

# PR13 Initial Industry Plan Supporting Document

## **Rail Industry CP5 environment plan**

September 2011



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### ***Supporting the Initial Industry Plan***

#### **Introduction**

In 2010 the Sustainable Rail Programme (SRP) published Managing Rail's Environmental Impact in CP5 and Beyond as a supporting document to the industry's Planning Ahead 2010: The long term planning framework. This document follows on from Managing Rail's Environmental Impact in CP5 and Beyond, and supports the industry's Initial Industry Plan (IIP).

In that initial document the SRP described how the full range of environmental issues were reviewed at a cross-industry workshop, with two key issues – carbon and noise impacts related to the EU Environmental Noise Directive (ENDs) – identified as needing to be addressed at the industry level. The document contained an initial analysis of these issues and proposed the development of a carbon management framework for rail, as well as confirming the need for further analysis and understanding of the risks and opportunities arising from carbon and noise.

This document outlines the significant progress made on these issues over the intervening year. It outlines some of the key opportunities and barriers to developing a lower-carbon railway and updates the carbon trajectories first shown in 2010. It defines the industry-agreed carbon management framework and estimates the resources needed to meet the requirements of ENDs.

As with Managing Rail's Environmental Impact in CP5 and Beyond, this document is published by the SRP on behalf of the industry and is the result of significant work by many organisations from across GB rail (see appendix 1 for an outline of the process).

## Executive Summary

Transport needs to decarbonise if the UK is to meet its commitments to tackle climate change, and while rail is already a low-carbon mode it is committed to doing more to drive emissions down further. Planning Ahead 2010 set the ambition to enable 50% reduction in carbon in the long-term<sup>1</sup>, this environment plan sets out the necessary first steps in meeting that goal.

Traction emissions make up the bulk of GB rail's carbon footprint. Under the IIP's Base Plan scenario they are forecast to remain steady through CP5, while associated energy costs rise significantly to over £900 million. Research suggests that, all else being equal, energy efficiency interventions can lead to a 5% reduction in traction carbon emissions over CP5, compared to business as usual. But critically there is a lack of data and understanding needed to realise rail's full potential. Further barriers include costs and benefits sitting in different organisations, the poor status of carbon in decisions and the drive to reduce capital costs.

The Carbon Management Framework outlined in this plan is designed to overcome these barriers and enable greater carbon and cost savings by the industry. The framework entails:

- Energy efficiency being included in franchise contracts
- Incentivising increases in on-train metering and a reduction in electricity system losses
- Including whole life and whole system energy and costs in investment decisions
- Robust measuring and monitoring of carbon

The framework will need industry, government and the regulator to work together to implement it. When implemented it will enable progress a lower-carbon railway in short and medium term. In the longer term electrification, allied to the decarbonisation of electricity generation, will be critical to delivering a step-change in carbon emissions potentially leading to a 64% reduction in traction emissions between 2009/10 and 2050.

On noise issues, the need to meet the requirements of the EU Environmental Noise Directive will entail both a need for investigation of areas identified as having possible noise issues and potential interventions to reduce noise impacts. It is estimated that this will need a resource commitment of £11-23.5 million through the course of CP5.

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<sup>1</sup> Based on a 2009/10 baseline

## DEVELOPING A LOWER CARBON RAILWAY

### Carbon - The Current Context

The UK Government has set ambitious targets to reduce carbon emissions by 34% by 2020<sup>2</sup> and 80% by 2050, both from 1990 levels. The Scottish Government has the same 2050 target, but has set a tighter interim reduction target of 42% per cent by 2020.

As transport is a major, and currently growing, part of the UK carbon footprint, there will need to be a significant reduction in transport emissions if these targets are to be met. Domestic transport accounts for 22% of UK greenhouse gas emissions<sup>3</sup>, with road transport responsible for the major part of this. Partly as a result, much of the focus on reducing transport emissions up to now has been on road vehicles, and it is starting to have an effect.

Emissions of new cars are falling, driven by EU legislation and higher fuel prices. By 2020, carmakers selling vehicles in the EU must achieve an average of no more than 95g/km of CO<sub>2</sub> across all vehicles sold in the EU (pending an impact assessment). At current UK occupancy levels this would equate to 59gCO<sub>2</sub> per passenger km, however it would take a significant number of years for this new average to roll out across the existing road fleet.

Beyond this, the potential for electric vehicles – both as low carbon transport and a new green manufacturing industry – has also been given significant priority and funding.

Rail is already among the lowest carbon modes of transport and is likely to remain so. UK figures published in August 2011<sup>4</sup> show that National Rail emits 53.4gCO<sub>2</sub> per passenger km (ppkm) compared to an average 127 gCO<sub>2</sub> for cars. For freight, rail emits 28 gCO<sub>2</sub> per tonne km compared to 127.2 gCO<sub>2</sub> for HGVs.

However, in response to the challenge of climate change the industry acknowledges that it needs to deliver significant carbon savings, even within the constraints of growth, improved service delivery and overall value for money. This last in particular offers a potential win-win, as energy costs are predicted to rise significantly in the coming years.

In Planning Ahead 2010: The long term planning framework, the rail industry outlined its ambition to enable rail to cut its carbon emissions by 50% in the long-term and contribute widely to cutting transport's carbon emissions. This, it stated, could be achieved through electrification, cleaner fuels and greater energy efficiency.

The plans and analysis in this document lay out the first, crucial steps to achieving that ambition.

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<sup>2</sup> This may rise to 42% if appropriate international agreements on limiting carbon emissions are achieved

<sup>3</sup> [www.decc.gov.uk/en/content/cms/statistics/climate\\_stats/gg\\_emissions/uk\\_emissions/2009\\_final/2009\\_final.aspx](http://www.decc.gov.uk/en/content/cms/statistics/climate_stats/gg_emissions/uk_emissions/2009_final/2009_final.aspx)

<sup>4</sup> From August 2011 Guidelines to Defra/DECC's Greenhouse Gas Conversion Factors for Company Reporting. Emission factors quoted are 'Direct CO<sub>2</sub>' for comparison with forecasts. Figure for cars adjusted for an average occupancy rate of 1.6 based on Transport Statistics Great Britain 2010

## Rail's current position

Research commissioned by the Sustainable Rail Programme and Technical Strategy Leadership Group calculated that the whole-system carbon footprint of rail in 2008 made up of 63% traction, 15% non-traction and 22% embodied emissions.

