Metropolitan Transport Research Unit

Supplementary report on environmental and safety impacts of the transfer of freight from road to rail on key strategic corridors

Report prepared for Campaign for Better Transport

December 2017

Introduction

Subsequent to the report on reducing congestion in selected strategic road corridors through transferring freight to rail[1] the Freight on Rail group have asked for an assessment of the scale of impact on key aspects of air quality and carbon emissions in those corridors. This has drawn on the work undertaken for the "Tracks" programme, both on air quality and carbon[2], across a range of traffic forecasts. In addition the question of any impact on road casualties was included.

Key Conclusions

The overall conclusions support in greater detail the congestion benefits which could be obtained by transferring freight to rail in the four corridors studied. These are of sufficient scale to be relevant both in terms of a scheme and a policy context.

Moving from a corridor approach to national policy framework, co-ordinated with initiatives such as the Northern Powerhouse freight work, would clearly deliver a range of important impacts ranging from the reduction of air pollution to carbon and accident savings. While this note is not a detailed environmental impact assessment, the evidence suggests that benefits are clearly achievable by the study date of 2025.

Less significant benefits would be achieved in the short term as progress is made, for example in improving rail capacity to the ports, and more significant benefits would be achieved if the policy of improving capacity and the attractiveness of rail freight (or other alternatives) were extended beyond this timescale.

The summary of results are:

Reduction in NOx from all road traffic in the corridors studied	10%
Reduction in particulates from all road traffic in the corridors studied	7%
Reduction in carbon from all HGVs over 3.5t gvw nationally	2.5%
Potential reduction in fatalities and KSI involving an HGV >3.5t gvw	3-4 fatalities, 17-18 KSI

The Tracks report referred to earlier estimates the impact on carbon emissions of applying a range of policies similar to the corridor study but across the whole network. This produced a reduction of 2.5-3 million tonnes CO2 Equivalent, about 20% of all HGV carbon emissions.

1 *Impact on congestion of transfer of freight from road to rail on key strategic corridors*, MTRU for DfT and CfBT, March 2017

2 *Environmental quality, climate change and transport innovation* Tracks programme, October 2017 The calculations for emissions in this report use the same data set (Corinair 5).

Study approach

Two approaches have been taken, the first, for air quality, considers what proportional reduction would be obtained locally in the corridors. The rationale is that this is where the impact is felt. This uses the count data and proportions of different vehicle types.

For carbon and accidents, where the national impacts are relevant, reductions in vehicle kilometres are generated from the count data using average journey lengths for the type of vehicle traffic being reduced. Rates of emissions and casualty involvement can then be used to provide an absolute number of casualties. Since accident data is available in greater detail by type of road, a weighted average for motorway and A roads is used. However, details are not available for different types of HGV so the figures assume a uniform involvement rate. This is unlikely to be the case due to the significantly greater forces involved when an articulated HGV is involved in an accident. It is therefore likely to be an underestimate and further work is needed in this area. This is considered in more detail later in this note.

For locally significant emissions the proportion of traffic is used as the key measure to which emission factors are applied. This provides an estimate of the proportion of emissions from each vehicle type. In this analysis five main types of vehicle are used to which different emission factors are applied.

- Passenger car
- LGV
- Smaller HGVs (mainly rigid)
- Articulated HGVs over 32tonnes gvw.

These emission factors are then applied to vehicle kilometres on the strategic network corridors alone. This is because road distribution from rail depots will be required for many consignments and therefore emission and accident rates for built up and local roads have not been used in the analysis. This also avoids issues caused by the greater variability in accident rates and emission characteristics on local road networks. Nevertheless this gives a high level picture of the potential improvement from reducing bulk road freight, and of the likely scale of benefit from the transfers suggested in the original report.

An assumption had to be made about the proportion of Euro V and Euro VI HGVs in the traffic mix, and about the average emissions from cars, in 2025. The proportion for HGVs was 86% EuroVI and 14% EuroV. Whether this will be achieved depends on how quickly HGVs are replaced. It is also assumed that the standards achieve in practise what they do in theory and in a test environment. The average car emissions (petrol and diesel combined) for 2025 were taken to be 75gms/km, compatible with the Tracks air quality calculations.

