	**72.74**	**0.46**	**1.65**	**0.08**	**0.27**	**6.73**	**24.06**	**0.36**	**1.28**	**27.96**	**100**

COMPARISON OF 2007 FREIGHT-KILOMETRES AND CO_2 EMISSIONS



The freight sector's carbon emissions are rarely studied holistically or across the transport modes. Freight accounts for over 20% of our total transport emissions[5] – nearly 5% of the UK's total – with road transport being the biggest contributor. Clearly the most economical mode in terms of emissions per tonne/km by a factor of 3 is ship, followed by rail. On the other hand, international air cargo is by far the worst polluter but it is difficult to envisage a viable business alternative.

SO WHAT SHOULD BE DONE?

Clearly modal shift to more carbon efficient modes must be encouraged. The UK's ports are very efficient and handle 95% of our imports and exports[6] and are considered to be the most successful in Europe. Most of this passes through a few main port hubs whose infrastructures' have become quite congested. However, the UK has 120 commercial ports, many of which remain under-utilised and indeed some are facing closure. With lots of marine capacity there seems little logic in transferring cargo to our already congested roads and railways.

HOW DO WE DO IT?

Rail, Sea and Road. Technology will help improve the overall carbon efficiency of all freight modes. However, the optimum solution lies with having an integrated long term strategy based on carbon. There is scope to reduce the volume of domestic freight carried overland by better utilisation of short sea shipping and increasing the number of port hubs. Onward movement of freight over the shorter final distances could then be carefully managed preferring rail where there is capacity and with road as the final option. This would require substantial investment in ports and the surrounding infrastructure but no more than what would be needed to provide greater capacity on the roads or railways.

Collaboration between the UK's haulage companies and Government on the management of such a network would be essential to ensure our companies are not disadvantaged. There would, in some instances, need to be an agreed compromise for the haulage of priority cargoes.

FREIGHT ACCOUNTS FOR OVER 20% OF ALL TRANSPORT EMISSIONS AND NEARLY 5% OF THE UK'S TOTAL EMISSIONS.

CONCLUSION

Reducing the UK's emissions from transport requires joined-up thinking, more ambitious targets and significant investment. In particular, the Institution of Mechanical Engineers recommends that:

- The current EU targets aimed at reducing emissions from cars are not stringent enough. We recommend that with an increasing vehicle fleet size, more miles being travelled and in order for any significant impact to be felt, average CO_2 emissions for the passenger vehicle fleet should be revised to 70g/km by 2020 and 30g/km by 2050.
- Whilst technology will facilitate significant reductions in transport emissions, it is clear that changes in public behaviour will also have a huge impact. There are a number of initiatives aimed at encouraging "greener" travel but with little co-ordination. We recommend that Government includes in its strategy for emissions reduction a clear plan to provide the public with the best options for travel based on carbon cost complimented with a ticketing structure that incentivises behaviour change.
- In order to maximise the contribution of freight towards meeting the UK's emission targets, Government should take a holistic approach to its freight strategy based upon cost and long term carbon benefit. It should stimulate investment in a wider hub and spoke freight network which uses all freight modes, and in particular fully utilises our short sea options.

REFERENCES

1 www.defra.gov.uk/ENVIRONMENT/statistcs/globatmos/download/ghg_ns_2090326.pdf

2 DfT, Future of Air Transport 2004

3 DfT, Delivering a Sustainable Railway – July 2007

4 The UK is one of 188 signatories to the Chicago Convention, regulated by the International Civil Aviation Organisation, co-ordinates and regulates international air travel. The convention establishes the rules governing airspace, aircraft registration and safety and details the rights of the signatories in relation to air travel. The Convention also exempts air fuels from tax.

5 DfT, Delivering a Sustainable Transport System: The Logistics Perspective December 2008

6 ICE State of Nation Report on Transport 2007

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