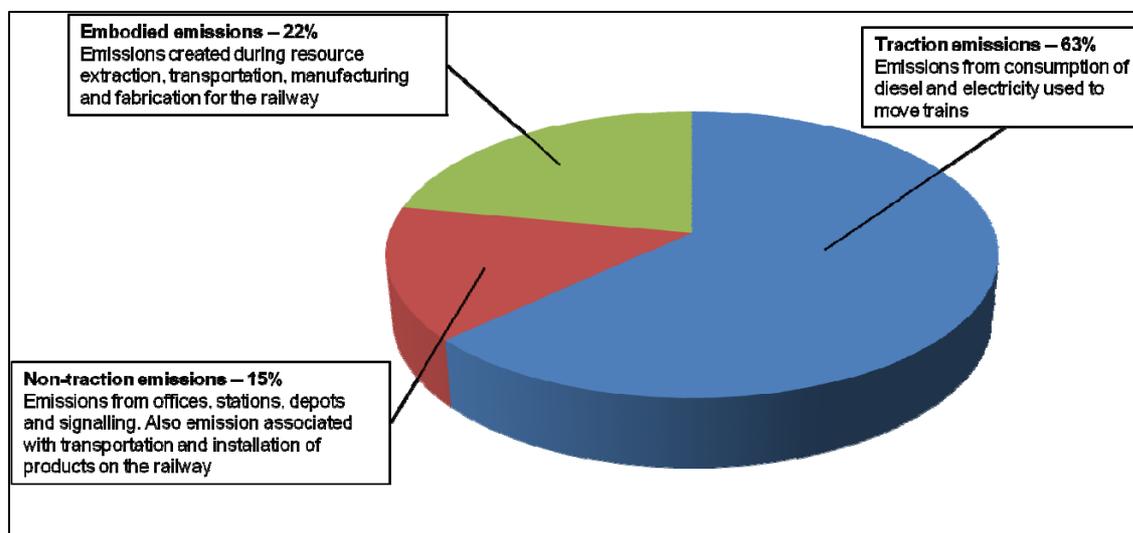


Figure 1 – Breakdown of rail lifecycle carbon

Traction emissions, which make up the bulk of overall emissions, have remained roughly level in both absolute and normalised terms since 2008<sup>5</sup>, despite significant increases in capacity.

Traction energy costs are currently approximately £600 million, or 4% of industry costs and are expected to rise with general energy prices due to:

- Rising oil prices
- A potential gap in domestic supply as UK power stations are decommissioned
- The cost of investment in renewable and low-carbon generation
- Increasing demand as a range of sectors, including road, decarbonise through electrification
- Increasing legislative pressure, such as a carbon floor price, Carbon Reduction Commitment and the EU Emission Trading Scheme.

Neither non-traction nor embodied emissions are currently reported and in general the industry's understanding of them is not as sophisticated as for traction.

## Carbon in CP5

Looking forward, the Initial Industry Plan outlines two scenarios for CP5, the Base Plan and the Base Plan + Options (see appendix 2 for more details). Carbon trajectories have been developed against these scenarios using a modelling approach developed by the Department for Transport (DfT). The trajectories are dependent on a range of assumptions, and in some cases there remains some uncertainty in delivering assumed changes. As such the trajectories should be considered indicative and are not forecasts.

<sup>5</sup> For more details see A Better Railway for Britain: rail industry sustainable development report 2011

The trajectories are based on an estimate of current emissions based on the timetable and rolling stock and using the environmental module of the DfT's Network Modelling Framework. These are then calibrated using actual diesel and electricity consumption where available. Future emissions are then forecast using a series of top-down overlays constructed from assumptions around the key drivers of change. These include:

- Increases in passenger and freight demand consistent with the IIP scenarios
- Changes in rolling stock such as the introduction of new rolling stock<sup>6</sup> or regenerative braking
- Agreed electrification schemes such as the Great Western Mainline, schemes in the North West of England and Edinburgh Glasgow Improvement Programme
- Changes in grid electricity emission factors, based on DECC projections
- The transition to zero sulphur fuel in 2012<sup>7</sup> and the gradual increase in biofuel content

Based on these 'business as usual' impacts, emissions under the Base Plan scenario<sup>8</sup>, are forecast to fall slightly through CP5, having risen 5% between 2009/10 and 2013/14 (for a more detailed breakdown of the business as usual trajectory see appendix 3). The Base Plan + Options follows a similar pattern, though emissions overall are higher. This is reversed in the longer-term as the impacts of greater electrification are felt (see figure 4).

Energy costs rise much more substantially, up 46% on 2009/10 to more than £900m per annum by the end of CP5<sup>9</sup>. This is due to the assumed increases in the prices of electricity and diesel and the fact that energy consumption keeps increasing through CP5 but is somewhat decoupled from carbon emissions due to greater electrification and the decarbonisation of grid electricity.