Each of the impacts is considered in more detail in the following sections of the report.

NOx

The emission factors used for 2025 are derived from most recently published Corinair data as in the Tracks Air Quality report. This takes account of the improvement in real world performance from cars and vans to 2025. We have also added the assumption that 10% of all motive power for cars will be from electricity. The picture for LGVs is uncertain so no parallel allowance is made for LGVs. However, this would tend to increase the share of NOx produced by the articulated HGVs.

Two corridors analysed in the report, M6 and M62, have been used and the percentage of each type of traffic averaged over the three links used as examples in the freight transfer study. In fact the numbers are fairly consistent for HGVs.

For other corridors there are greater difference between the spot counts along the corridor, for example the A14 is variable but with very similar proportions of articulated HGVs between Cambridge and Ipswich (average 11%) but higher articulated HGV flows (17%) on the section of the A14 between Ipswich and Felixstowe.

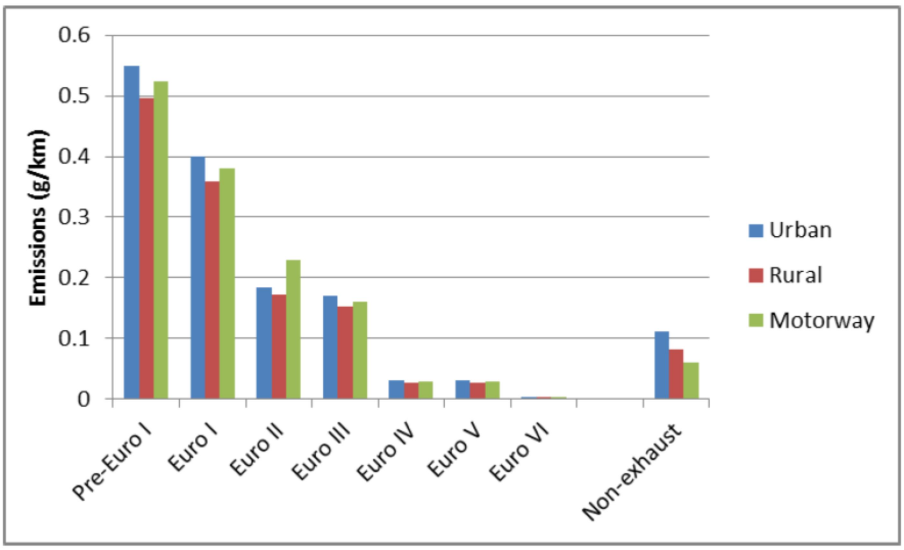
Table 1: Share of road traffic NOx by vehicle type

Vehicle type	Emission factor	% of flow M6	% of flow M62	% of NOx M6	% of NOx M62
Passenger car	.063	71%	70%	24%	23%
LGV	.248	12%	14%	16%	19%
Rigid HGV	.462	4%	4%	9%	9%
Artic HGV >32 T	.804	12%	12%	50%	49%

The table shows that about 50% of NOx from traffic in the two corridors would be derived from articulated HGVs and the predicted transfer to road of 20% would therefore reduce the total NOx from all traffic by about 10%. Similar results would be obtained wherever the proportion of the largest GHVs (5 axles or more) is at this level.

Particulates

For particulates, if the Euro standards are achieved in practise, these will fall very dramatically in relation to exhaust emissions by 2025 and the articulated vehicle share would be similar to the vehicle kilometres (around 10%). Of far more concern are the particulates from tyres, brakes and resuspension of already deposited particulates and similar material. This is shown clearly in the figure below. This also illustrates how particulates from HGV exhausts could become relatively insignificant. This of course depends on the Euro VI standards being achieved in real world situations.



