Reducing the Carbon Footprint of Road Freight Transport

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Economic Growth Increases Freight Transport Emissions per Capita

Source: Eom, Schipper and Thompson, 2012
CO₂ emissions from UK domestic road haulage

UK-registered lorries

Data Sources: DfT: Road Freight Statistics; DEFRA: Guidelines to GHG Conversion Factors for Company Reporting
Decarbonisation Framework for Road Freight Transport

- Weight of goods produced / consumed
- Weight of goods transported by road
- Road tonne-lifted
- Road tonne-kms
- Total vehicle-kms
- Timing of deliveries
- Energy efficiency
- CO₂

- Modal split
- Average handling factor
- Number of links
- Average length of haul
- Length of links
- Average load on laden trips
- Average % empty running

- Vehicle operation / fleet management
- Energy efficiency
- Energy consumption
- Carbon intensity of energy
- Carbon content of energy

Supply chain structure
Vehicle utilisation

Aggregate key parameter - lever

Similar analyses for other modes
Decarbonisation Scenario for UK Road Freight in 2050

- Total amount of freight movement stable at 2007 level
- Road share of freight tonne-kms reduced from 64% to 50%
- % of truck kilometres run empty reduced from 27% to 17%
- Average weight-based load factor up from 59% to 70%
- 40% improvement in energy efficiency
- 30% reduction in the carbon content of the energy
- 80% reduction in CO₂ emissions relative to 1990

Source: McKinnon and Piecyk, 2009
Trend in Freight Transport Intensity

*Ratio of Tonne-kms to GDP*

Source: Eurostat
% of Lorry-kms Run Empty: 1973-2010

Source: Department for Transport – CSRGT

Source: Eurostat report 63/2011
Increase in maximum truck weight – *industry takes time to adjust to new limit*

Declining density of freight – *no account taken of cube utilisation of lorries*

Growth of just-in-time replenishment – *more frequent delivery of smaller orders*
Fuel Consumption of HGVs: \textit{litres per 100 kms}

Source: Department for Transport – CSRGT
International Energy Agency Projections 2005-2050

*Trucking*

GHG emissions (m tonne CO2e)

- **Modal shift**: -6%
- **Alternative energy**: -29%
- **Improved efficiency**: -24%

Source: IEA, 2009

‘Blue map shift scenario’
Levels of Environmental Intervention

Supply Chain Structure

Logistics System Design

Vehicle Routing and Scheduling

Vehicle Loading

Driving

Vehicle Maintenance

Vehicle Design

Vehicle + equipment manufacturers

Logistic service providers

Individual shippers

Supply chain partners

National Government

European Commission
Software tool to help companies assess the combined effect of 38 decarbonisation measures – both technological and operational
Switch from powered to fixed-deck trailers (for double-decks)

Most double-deck box trailers in the UK have powered-decks allowing operators to lower and offload the top deck anywhere. The hydraulic system for the powered deck adds extra weight to the trailer reducing its fuel efficiency. It is estimated that a trailer with a fixed second deck is around 3-4% more fuel efficient than one with a powered deck, other things being equal. Box double-deck trailers with a fixed deck require external lifting gear at factories, warehouses and shops. Where space permits these can be installed quite quickly and, for some types of logistics operation, offer a good rate of return. Allowance must be made for the electricity used by the external lifting equipment and related CO2 emissions.

Typical Value: 3%

Select a value within the typical ranges shown above

Note: Enter 0% if you wish a vehicle type to be excluded

<table>
<thead>
<tr>
<th>% of kilometres applied to measure</th>
<th>This Year</th>
<th>2013</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5 to 18 tonne rigid - urban distribution</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Over 18 tonne rigid - special loads</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Over 32 tonne artics - primary trunking</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

1. Vehicle Design and Safety
   1.1 Adopt vehicles with automatic transmission
   1.2 Set vehicle speed limiters
   1.3 Reduce engine idling
   1.4 Switch from powered to fixed-deck trailers
   1.5 Reduce vehicle tare weight
   1.6 Install cab roof fairing

2013 2015

Yes Yes

Yes Yes

No No

Yes Yes
Horizontal Collaboration
ECR UK – Starfish project

Pilot survey 2009-10

27 Large FMCG Companies Participated 2010-11

Annualised Data

<table>
<thead>
<tr>
<th>Company</th>
<th>No of Flows</th>
<th>No of Movements /Year</th>
<th>No. of Pallets or Pall Equiv Moved/Year</th>
<th>Annual km (millions)</th>
<th>No of Depots</th>
<th>No. of Vehicles or Full Veh Equiv's</th>
<th>Annual Tpt CO2 Emissions (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Booker Group Plc</td>
<td>47,104</td>
<td>9,772,164</td>
<td>126,681,239</td>
<td>1,184.982</td>
<td>271</td>
<td>6,765</td>
<td>1,120,200</td>
</tr>
</tbody>
</table>

Represents
- £200 billion of UK turnover
- 8% of all UK road tonne-kms
- 6.3% of truck kilometres travelled

Annual Tonne km (billions) | Average length of haul (km)
---------------------------|---------------------------
10.63                      | 124.2
A total of 271 warehouse locations
6 retailers account for 91 warehouses
18 manufacturers account for 137
3 wholesalers account for 43

24 (46%) warehouses fall within 9 zones with a 35 km radius
Consolidation of Inter-regional Flows

*channelling flows through consolidation hubs in each region*

Location of hubs optimised with respect to intra-regional flows

<table>
<thead>
<tr>
<th>% saving for Part Load Movements Affected</th>
<th>Total Cost</th>
<th>Total Kilometres</th>
<th>Total Hours</th>
<th>Tonnes of CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.7%</td>
<td>20.8%</td>
<td>6.1%</td>
<td>18.9%</td>
<td></td>
</tr>
</tbody>
</table>
Cost Effectiveness of Reducing CO$_{2e}$

Abatement of CO$_{2e}$ vs Cost

Potential CO$_{2e}$ reduction:
slope = cost / tonne of CO$_{2e}$ saved

Average for other sectors?

Freight transport?
CO₂ Abatement Potential and Costs: *Sectoral Variations (idealised)*
Centre for Sustainable Road Freight Transport (CSRFT)

• Collaboration between Heriot-Watt and Cambridge Universities
• Funded by Engineering and Physical Sciences Research Council and industrial consortium (Volvo Trucks, DHL, Tesco, Wincanton, John Lewis, Goodyear etc)
• Start date: October 2012 5 year programme
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