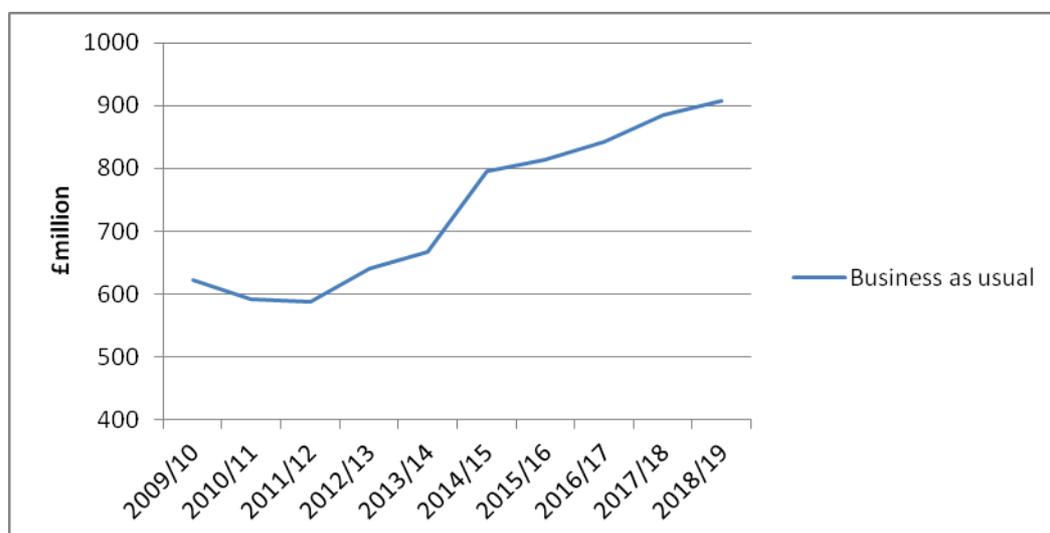


Figure 2 – Traction energy costs 2009/10-2018/19

<sup>6</sup> III B engines will create an initial penalty but will even out due to lightweight trains

<sup>7</sup> Assumption for the trajectory is that from 2012 rail fuel consumption will be split equally between the two fuels ie: 50% will be zero sulphur gas oil and 50% will be zero sulphur road diesel.

<sup>8</sup> Passenger numbers growth under both scenarios are the same as schemes under the Base Plan scenario are already mostly embedded and schemes under the Base Plan + Options scenario will not be delivered until the end of CP5

<sup>9</sup> This uses the DECC central energy cost forecast

While under such a 'business as usual' scenario passenger emissions fall to 40.1gCO<sub>2</sub> per passenger km and freight falls to 25.9gCO<sub>2</sub> per tonne km, a rise in absolute emissions between 2009/10 and 2018/9 is clearly not desirable in terms of a stated ambition to reduce absolute carbon emissions or the need to deliver a low-cost railway. Further efforts on energy efficiency are needed and the industry is committed to progress this.

### **Energy efficiency in CP5**

In developing this environment plan the SRP commissioned research to understand the potential for the rail industry to deliver carbon and energy savings through efficiency interventions in CP5<sup>10</sup>. Potential interventions were prioritised at an industry workshop, with business cases then developed to consider financial payback and potential barriers to implementation.

Ten interventions were prioritised by the industry, with subsequent research excluding four where there was insufficient data or clearly no business case<sup>11</sup>. The remaining six were<sup>12</sup>:

- Promotion of eco-driving practices
- Reduce diesel engine idling
- Selective engine shut down
- Further roll out of regenerative braking
- Hotel load management
- Improved energy efficiency of new rolling stock

These were mapped onto the CP5 trajectory, with conservative estimates taken of what could be viably implemented (the underlying assumptions for each intervention are shown in Appendix 4). The result is an almost 5% drop in carbon emissions in 2018/19 compared to the business as usual case, taking emissions back to the 2009/10 level with an estimated £100 million saving on energy achievable within CP5. However, the potential costs associated with implementing these interventions are not currently well enough understood to develop a detailed business case.

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<sup>10</sup> Business case for carbon interventions, Atkins, May 2011

<sup>11</sup> Three interventions were excluded where data or business cases were uncertain were: energy efficient train control systems, energy efficiency initiatives at existing stations and depots and production of renewable energy at stations and depots. There has been no consensus on potential efficiency savings achievable through interventions to reduce electricity transmission losses and this has therefore also been excluded.

<sup>12</sup> These interventions were only considered in their entirety and some level of disaggregation may be needed to identify further opportunities (eg in eco-driving) at an organisation level (where it is often happening) or through more specific research.

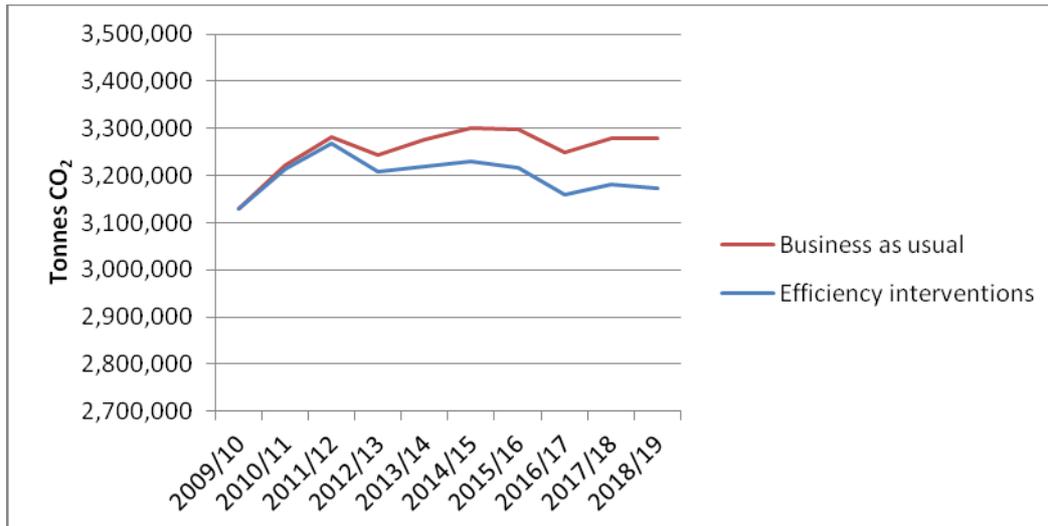


Figure 3 – Carbon emissions 2009/10-2018/9

### Barriers to greater efficiency

As stated, this is a conservative view of what could be implemented in CP5. This position is informed by the significant barriers to greater implementation that have been identified during the research for this plan.

