A survey of expert opinion on the environmental impact of road freight transport in the UK in 2020

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Research background

- This research has been conducted as part of a 4 year multi-university project founded by the UK EPSRC, called Green Logistics.

- Universities involved: Cardiff, Heriot-Watt, Lancaster, Leeds, Southampton and Westminster

- The aim of GL project is to look at different ways to improve the economic, environmental and social sustainability of the UK transport industry.

- Heriot-Watt University- leadership in WM 2 – Understanding and Forecasting Business-as-Usual Trends.
Research background

Scientists at the Mauna Loa observatory in Hawaii say that CO₂ levels in the atmosphere now stand at 387 parts per million (ppm), up almost 40% since the industrial revolution and the highest for at least the last 650,000 years. http://www.esrl.noaa.gov/gmd/ccgg/trends/

CO₂ level in the atmosphere is rising at about 2 ppm each year as emissions continue unabated.

“It is increasingly unlikely any global agreement will deliver the radical reversal in emission trends required for stabilisation at 450 ppm CO₂e. Similarly the current framing of climate change cannot be reconciled with the rates of mitigation necessary to stabilise at 550 ppm CO₂e and even an optimistic interpretation suggests stabilisation much below 650 ppm CO₂e is improbable”.

Anderson K. and Bows A. (2008)

Sources of CO₂ Emissions by End User: UK 2004

- Passenger transport: 22%
- Freight transport: 6%
- Domestic: 27%
- Agric / Forestry: 1%
- Public: 4%
- Business: 40%
- Lorries: 22%
- Vans: 13%

UK transport sector CO₂ emissions by mode 2005 by source (excluding international aviation and shipping)

- Cars: 54%
- Vans: 13%
- Lorries: 22%
- Buses: 3%
- Railways: 2%
- UK Air: 2%
- UK Shipping: 3%
- Other: 1%

DEFRA, 2006
CfIT, 2007
Understanding and forecasting BAU trends—research design

Research issues:
- Recent trends incorporate the effects of past and current policy measures
- Extrapolatory and causally-based forecasting
- Discontinuity in statistical time-series
- Complex inter-relationship between the parameters
Two round Delphi survey

Sample composition (by stakeholder group)

First round:
- 347 invitations
- 100 responses
- Response rate = 29%

Response rate by stakeholder group

Second round:
- Personalised invitations sent out on 23rd June 2008, survey closed on 20 August 2008
- 66 responses
- Final report: October 2008
To what extent concern about climate change impacts companies’ operations

(0 = not at all and 4 = large extent)
Decoupling of economic growth and road freight traffic level

Decarbonisation Framework for Freight Transport

- Value of goods produced / consumed
  - Weight of goods produced / consumed
    - Weight of goods transported by road
      - Road tonnes.lifted
        - Road tonne-kms
          - Total vehicle-kms
            - Fuel consumption
              - CO₂

Less road freight traffic - better environmental performance
Over the past 10 years UK Gross Domestic Product (GDP) has been growing at a much faster rate than road tonne-kilometres.

Decoupling of Gross Domestic Product (GDP) and road tonne-kilometres?

How road tonne will grow up to 2020 compared to GDP?

Average response: - 0.5

(Where -2 = much slower, 0 = same rate and 2 = much faster)
Decarbonisation Framework for Freight Transport

- Weight of goods produced / consumed
- Weight of goods transported by road
- modal split

Key parameters:
- aggregate
- key parameter
- determinant
Changes in modal split (in terms of tonne-kms carried by different modes)

<table>
<thead>
<tr>
<th>Mode</th>
<th>2006</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of road</td>
<td>64%</td>
<td>59.9%</td>
</tr>
<tr>
<td>Share of rail</td>
<td>9%</td>
<td>11.4%</td>
</tr>
<tr>
<td>Share of inland waterways / coastal shipping</td>
<td>23%</td>
<td>24.4%</td>
</tr>
<tr>
<td>Share of pipeline</td>
<td>4%</td>
<td>4.4%</td>
</tr>
</tbody>
</table>
Projected changes in value of 1 tonne of product moved by different transport modes by 2020 (in real terms)

(-2 = large decrease and 2 = large increase)
Factors influencing the amount of freight carried by rail by 2020

- Reliability
- Flexibility
- Accessibility of terminals
- Cost
- Congested rail infrastructure
- Additional handling involved
- Bureaucracy
- Speed
- Commodity mix

(0 = not at all and 4 = large extent)
Effectiveness of potential Government measures in increasing rail’s share of the UK freight market

(0 = no effect and 4 = very effective)
How are the constraints on using rail and shipping services likely to change by 2020?

(-2 = constraints significantly easing and 2 = constraints significantly tightening)
Decarbonisation Framework for Freight Transport

- Weight of goods produced / consumed
- Weight of goods transported by road
- Road tonnes-lifted
- Road tonne-kms
  - modal split
  - average handling factor
  - average length of links
  - supply chain structure
  - efficiency of vehicle routing

aggregate  key parameter  determinant
Projected changes in the key parameters determining supply chain structure

- Average length of haul
  - 2006: 87km
  - 2020: 85.9km

- Handling factor (road)
  - 2006: 3.4
  - 2020: 3.4
By how much the amount of freight traffic will change by 2020 in terms of total tonne-kms carried by all modes within the UK?

(Current situation = 100, higher values represent more tonne-kilometres)

257 billion tonne-kms in 2005 → 322 billion tonne-kms in 2020
Likely changes in the key parameters determining vehicle utilisation

- **Lading factor**
  - 2006: 57%
  - 2020: 63.8%

- **Empty running**
  - 2006: 27%
  - 2020: 22.1%
Decarbonisation Framework for Freight Transport

- Weight of goods produced / consumed
- Weight of goods transported by road
- Road tonnes-lifted
- Road tonne-kms
- Total vehicle-kms
- Timing of deliveries
- Pattern of delivery
- Exposure to traffic conditions
- Average speeds
- Fuel efficiency
- CO₂
- Carbon intensity of fuel
- Fuel consumption
- Average handling factor
- Average length of links
- Average load on laden trips
- Average % empty running
- Distribution of vehicle-kms by vehicle size, weight and type
- Efficiency of vehicle routing
- Vehicle carrying capacity by weight / volume
- Vehicle utilisation on laden trips
- Level of backhauling
- Other influences on fuel efficiency
- Modal split
- Supply chain structure
- Aggregate
- Key parameter
- Determinant
Expected changes in fuel efficiency and carbon intensity

(-2 = large decrease and 2 = large increase)
Likely effectiveness of potential means of improving the fuel efficiency by 2020

0 = no importance  4 = very important

- Vehicle design
- Engine performance
- Information technology
- Training schemes for fuel efficient driving
- Out of hours delivery operation
- Higher fuel prices
- Incentive schemes for employees
- Improved vehicle maintenance
- Dissemination of best practice in fuel management

(0 = no importance  4 = very important)
Conclusions

• The inter-relationships between the range of business trends which interact to determine freight traffic levels and related externalities are very complex.

• Some of the trends anticipated by the panel are likely to increase the environmental impact, while others will have an offsetting effect.

• The standard deviation values revealed significant differences of opinion on some key variables, which may narrow in the second round of the survey.

• Further analysis and modelling work are needed to evaluate the relative contribution of all factors to the emission trends.
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