Reproduced from: TRL report CPR 1976, October 2014

Non-exhaust particulates have been understood to be at least as great as exhaust emissions for some time[3] but they are unaffected by exhaust improvements. By 2025 they will almost certainly form the great majority of particulates from road transport. Supported by a recent European Commission review[4] the DEFRA non-exhaust emission rates have been used to produce an estimate for these particulates. In equivalent terms to the NOx data, the total share of particulates from articulated HGVs is 35%, and the projected reduction of 20% in such traffic would produce a reduction of 7% of total traffic particulates. This estimate is sensitive to any further reduction from other classes of vehicle from the introduction of regenerative braking. The latter is integral to electric and hybrid vehicles and is an area where further detailed work could be undertaken. In the meantime this estimate of the importance of HGV particulates should be considered conservative.

Carbon

To put the traffic changes in a national carbon context it was necessary to generate vehicle kilometres from the count data. The approach used was to calculate a vehicle kilometre reduction using the median value for average journey length (200 kilometres) multiplied by the vehicle flow. It was assumed that the 2000 vehicle per day reduction target was achieved in 4 corridors. In fact in the transfer study this figure was exceeded in 3 of the 4 corridors.

The calculation is: vehs per day (8000) X 365 X ave trip length (200). This produced a saving in vehicle kilometres from articulated HGVs with 5 or more axles of .58 billion a year.

The total for all HGVs is 18.6 billion vehicle kilometres per year (2015). The same source (Corinair 5) was used for HGV emissions for Euro V and Euro VI articulated vehicles >32t gvw. These are in fact the same (794 gm/km) – the main changes to the standards are not carbon-related.

This produced an estimate of a reduction of 464,000 tonnes of CO_2 equivalent a year, about 2.5% of the national total for carbon from all HGVs (3.5t gvw and above).

Casualties in reported accidents involving HGVs

Accident calculations have a lower level of certainty for several reasons:

- The individual characteristics of different stretches of road have a significant impact in terms of accident rates and the analysis is not at this level of detail
- Assumptions need to be made about length of haul and national data has been used
- Casualty involvement rates are available nationally at the all HGV level (over 3.5t gvw) but not for different types, in particular the specific category which is affected by the freight transfer[5].

As with carbon, the approach used was to calculate a vehicle kilometre reduction using the median value for average journey length (200 kilometres) multiplied by the annual flow. Again it was assumed that the 2000 vehicle target was achieved in 4 corridors.

To test for casualty impact an average involvement rate for Motorways and non-built up A roads was applied to the vehicle kilometres.

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3 For example see Harrison et al, 2001, as reported in *Briefing paper on non-exhaust particulate emissions from road transport,* TRL 2014: http://www.lowemissionstrategies.org/downloads/Jan15/Non_Exhaust_Particles11.pdf

4 *Non-exhaust traffic related emissions. Brake and tyre wear PM*, JRC 2014: https://ec.europa.eu/jrc

5 See Table RAS 30017 *Casualties in reported accidents involving vehicles of different types by built-up and non built-up roads 2016,* DfT

This average was weighted by the proportion of vehicle kilometres on each road type – 12.3 billion for Motorways and 9.7 billion for the A roads[6]. Thus the motorways have a greater impact on the average than the A roads. The weighted average vehicle involvement rates are set out below.

Table 2 Involvement rates for HGVs

	Fatalities	KSI
Road type	Rate per billion veh km	Rate per billion veh km
Non-built up A	13.6	56.3
Motorway	2.5	15.7
Weighted average	6.8	30.8

Source: RAS 30017, TRA 0204, MTRU calculation

Applying the weighted average to the vehicle kilometres saved produced an estimate of 3-4 fatalities per annum which might have been avoided and an equivalent figure of 17-18 killed or seriously injured (KSI). Given the small number of fatalities and the variation in accidents in terms of specific locations, it is clear that this is subject to a higher level of uncertainty than the other estimates in this note. However they are sufficient to indicate that benefits would occur and that, if a specific business case were required, a more detailed study would be worthwhile, using better vehicle type data and local accident data for the corridors.

Conclusions

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6 See TRA0204 *Road traffic by vehicle type and road class in Great Britain, annual 2016,* DfT