For instance, these savings only cover traction energy, and while non-traction carbon is not as significant as traction, it still accounts for around 20% of rail's direct carbon footprint<sup>13</sup>. Stations, depots and train control systems are thought to be key contributors to this. Non-traction energy will face similar rises in energy prices, with an additional levy for many rail industry organisations through the Carbon Reduction Commitment Energy Efficiency Scheme. However, there has proved to be inadequate baseline data or understanding of future potential savings for a robust non-traction forecast, as well as a lack of understanding over potential drivers. While it is expected that data quality will improve, driven by the requirements of the Government's Carbon Reduction Commitment, this is clearly an issue if the industry intends to reduce carbon emissions in this key area.

To develop a more robust view of the barriers that were preventing further energy and carbon efficiency from being implemented the SRP ran a workshop with energy and environment managers from across the industry. The workshop concluded that:

- There is a poor understanding of energy/carbon saving potential and the financial viability of interventions, in part due to slow progress with traction electricity metering and a lack of robust measurement of energy use
- Costs and benefits don't always sit within a single organisation, with cooperation and sharing mechanisms unclear or inefficient
- Carbon and energy have a poor status within strategic and operational decisions and lose out to other factors
- There is insufficient consideration of energy and carbon within approaches to minimise industry whole life costs

<sup>13</sup> 15% if considering indirect emissions.

These barriers are significant, but not insurmountable. To overcome them and help accelerate the move towards a truly low-carbon railway, the SRP, working with industry partners, has developed a carbon management framework. This is outlined below.

## **Enabling a lower carbon railway**

### ***Carbon Management Framework***

An effective carbon management framework can incentivise actions in key areas to overcome the barriers to greater energy and carbon efficiency. Given the complexities of the industry, such a framework needs to include process, policy and financial elements.

Robust measurement and monitoring of energy use will be critical to its success (for details see appendix 5). On-train metering, for instance, is a key enabler to achieving greater traction energy efficiency. With the cost of metering estimated to be £6-8,000 per AC trainset and £16-20,000 per DC trainset, it is perfectly possible to achieve full metering of current rolling stock in CP5 if the right incentives are in place. While, as noted above, non-traction energy also needs to be properly measured, monitored and reported.

But measurement is only one element. Carbon needs to be targeted in the contracts through which the industry is managed, to ensure adequate resources and senior management involvement. And full consideration needs to be given to energy and carbon in consideration of minimising industry whole life costs, to ensure that low-carbon solutions can be built in to key decisions and projects.

The Carbon Management Framework, which is included as part of the Initial Industry Plan, reflects these needs, and will be key to overcoming the barriers currently slowing progress. The framework is not a group of standalone objectives, nor can it be implemented by individual organisations alone. It represents a whole-system approach, bringing together the CP5 settlement and franchising policy as the two key drivers of change in the industry change. It will require the industry, ORR, and Government to work together to achieve a successful outcome, as they have worked together to develop the framework in the first place.

### ***Industry Carbon Management Framework***

- Energy efficiency, hence cost reductions, should be included in franchise contracts, alongside robust measurement and reporting
- An increase in the metering of traction energy by CP5 should be incentivised, through EC4T, to ensure that operators pay for what they use and reap the benefits of efficiency savings
- Network Rail should be incentivised through appropriate financial mechanisms, to efficiently reduce electrification system loss, according to its relative ability to manage the risk
- Whole life energy and cost savings should be included as criteria in investment decisions and project criteria, applied across organisational and franchise boundaries. This suggests we need to explore different project financing assessment models that better take into account consideration of whole life whole system impacts.
- A more robust approach to measuring and monitoring carbon emissions should be implemented, covering both traction and non-traction

Implemented, the Carbon Management Framework will generate further, potentially significant, reductions in carbon emissions. The Strategic Business Plan, to be published in 2013, will give more detailed plans and highlight the potential impact of the plan.

### **Longer term carbon reductions**

While the Carbon Management Framework will be crucial to ensuring greater efficiency in the short and medium term, in the longer term electrification and reducing the carbon intensity of electricity generation will be key to a significant reduction in rail's carbon footprint.

Under the IIP Base Plan, emissions fall by 32% by 2050 from the 2009/10 baseline with no additional electrification beyond that already committed. This is due in large part to the decarbonisation of the grid. However, in the Base Plan + Options, with additional electrification schemes including the Midland Mainline in CP5, meaning that 90% of passenger and 50% of freight kilometres will be electric powered by 2035, emissions fall by 64% by 2050.

It should be noted that with the greater level of energy efficiency made possible by the Carbon Management Framework these figures should be even higher.

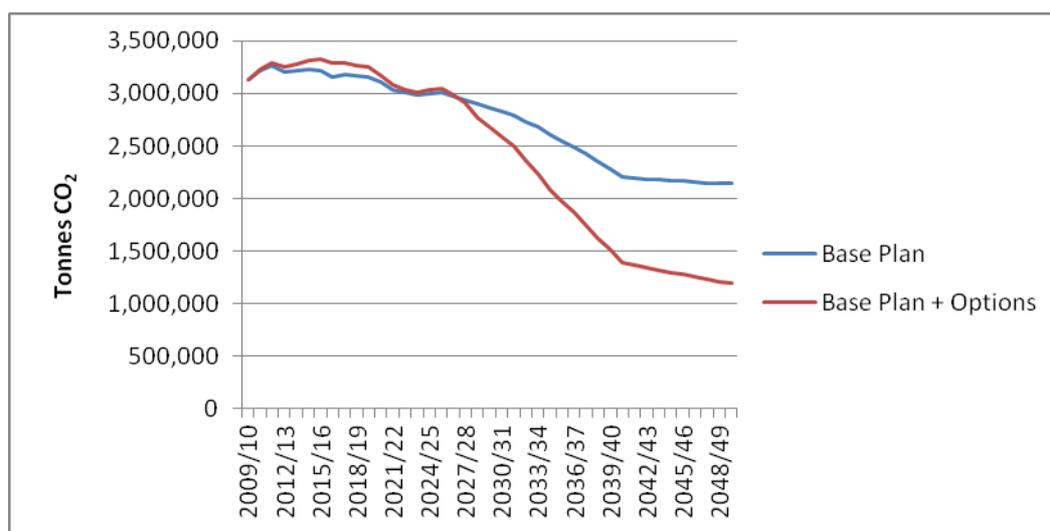


Figure 4 – Traction carbon trajectory to 2050<sup>14</sup>

<sup>14</sup> As the industry's planning horizon for capacity forecasts is 2033/34, no demand growth is included in underlying assumptions beyond this point, however carbon trajectories out to 2050 have been produced to show the expected impact of further improvement in grid mix to this point

## **MEETING THE REQUIREMENTS OF THE EU ENVIRONMENTAL NOISE DIRECTIVE IN CP5**

### **EU Environmental Noise Directive**

The main aim of the EU Environmental Noise Directive (END) is to provide a common basis for tackling transport and industry related noise problems across the EU. It requires that:

- Exposure to environmental noise is determined through noise mapping
- Information is provided on environmental noise and its effects on the public
- Action plans are adopted, based on the mapping results, designed to manage noise issues and effects, including noise reduction if necessary
- Good environmental noise quality is preserved where it exists.

Each government nominates 'Competent Authorities' which are responsible for meeting the requirements. In GB these are the Secretary of State/Defra in England, the Welsh Ministers/Welsh Assembly Government in Wales and the Scottish Ministers/Scottish Government in Scotland.

Noise mapping is being undertaken in 5 year cycles known as 'rounds' in 2007, 2012 and 2017 etc. After each round of mapping, noise action plans (NAPs) are produced. These detail the steps needed to investigate whether an intervention is needed at a local level to mitigate specific noise issues.

The NAP for major railways in England prepared by Defra mentions a body termed the Relevant Rail Authority, it has been agreed with Defra that this consists of DfT and ORR. The Relevant Rail Authority is tasked with investigating the outputs of the mapping and implementing or securing budget for noise mitigating actions. The Relevant Rail Authority intends to fulfil its obligations through the HLOS and periodic review process.

The Noise Policy Working Group (NPWG), a cross industry group convened by the Sustainable Rail Programme, has been given a remit to develop recommendations and estimates for meeting END requirement in CP5.

### **Noise Mapping and Action Plans**

In considering the need to meet END requirements, it is important to note that the noise mapping is a modelled assessment. It has been undertaken by the three Competent Authorities using a computer modelling system which takes into account input variables (e.g. rolling stock, site, proximity of dwellings) which have an impact on the noise levels generated. The data used was gathered from existing railway data and also other sources (e.g. postcode data). The rail industry's Noise Policy Working Group considers that there may be serious issues with the accuracy of the outputs of the modelling.

Under the legislation there is a requirement to identify interventions for locations where the modelled noise levels are above a given threshold or in the most sensitive locations (based on population criteria). However, given the issues with the mapping identified above, any locations that are proposed to have any future interventions to mitigate noise need to undergo a full assessment to determine whether there is an actual issue. If there is an issue, then the causation needs to be identified so that the appropriate mitigation can be adopted.

### ***First round mapping***

The first round of noise mapping and noise action plans (NAPs) have identified a number of areas which need to be considered further by the Relevant Rail Authorities. These areas were identified using modelled noise levels<sup>15</sup> within two key parameters:

- Agglomerations with population in excess of 250,000 or
- Corridors with 60,000 train passages in total per year for major rail outside of agglomerations<sup>16</sup>

Using these parameters, the first round of mapping identified the following as needing further investigation<sup>17</sup>:

- England: 736 Important Areas (IAs)
- Wales: 19 Candidate Noise Action Plan Priority Areas (CNAPPAs)
- Scotland 6 Candidate Noise Management Areas plus 12 further locations within agglomerations.

Transport Scotland has since completed its investigation of round 1 locations and concluded that no action needs to be taken.

### ***Second Round Mapping***

The second round of noise mapping is due to commence in 2012. The major difference between the two rounds is that the thresholds are lower in the second round:

- Agglomerations with a population in excess of 100,000 or
- Corridors with 30,000 train passages in total per year in the case of major rail outside of agglomerations

### **Developing funding estimates for CP5**

In developing potential funding needs in CP5, it would have been ideal to have been able to consider individual locations and prioritise where action might be necessary on the network. Unfortunately, in the case of England, where the bulk of the locations are found, DEFRA's timetable for undertaking mapping and publishing results means this has not been possible. An alternative approach has had to be developed based on a set of assumptions around the proportion of locations which will need interventions and the types of interventions likely to be most effective.

At a later date, closer analysis of the specific locations identified will take place. This will be facilitated through web portals which are being developed by the Competent Authorities in England and Wales.

Second round mapping is due for completion in 2012, further NAPs will need to be produced in response to this. Considering the time taken to produce NAPs for the first round it is unlikely that these will be completed in time for any outcomes or actions to be factored into

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<sup>15</sup> England – top 1% affected by railway noise: Wales – top 1% affected by railway noise and where that noise is over 68dB; Scotland –top 1% affected by railway noise

<sup>16</sup> NB these last two are separate parameters and appear separately in funding estimates as 'agglomeration' and 'major railway'

<sup>17</sup> NB - each authority uses a different terminology and different criteria for what it deems as a location for investigation

the CP5 planning process. However, mitigating interventions may need to be taken within the CP5 timeframe. An estimate of the possible costs has therefore been developed.

Third round mapping is due to take place in 2017, with NAPs coming after that. These have been excluded from consideration in CP5 but it is proposed to factor them in to the planning process for CP6.

### **Modelling funding estimates**

The NPWG has developed an estimate for potential funding needs in CP5 by considering the following:

- Likely effective interventions
- The number of areas where intervention is necessary
- Potential number of second round areas based on assumptions

#### *Interventions*

Interventions have been assessed by considering effectiveness, associated benefits and costs. Taking these factors into consideration the following were identified by NPWG as potentially applicable interventions for reducing an actual noise issue in response to END:

- More likely
  - Rail tuned absorbers
  - Noise barriers (in specific circumstances)
- Less likely
  - Sound insulation/façade insulation at properties
  - Bridge noise reduction

The following table summarises the typical cost of these interventions. These figures are the 'capital costs' only - ie they do not include possession costs or any ongoing operational costs – and should be considered as indicative as costs will vary over time and are dependent on location.

<b>Intervention</b>	<b>Cost</b>
Rail-tuned absorbers	£300 per track metre
Noise barriers (3 metre)	£1275 per metre
Sound insulation/façade insulation	£3000 per property
Bridge noise reductions	£0 – ongoing maintenance and renewal costs <sup>18</sup>

A number of other interventions, though they would not be recommended purely for noise mitigation, may have a positive impact if implemented as part of a project or through maintenance. In such cases they could satisfy the need to act identified under a NAP.

- Increase the frequency and nature of railhead grinding.
- Profiling of rolling stock wheels to reduce the presence of wheel flats on the rail network.

<sup>18</sup> Bridge noise reductions would be dealt with as part of the ongoing maintenance and renewals programme. Bridges are upgraded often using new material, such as precast concrete, which is considered to reduce noise when trains are crossing the bridge.

- Meeting TSI requirements
- Electrification
- Welded track
- Switches and crossings
- Changes to rolling stock
- Eco driving
- Reducing the number of wheel profiles in use on the network to improve the contact conditions at the wheel/rail interface.
- Replacement of cast-iron tread brakes with composite tread brakes, as a retrofit.
- Greasing rails as part of a normal maintenance regime

### *Areas Needing Intervention*

For the first round of strategic noise mapping and the noise action plans, Defra has suggested that it would expect that the rail industry would be able to consider interventions at between 2% and 5% of the total locations identified. These have been used to calculate higher and lower cost scenarios. For both scenarios it has been assumed<sup>19</sup> that locations are roughly 500 metres in length and 25 dwellings per location will be subject to noise exposure.

The type of intervention is unlikely to be the same at every location, therefore the calculations for the scenarios look at different mitigation measures. NPWG has assumed the following proportions of interventions, based on discussions with the industry and the likelihood of using a specific intervention. It is important to note that this is a professional judgement based on limited information data and a range of assumptions.

- 70% Rail-tuned absorbers
- 5% single-side barriers
- 5% double side barriers
- 10% sound insulation
- 10% bridge noise reduction

### *Potential second round areas*

Given that second round mapping is not due to be complete until 2012, an estimate has had to be made of the number of possible areas it might cover. However, given the lack of data, these estimates are for modelling purposes only and should not be considered as a reliable guide.

In making these estimates, the following assumptions have been made:

- Mapping undertaken for the 2nd round will be done in the same way as for the 1st round
- The density of dwellings is the same for the 2nd round as assumed for the 1st round
- For major railways outside of agglomerations as the threshold level of traffic is 50% lower, the effect on properties should be 50% lower per km
- For agglomerations, the physical size of a 2nd round agglomeration is on average half that of those considered in the 1st round

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<sup>19</sup> Based on the assumption that postcode areas are approx 500 metres long and containing 25 dwellings.

As the number of agglomerations to be included second round and the approximate ratio of major rail between the first and second round for each of England, Wales and Scotland, are all known, the following calculation can be made:

	First round areas	Ratio 2 <sup>nd</sup> /1st round	Second round areas
England – major railway	221	2.5	164
England - agglomeration	515	2.8	460
Wales – major railway	7	3.75	10
Wales – agglomeration	10	1.5	3
Scotland – major railway	6	2	3
Scotland - agglomeration	12	2.5	9

#### *Funding estimates*

Using the assumptions and figures outlined above the following estimates of potential funding needs in CP5 to meet the END requirements have been developed.

Higher Scenario – approximately 5% of locations require intervention<sup>20</sup>

Intervention	Locations	First round (£000)			Second Round (£000)		
		England <sup>21</sup>	Wales <sup>22</sup>	Scotland <sup>23</sup>	England	Wales	Scotland
Rail-tuned absorbers	70%	7,200	170	0	6,600	156	146
Single side barrier	5%	1,275	30	0	1,220	29	27
Double side barrier	5%	2,550	60	0	2,440	58	54
Sound insulation	10%	300	7	0	215	5	5
Bridge noise reduction	10%	0	0	0	0	0	0
TOTAL	£	11,325	267	0	10,475	248	232

<sup>20</sup> NB due to rounding figures may not be exact percentages

<sup>21</sup> England has 736 IA locations in total, assumptions around anomalies and where action has already taken place reduce this to 703, which is the figure used to calculate cost estimates

<sup>22</sup> NB the cost split between England, Wales and Scotland is based purely on a proportionate approach to the number of locations

<sup>23</sup> NB Scotland has no first round locations to take forward.

Lower Scenario – approximately 2% of locations require intervention

Intervention	Locations	First round (£000)			Second Round (£000)		
		England	Wales	Scotland	England	Wales	Scotland
Rail-tuned absorbers	70%	2,930	70	0	2,580	60	57
Single side barrier	5%	620	15	0	610	15	14
Double side barrier	5%	1,245	30	0	1,220	30	27
Sound insulation	10%	145	4	0	145	3	3
Bridge noise reduction	10%	0	0	0	0	0	0
<b>TOTAL</b>	<b>£</b>	<b>4,940</b>	<b>119</b>	<b>0</b>	<b>4,555</b>	<b>108</b>	<b>101</b>

Given the NPWG's misgivings about the strategic mapping process it is felt that there is a significant need for the ongoing assessment of locations relating to both the first and second round of mapping to ensure that mapped noise issues reflect actual issues and that causation can be identified. There is currently no provision for such resource and as the relevant rail authorities intend to fulfil their obligations through the HLOS, it is recommended that this is included in planning to the order of £200,000/year through CP5, totalling £1,000,000.

Taken together this results in total potential funding needs to meet the requirements of END in CP5 of between £10,832,000 and £23,547,000.

## **NEXT STEPS**

Over the course of the next year, the SRP will be developing a detailed plan to support the implementation of the Carbon Management Framework. As well as developing the detail of the framework itself this will map out what needs to be done, and by who, to make the framework a reality.

In developing the detail of the framework, the SRP will refine the data and evidence, reviewing the carbon trajectories and gaining a better understanding of the costs and business cases for efficiency interventions, to identify the best value areas for the industry to reduce carbon emissions. Particular focus will be given to a better understanding of the risks and opportunities with non-traction energy.

The outcome of this work will be a more robust analysis of the costs, savings and impact of the framework, to be included with the Strategic Business Plan.

With regard to the Environmental Noise Directive, as the results of the first phase of mapping are analysed, estimates for the resource needs in CP5 will be refined.

## **APPENDICES**

### **Appendix 1 – Process outline**

The remit for the work outlined in this report was given by the Planning Oversight Group as part of their development of the Initial Industry Plan.

The work has been overseen by the Sustainable Development Steering Group, which is the leadership group of the Sustainable Rail Programme. It is made up of executives from across the industry including Network Rail, RIA, ROSCOs, ATOC, FOCs and TOC owning groups as well as DfT and ORR.

The detailed work on carbon has been led by a working group made up of ATOC, Network Rail, RSSB, ORR and DfT, with industry engagement and oversight through the Carbon Reduction Working Group – chaired by Network Rail, with participation from across the industry. Specific workshops have been held on identifying and prioritising interventions, barriers to greater implementation of energy and carbon efficiency interventions and the impact and cost of interventions.

The detailed work on the EU Environmental Noise Directive impacts has been done through the Noise Policy Working Group, chaired by ATOC and with representation from across the industry.

## **Appendix 2 – Initial Industry Plan scenarios**

### **Base Plan**

The Base Plan scenario reflects a railway that delivers on existing commitments but otherwise maintains end of CP4 outputs in the longer term.

With respect to carbon emissions, key features of this scenario are:

- Committed capacity and electrification schemes, for example Crossrail, Thameslink, the Edinburgh Glasgow Improvement Programme (EGIP) and electrification of the Great Western Mainline and in the North West of England are delivered in CP4 and CP5. No major schemes are assumed beyond these.
- The industry continues to accommodate growth where possible, but in the absence of investment to enhance the infrastructure, its ability to do this becomes increasingly constrained, especially in the peak.

### **Base Plan + Options**

The Base Plan + options scenario provides funders with choices in CP5 which will enable them to deliver better outcomes in areas of safety, efficiency, sustainable economic growth and rail-user satisfaction (passenger and freight). Key features of this scenario are:

- Additional, prioritised capacity schemes included in CP5
- Further electrification schemes in CP5 (notably Midland Main Line)
- In the longer term it is assumed that the railway continues to accommodate demand growth both in the peak and off-peak, and that a rolling programme of electrification is continued such that c. 90% of passenger journey and 50% of freight journeys are electric powered by 2035.

### Appendix 3 – Detailed CP5 carbon trajectory

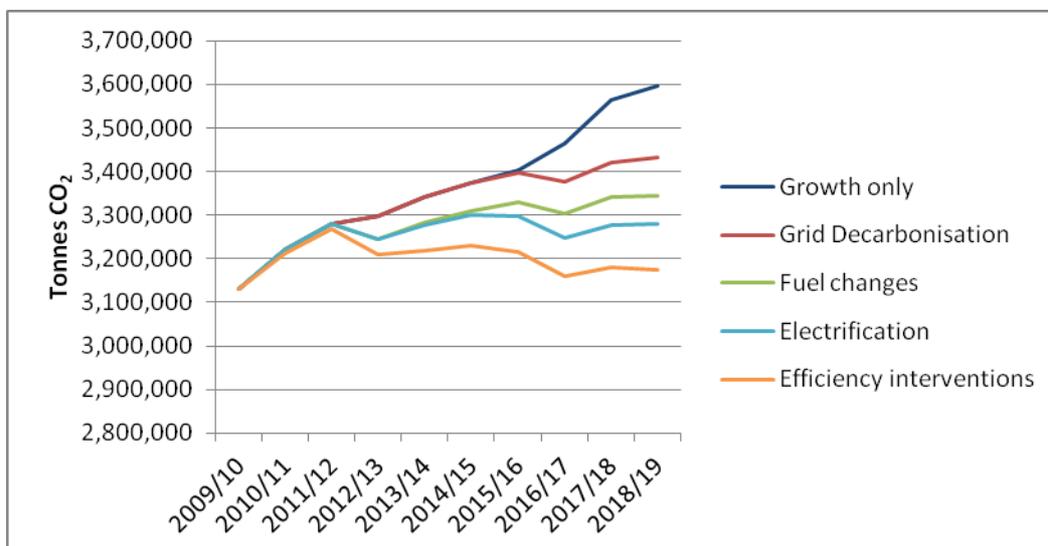
The graph below details the impact of the modelled overlays on carbon emissions through CP5 using the IIP Base Plan and the assumptions outlined in the main document.

The Growth only trajectory relates to the carbon emitted with no changes at all except predicted growth.

The electrification trajectory in this version corresponds to the business as usual trajectory used in the main document, ie it is assumed that grid decarbonisation, fuel changes and agreed electrification schemes will happen.

Of the difference between the Growth only and Electrification trajectories in 2018/19:

- 52% is due to Grid Decarbonisation
- 27% is due to fuel changes
- 21% is due to electrification



## Appendix 3 – Carbon efficiency interventions assumptions

Values used for carbon efficiency were based on best estimates, using a low deployment scenario, including expected level of existing deployment of interventions.

Traction efficiency values were then assessed in the light of emerging knowledge around rolling stock efficiencies and replacement cycles, with knowledge of franchise renewal dates, as well as the practicality of proposed interventions.

The underlying assumptions for each intervention were:

### 1. Promotion of eco-driving practices

- Efficiency savings were identified through deploying eco efficient driving, such as selective acceleration, coasting, use of gradients and safe change in brake use
- It is considered to be applicable to electric and diesel passenger trains and to freight on a mileage basis
- Deployment timescales were based on the assumption that it would be implemented by TOCS with long franchises left to run by the end of CP4 and for TOCs with franchises that are renewed during 2012 to 2015 it would be between 2013 to 2016 period

### 2. Reduced engine idling intervention

- Efficiency savings were identified for reducing the extent to which diesel engines are left idling whilst trains are stationary
- It is considered to be applicable to more modern freight locos and passenger DMUs
- Deployment timescales were based on the assumption that it would be implemented by TOCS with long franchises left to run by the end of CP4 and for TOCs with franchises that are renewed during 2012 to 2015 it would be between 2013 to 2016 period

### 3. Selective engine shutdown

- Efficiency savings potential were identified to, where deemed possible, shut down redundant engines when full power is not required (eg partial loading) or alternatively to de-rate engines to constrain maximum available power
- It is considered to be applicable on a minority of diesel and diesel electric multiple units passenger trains
- It is expected that this will be fully deployed, where practicably possible, before start of CP5

### 4. Roll out of regenerative braking

- Efficiency savings were identified to further roll out regenerative braking measures to reclaim energy otherwise wasted during braking
- It is considered applicable on all modern passenger electric fleet
- Deployment timescales will mainly be during CP4

## 5. Hotel load management

- Efficiency savings were identified to reduce energy use associated with hotel loads (heating, air conditioning and lighting)
- It is considered applicable on all passenger fleet
- Deployment timescales were based on the assumption that it would be implemented by TOCS with long franchises left to run by the end of CP4 and for TOCs with franchises that are renewed during 2012 to 2015 it would be between 2013 to 2016 period.

## 6. Improved energy efficiency of new rolling stock

- Efficiency savings were identified for improving energy efficiency during the design and production of new rolling stock
- There was a lack of data around efficiency savings through refurbishment of rolling stock but it was noted as an area for future research.
- Deployment timescales were based on known major investment projects

## Appendix 5 – Carbon measurement and monitoring

An important element of the Framework is the robust measurement and reporting of performance by industry. In agreement with industry the following approach is recommended:

- The measurement of carbon emissions is aligned to the Defra guidelines<sup>24</sup>, following the scope 1-3 model<sup>25</sup>, and covering the Kyoto protocol Greenhouse gases (GHG) measured in carbon dioxide equivalent (CO<sub>2</sub>e)<sup>26</sup>, as a credible and widely accepted approach.
- That robust measurement to provide actual and up-to-date figures will be in place for scope 1 and 2 against which industry will report by funder by the start of CP5.
- That a common methodology to calculate scope 3 emissions is adopted by the start of CP5 which focuses on significant and cumulative emissions where improvements can be delivered.
- That a periodic assessment of total industry carbon footprint should be undertaken in line with control period timescales, to support rail's understanding of the best use of resources to manage dominant sources.

It is recommended that industry measures the following traction and non-traction<sup>27</sup> energy indicators:

### ***Traction***

- Total traction CO<sub>2</sub>e emissions by passenger and freight, split into diesel and electricity
- Total traction energy used by passenger and freight, split into diesel and electricity
- Traction CO<sub>2</sub>e emissions normalised per passenger/km, passenger vehicle/km and net freight tonne/km

### ***Non-traction***<sup>28</sup>

- Total CO<sub>2</sub>e from stations and depots and occupied buildings
- Total energy used by stations and depots and occupied buildings

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<sup>24</sup> <http://www.defra.gov.uk/environment/business/reporting/index.htm>

<sup>25</sup> Scope 1 – direct fuel use such as gas or diesel

Scope 2 – direct use of energy directed elsewhere, such as electricity or steam

Scope 3 – energy used elsewhere, such as in manufactured purchased goods, or in providing purchased services

<sup>26</sup> Six main GHGs are covered by the Kyoto Protocol: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), hydrofluorocarbons (HFCs), nitrous oxide (N<sub>2</sub>O), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) whereby all GHGs are expressed as if they had the same climate change effects as CO<sub>2</sub>.

<sup>27</sup> NB – the precise indicators will be reviewed as the protocol is developed to ensure all significant sources are captured

<sup>28</sup> While these have been agreed, it is acknowledged that they are not necessarily consistent with a metric that reports all scope 1 and 2 non-traction emissions. This will be reviewed over the coming year.

**The following process for reporting is proposed:**

- Current reporting protocols (used to report to National Rail Trends) will be reviewed and amended as necessary to report all above indicators. The aim of the protocol will be to ensure consistency and transparency in the measurement and reporting of carbon.
- Individual data owners to send data, in line with agreed industry protocol, to a central point, where it will be collated to provide an industry level report by funder for England & Wales and Scotland against each indicator.
- The ORR's data assessment framework, used to assess the quality of NR's annual returns, could be used to assess industry's progress towards robust reporting.
- The Sustainable Rail Programme (SRP) will monitor performance against the carbon trajectory and will provide an annual assessment of progress, providing recommendations to Planning Oversight Group where action is required to support intervention delivery. This would include an explanation where there is an alternative reason for an unexpected rise in emissions, such as growth.
- SRP will ensure the monitoring and reporting process itself remains fit for purpose. This would include changes in Government reporting expectations and changing requirements such as the CEN standard for reporting GHG and energy consumption<sup>29</sup>.

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<sup>29</sup> Energy consumption and Greenhouse gas emissions of transport services CEN standard is currently being developed